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Malnutrition Identified by Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition Is Associated With More 30-Day Readmissions, Greater Hospital Mortality, and Longer Hospital Stays: A Retrospective Analysis of Nutrition Assessment Data in a Major Medical Center

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Abstract

Background: Few studies have compared malnutrition identified by the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition (AND/ASPEN) consensus criteria with clinical outcomes. Our goal was to compare 30-day readmissions (primary outcome), hospital mortality, length of stay (LOS) in survivors, and time to discharge alive (TDA) in all patients assessed as malnourished or not malnourished using these criteria in fiscal year 2015. We hypothesized more frequent admissions, greater mortality, longer LOS, and less likely shorter TDA in the malnourished patients. *Methods:* Demographic variables, clinical outcomes, and malnutrition diagnosis for all initial patient admissions were obtained retrospectively from the electronic medical record. Logistic regression was used to compare categorical and Cox proportional hazards for TDA in unadjusted and adjusted (age, sex, race, medical/surgical admission, Charlson Comorbidity Index) models. *Results:* Of the 3907 patients referred for nutrition assessment, 66.88% met criteria for moderate or severe malnutrition. Malnourished patients were older (61 vs 58 years, $P < .0001$), and survivors had longer LOS (15 vs 12 days, $P = .0067$) and were more likely to be readmitted within 30 days (40% vs 23%, $P < .0001$). In adjusted models, 30-day readmissions (odds ratio [OR] 2.13, 95% confidence interval [CI] 1.82–2.48) and hospital mortality (OR 1.47, 95% CI 1.0–1.99) were increased, and the likelihood of earlier TDA was reduced (hazard ratio [HR] 0.55, 95% CI 0.44–0.77) in those who had >2-day stay. *Conclusion:* The AND/ASPEN criteria identified malnourished patients in a high-risk population who had more adverse clinical outcomes. Further studies are needed to determine whether optimal provision of nutrition support can improve these outcomes. (*JPEN J Parenter Enteral Nutr.* 2018;00:1–6)

Keywords

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

Clinical Relevancy Statement

The association between malnutrition and worse clinical outcomes is established. However, historically varying methods were used to define malnutrition. The Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition (AND/ASPEN) malnutrition consensus criteria provide a new standard for the diagnosis of malnutrition with limited data on associated clinical outcomes. The aim of this retrospective investigation was to evaluate important clinical outcomes in a large sample of hospitalized patients identified with or without malnutrition using the AND/ASPEN criteria. Outcomes were adjusted for risk factors to account for the impact of disease severity on outcomes, although it is not possible to completely isolate the effect of malnutrition. This study confirms that the AND/ASPEN criteria identify malnourished patients with greater hospital mortality, readmissions, and longer length of stay in survivors.

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Introduction

A consensus approach to recognizing malnutrition in adults was advanced by the Academy of Nutrition and Dietetics (AND) and the American Society for Parenteral and Enteral Nutrition (ASPEN) in 2012.[1] After screening for nutrition risk, this approach considers the duration (acute vs chronic) and intensity of inflammatory response based on admitting diagnosis (marked inflammatory response with diagnosis of major infection or injury, mild to moderate response with chronic organ failure or disease, no inflammation with starvation or anorexia nervosa) as the context of the diagnosis of malnutrition. The criteria used to diagnose malnutrition are obtained from history of weight loss and change in food intake and nutrition-focused physical examination for loss of fat mass, muscle mass or presence of edema. Malnutrition presents a risk for significantly worse clinical outcomes during hospital stays in international studies that used a series of methods to identify malnutrition.[2-6] Small studies suggested that the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition (AND/ASPEN) approach could identify patients with longer hospital stay[5] and greater mortality,[7] but the approach has not been confirmed in a large sample or against other outcomes.

In all consecutive referrals for nutrition assessment in a fiscal year in a large tertiary care hospital, our primary aim was to determine whether 30-day readmissions were different in patients identified as malnourished or not malnourished using the AND/ASPEN criteria. Our secondary aims were to compare hospital mortality, length of stay (LOS) in survivors, and time to discharge alive (TDA) in malnourished or not malnourished patients. We hypothesized that the malnourished patients would have more 30-day readmissions, greater mortality, longer LOS in survivors, and longer TDA.

Methods

The project was approved by the University of Pennsylvania Institutional Review Board. Beginning in 2013 the Clinical Nutrition Support Service at the Hospital of the University of Pennsylvania, an 800-bed high-acuity hospital, adopted the AND/ASPEN criteria as a routine component of nutrition assessment. The initial hospital admission for all patients referred for nutrition assessment in fiscal year 2015 (July 1, 2014–June 30, 2015) was included in this retrospective electronic medical record (EMR)-based analysis. Patients were referred for nutrition assessment based on nutrition risk identified by admission screen using the validated Malnutrition Screening Tool,[8] by provider orders for consults, enteral (EN) or parenteral nutrition (PN), and/or by intensive care unit (ICU) stay >2 days.

Patients were assessed for malnutrition within 24 hours of referral using the AND/ASPEN criteria. Patients who were classified as nonsevere (moderate) or severe malnutrition, by virtue of having at least 2 of the recognized criteria present (energy intake, weight loss, loss of body fat or muscle mass, and fluid accumulation) were combined into a single malnourished group. Those who did not meet criteria for malnutrition were the reference group. Although details of the 3 contexts (acute illness, chronic illness, and social and environmental circumstances) and the duration (acute or chronic) were evaluated and documented concurrently in text in the EMR, our database collected only the final diagnosis of moderate or severe malnutrition or not malnourished. At the time of data collection, the service had not yet implemented the use of dynamometers to evaluate handgrip strength. Furthermore, current use with hospitalized patients remains limited because of the high percentage of critically ill patients who cannot participate in grip strength testing.

Demographic and outcome (in-hospital mortality, LOS, and 30-day readmissions) data and the nutrition assessment category were obtained from the EMR. Charlson Comorbidity Index (CCI) was computed based on admission and discharge ICD-9 codes.[9] Age was evaluated in approximate quartile groups as follows (<50, 51–60, 61–70, 71–80, and >80 years).

Statistical Analysis

Descriptive characteristics of variables and tests of normality were assessed. Differences in demographic variables in malnourished and not malnourished groups were compared using unpaired t test, Wilcoxon rank sum test, or χ^2 as appropriate. Logistic regression (hospital mortality, readmissions) or Cox proportional hazard (TDA) was used in unadjusted models and in models adjusted for age group, sex, race, medical/surgical admission, and CCI. TDA includes data from all patients discharged alive or deceased but censors for the event of death. The patient's data are used up to the time of discharge or death (censored). The assumptions of proportional hazards were tested by χ^2 test for time interaction with malnutrition status.[10] The goodness of fit of the unadjusted and adjusted models was tested by the C statistic derived from computing the area under the receiver operating characteristic curve. All statistical analyses were conducted using SAS version 9.4 (SAS World Headquarters, Cary, NC), with $P < .05$ considered statistically significant.

Results

Data from 3907 patients were included (Table 1), of whom 66.88% met AND/ASPEN criteria for moderate or severe malnutrition. There was no difference in the proportion of men vs women or by racial identity, although the

Table 1. Demographic and Clinical Outcomes..

	Total (N = 3907)	Malnourished (n = 2613)	Not Malnourished (n = 1294)	*P* value[a]
Age (y)				<.0001
< 50	986 (25.24%)	584 (22.35%)	402 (31.07%)	
51–60	882 (22.57%)	601 (23.00%)	281 (21.72%)	
61–70	1018 (26.06%)	711 (27.21%)	307 (23.72%)	
71–80	669 (17.12%)	475 (18.18%)	194 (14.99%)	
80+	352 (9.01%)	242 (9.26%)	110 (8.50%)	
Gender				.1355
Male	2071 (53.01%)	1407 (53.85%)	664 (51.31%)	
Female	1836 (46.99%)	1206 (46.15%)	630 (48.69%)	
Race				.43
African American	1121 (28.69%)	739 (28.28%)	382 (29.52%)	
White	2293 (58.69%)	1558 (59.62%)	735 (56.80%)	
Asian	95 (2.43%)	60 (2.30%)	35 (2.70%)	
Other	132 (3.38%)	87 (3.33%)	4 (3.48%)	
Unknown	266 (6.81%)	169 (6.47%)	97 (7.50%)	
Type of Admission				<.0001
Medicine	2819 (76.07%)	1975 (75.61%)	844 (65.22%)	
Surgery	1087 (27.83%)	637 (24.39%)	450 (34.78%)	
Charlson Comorbidity Index	6.72, 95% CI 6.52–6.92 5.0 (IQR 2–9)	7.32, 95% CI 7.04–7.60 6.0 (IQR 2–10)	5.50, 95% CI 5.20–5.80 4.0 (IQR 1.00–8.00)	<.0001

Data are number (%) or mean, 95% CI, or median (interquartile range [IQR]).
[a]Malnourished vs not malnourished group.

population was primarily white (58.69%) and African American (28.69%). More patients were admitted to medical than surgical services (76% vs 28%). The malnourished patients were older (61 vs 58 years, $P < .0001$), and fewer patients were <50 years old (22.35% vs 31.07%, $P < .0001$) than those who were not malnourished. The proportion of medical admissions was higher than surgical admissions in the malnourished group (76% vs 65%, $P < .0001$). The CCI was significantly higher in the malnourished group (7.32 ± 7.21 vs 5.50 ± 5.55, $P < .0001$).

Clinical Outcomes

Thirty-day readmission rate for the entire group was 34.09%, and in-hospital mortality rate was 6.81%. Readmissions within 30 days were more frequent (40% vs 23%, $P < .0001$), and in-hospital mortality was greater (8% vs 5%, $P = .0001$) in malnourished patients. LOS in survivors was longer in malnourished patients [mean ± SD: 14.99 ± 17.82, median (interquartile range [IQR]): 9 (2, 16) days vs 11.85 ± 11.13 and 9 (4, 14) days, $P = .0067$].

Both unadjusted models and models adjusted for age, sex, race, medical/surgical service, and CCI are in Table 2. Malnutrition was associated with more 30-day readmissions (unadjusted odd ratio [OR] 2.24, 95% CI 1.93–2.61, $P < .0001$; adjusted OR 2.13, 95% CI 1.82–2.48, $P < .0001$) and greater hospital mortality (unadjusted OR 1.76, 95% CI 1.31–2.37, $P < .001$; adjusted OR 1.47, 95% CI 1.08–1.99, $P = .0102$) relative to non-malnourished patients. In patients who remained in the hospital >2 days, the hazards of shorter TDA were significantly lower in malnourished than not malnourished patients (unadjusted HR 0.56, 95% confidence interval [CI] 0.44–0.76, $P < .0001$; adjusted HR 0.58, 95% CI 0.44–0.77, $P = .0001$).The unadjusted HR model is shown in Figure 1.

Discussion

Our study has indicated that malnourished patients identified using the AND/ASPEN consensus criteria have more readmissions within 30 days, greater in-hospital mortality, longer LOS in survivors, and lower likelihood of shorter TDA. These findings hold even when analyses were adjusted for demographic variables, medical/surgical service, and CCI. To our knowledge, this is the largest published data using AND/ASPEN criteria.

Our findings of increased 30-day readmissions in malnourished patients generally agree with others. In patients with gastrointestinal (GI) surgery, readmissions were more frequent in the malnourished (22.6% vs 16.1%, $P = .045$).[11] In Veterans Affairs (VA) case–control patients, readmissions were greater in the malnourished group (31% vs 12%).[7] In surgical ICU patients, 30-day readmissions were increased in patients with protein-energy malnutrition (28.5% vs 18.7%, $P = .045$).[12] ln our sample, 30-day readmissions were also greater in the malnourished patients (40% vs 23%, $P < .001$), and the odds of readmission were doubled even when demographic characteristics, type of admission, and

Table 2. Clinical Outcomes for Malnourished Relative to Not Malnourished Patients..

	Group	Unadjusted	Adjusted[a]
Readmission within 30 days, OR (95% CI)	Malnourished	2.24 (1.93–2.61)***	2.13 (1.82–2.48)***
C statistic	Not malnourished	Reference	Reference
		0.584	0.634
Hospital mortality, OR (95% CI)	Malnourished	1.76 (1.31–2.37)***	1.47 (1.08–1.99)*
C statistic	Not malnourished	Reference	Reference
		0.557	0.733

[a]Adjusted for age group, sex, race, medical/surgical admission, and Charlson Comorbidity Index.
*$P < .05$; ***$P < .001$.

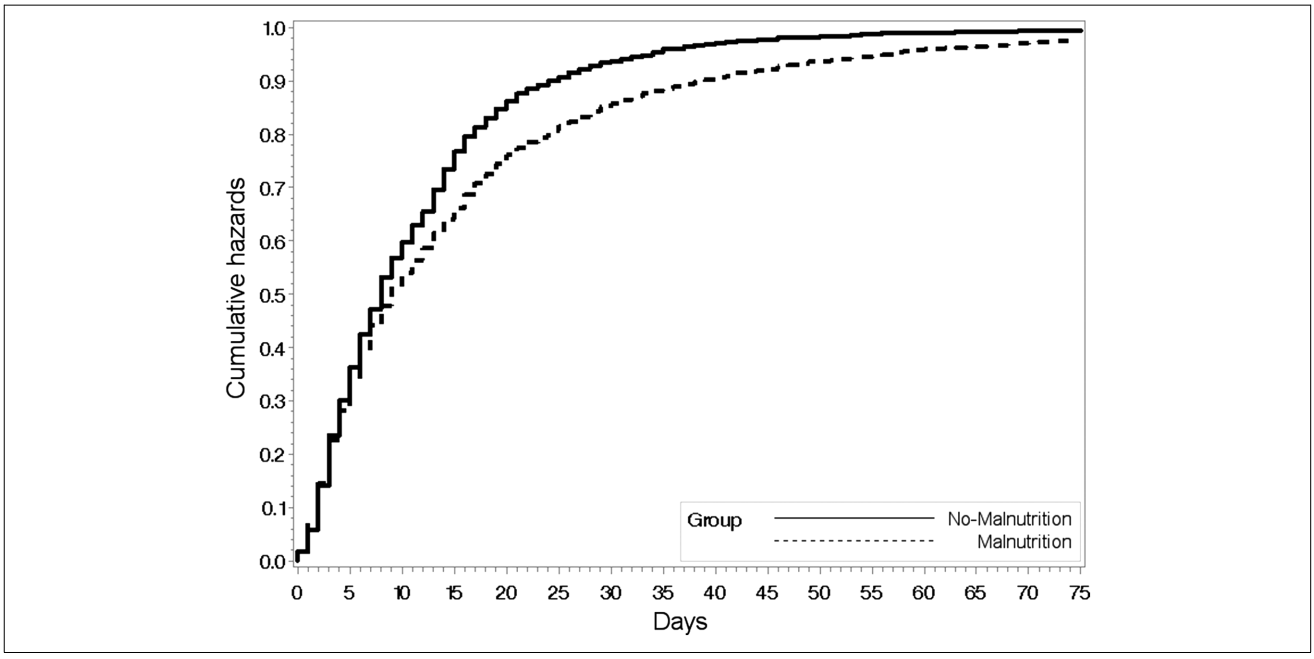

Figure 1. Time to discharge alive in patients identified as malnourished or not malnourished by Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition criteria. The hazard ratio was determined by Cox proportional hazards analysis.

CCI were included in the model. Because hospitals may be penalized financially when readmissions occur, it may be strategic to identify and treat malnourished patients early in the admission.

Smaller samples using the AND/ASPEN criteria agree with our finding that in-hospital mortality is increased in malnourished patients, and report even higher mortality rates after the hospital discharge. In 490 patients who had GI surgery, malnutrition was associated with higher in-hospital mortality (7.5% vs 2.3%, $P < .021$).[11] When criteria similar to AND/ASPEN criteria were used in 1361 emergency surgery patients in a single ICU, mortality was increased in malnourished patients (nonspecific malnutrition vs protein-energy malnutrition vs no malnutrition, respectively: in-hospital mortality, 10.8% vs 18.7% vs 6.8%, $P = .001$; 90-day mortality, 18.6% vs 31.8% vs 13.1%, $P < .001$; 12-month mortality, 29.3% vs 48.6% vs 25.6%, $P < .001$).[12] In a case–control comparison of 202 malnourished patients with 202 patients of similar age who were admitted to the same service on the same day in a VA hospital, the malnourished patients had greater 90-day mortality (32% vs 8%).[7] In our sample of 3907 patients admitted for medical and/or surgical treatments, the in-hospital mortality was greater in malnourished patients than those without malnutrition (8% vs 5%). Although we do not have mortality rates at later points in time, these reports by others of greatly increased mortality in malnourished patients over the posthospital timeframe highlight the vulnerable health of these patients.

Malnourished patients also have longer LOSs. In 682 Portuguese hospitalized patients, LOS >7 days was greater in the malnourished group (67% vs 31%, $P < .001$),[5] an

outcome that was associated with approximately 20% greater cost of care.[13] The malnourished VA patients more often had LOS >7 days (41% vs 14%, $P < .001$).[7] Our sample also had 3 days longer LOS in survivors (15 vs 12 days), time that would increase the cost of care. Furthermore, in patients who remain hospitalized >2 days, the likelihood of shorter TDA was reduced approximately 45% in patients with malnutrition, even in the adjusted model. Although we cannot identify the cause of the change after 2 days, it seems likely that for patients who leave within an earlier window, the discharge or mortality is more likely to be influenced by the nature of their clinical condition or its treatment than by a chronic problem like malnutrition.

Using the Subjective Global Assessment (SGA)[14] to identify malnourished patients, a method that considers similar criteria to the AND/ASPEN approach, the results are also similar to our findings. In 818 hospital patients in Singapore, even when adjusting for underlying disease, malnourished patients had longer LOS (6.9 vs 4.6 days), more 15-day readmissions (17% vs 10.5%), higher cost of hospitalization, and increased mortality at 1 and 3 years.[2] In 709 Brazilian patients, malnutrition was associated with greater mortality (12.4% vs 4.7%) and longer LOS (16.7 vs 10.1 days), the latter with 300% increase in cost of care.[4] In another group of 705 hospitalized Brazilian patients, malnutrition was associated with increased likelihood of very long LOS (>16 days; $P = .008$ in SGA B, $P < .0001$ in SGA C patients).[15] In 605 hospitalized Spanish non-ICU patients who required PN, those with moderate or severe malnutrition had increased in-hospital mortality (24%–25% vs 9%).[16] Finally, in 3122 patients in the Australasian Nutrition Care Day Survey, the malnourished patients had longer LOS (15 vs 10 days) and greater readmission rates (36% vs 30%).[17]

The prevalence of malnutrition cannot be derived from our analysis. Our sample included patients referred for nutrition assessment from a malnutrition risk screen, EN or PN orders, or a longer ICU stay. Of these high-risk patients, 67% had moderate or severe malnutrition by AND/ASPEN criteria. However, our hospital's total admissions during the 12-month study period were 34,256, including low-risk populations (e.g. obstetrics and clinical research center), and thus the overall prevalence of malnutrition in our hospital is probably significantly lower than 67% because not all patients receive a nutrition assessment. It is also possible that some patients who in fact had malnutrition were not identified in the referral criteria. In the absence of evaluation of every admission against the AND/ASPEN criteria, a true prevalence rate cannot be documented.

Our study has both strengths and limitations. The large sample includes all admitted adult patients assessed for malnutrition over a 12-month period. All registered dietitians had received in-depth and ongoing training, including competency assessment, on the malnutrition assessment criteria, had undergone random clinical pertinence monitoring and were experienced with the method of nutrition assessment. A strength of the AND/ASPEN approach is the ability to recognize malnutrition in overweight and obese patients, as well as those with significant inflammation, who were included in this population. The diverse patient population included both general medical/surgical and ICU admissions, as well as inpatient rehabilitation and long-term acute care. However, only patients who were referred for nutrition assessment were evaluated, and others not referred may also have been malnourished. Although there is no adequate measure of clinical acuity in a general hospital population, the CCI that was applied here, has been validated in other populations,[9,18] and also applied to hospitalized patients with malnutrition.[5,6,11]

Limitations to consider include the retrospective data collection, which risks missing details that might shed light on the differences in outcome. However, we have confirmed that no major changes in medical or surgical practices or differences in referral or documentation patterns occurred that would have great impact on the findings. Another potential limitation of our findings is that our statistical approach allowed capture of only the initial malnutrition evaluation; only the first admission was included in patients who had multiple admissions during the study period. Because patients could have become malnourished after the first assessment or during a subsequent admission, our approach may have underreported the full prevalence of malnutrition in patients initially evaluated as not malnourished. Furthermore, we were not able to determine whether the malnutrition existed at the time of admission or occurred during the hospital stay. Our patient sample, although reflective of our northeastern geographic region, may not be representative of other parts of the United States because of differences in racial/ethnic diversity. We did not include handgrip measures in our application of the AND/ASPEN criteria during this period because we had not yet incorporated the testing into our nutrition assessment process. Even though the dynamometers are currently available, in our high-acuity setting many patients are either sedated or too severely ill to cooperate with a handgrip strength measure. However, the AND/ASPEN approach requires only 2 of the 6 potential criteria to make a diagnosis and discourages the use of handgrip in patients with moderate malnutrition. Patients with severe malnutrition are likely to be identified on the basis of 2 of the 5 remaining criteria. A final limitation is that our 30-day readmission data did not distinguish between planned and unplanned readmissions.

In conclusion, this large study adds to the growing body of evidence that the AND/ASPEN criteria are effective at identifying patients with malnutrition who have more negative clinical outcomes than those identified as not

malnourished. Further studies are needed to determine what treatment approaches are most effective in improving outcomes in these patients whose malnutrition is disease related.

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Statement of Authorship

Lauren Hudson and Charlene Compher contributed to the conception/design of the research; Lauren Hudson, Charlene Compher, Cody Griffith, and Jesse Chittams contributed to the acquisition, analysis, and interpretation of the data; Lauren Hudson and Charlene Compher drafted the manuscript All authors critically revised and agree to be held responsible for the integrity and accuracy of the work, and have read and approved the final manuscript.

References

1. White JV, Guenter P, Jensen G, et al. 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.
2. Lim SL, Ong KC, Chan YH, Loke WC, Ferguson M, Daniels L. Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. *Clin Nutr*. 2012;31(3):345-350.
3. Agarwal E, Ferguson M, Banks M, et al. Nutrition care practices in hospital wards: results from the Nutrition Care Day Survey 2010. *Clin Nutr*. 2012;31(6):995-1001.
4. Correia MI, Waitzberg DL. The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. *Clin Nutr*. 2003;22(3):235-239.
5. Guerra RS, Fonseca I, Pichel F, Restivo MT, Amaral TF. Usefulness of six diagnostic and screening measures for undernutrition in predicting length of hospital stay: a comparative analysis. *J Acad Nutr. Diet*. 2015;115(6):927-938.
6. Allard JP, Keller H, Jeejeebhoy KN, et al. Malnutrition at hospital admission-contributors and effect on length of stay: A prospective cohort study from the Canadian Malnutrition Task Force. *JPEN J Parenter Enteral Nutr*. 2016;40(4):487-497.
7. Hiller LD, Shaw RF, Fabri PJ. Difference in Composite End Point of Readmission and Death Between Malnourished and Nonmalnourished Veterans Assessed Using Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition Clinical Characteristics. *JPEN J Parenter Enter Nutr*. Published September 8, 2016. https://doi.org/10.1177/0148607116668523
8. Skipper A, Ferguson M, Thompson K, Castellanos VH, Porcari J. Nutrition screening tools: an analysis of the evidence. *JPEN J Parenter Enteral Nutr*. 2012;36(3):292-298.
9. D'Hoore W, Bouckaert A, Tilquin C. Practical considerations on the use of the Charlson comorbidity index with administrative data bases. *J Clin Epidemiol*. 1996;49(12):1429-1433.
10. Allison P. *Survival Analysis Using SAS®: A Practical Guide, Second Edition*. 2nd ed. Cary, NC: SAS Institute Inc; 2010.
11. Mosquera C, Koutlas NJ, Edwards KC, et al. Impact of malnutrition on gastrointestinal surgical patients. *J Surg Res*. 2016;205(1):95-101.
12. Havens JM, Columbus AB, Seshadri AJ, et al. Malnutrition at intensive care unit admission predicts mortality in emergency general surgery patients. *JPEN J Parenter Enter Nutr*. Published November 11, 2016. https://doi.org/10.1177/0148607116676592
13. Guerra RS, Sousa AS, Fonseca I, et al. Comparative analysis of undernutrition screening and diagnostic tools as predictors of hospitalisation costs. *J Hum Nutr Diet.* 2016;29(2):165–173.
14. Detsky AS, McLaughlin JR, Baker JP, et al. What is subjective global assessment of nutritional status? *JPEN J Parenter Enter Nutr*. 1987;11(1):8-13.
15. Raslan M, Gonzalez MC, Torrinhas RS, Ravacci GR, Pereira JC, Waitzberg DL. Complementarity of Subjective Global Assessment (SGA) and Nutritional Risk Screening 2002 (NRS 2002) for predicting poor clinical outcomes in hospitalized patients. *Clin Nutr*. 2011;30(1):49-53.
16. Study Group of Hyperglycemia in Parenteral Nutrition; Nutrition Area of the Spanish Society of Endocrinology and Nutrition (SEEN). The Subjective Global Assessment predicts in-hospital mortality better than other nutrition-related risk indexes in noncritically ill inpatients who receive total parenteral nutrition in Spain (prospective multicenter study). *J Acad Nutr Diet.* 2013;113:1209-1218.
17. Agarwal E, Ferguson M, Banks M, et al. Malnutrition and poor food intake are associated with prolonged hospital stay, frequent readmissions, and greater in-hospital mortality: results from the Nutrition Care Day Survey 2010. *Clin Nutr*. 2013;32(5):737-745.
18. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol*. 1992;45(6):613-619.