RESEARCH

Original Research: Brief

The Association between Oral Nutritional Supplements and 30-Day Hospital Readmissions of Malnourished Patients at a US Academic Medical Center

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ABSTRACT

Background Malnutrition affects up to 50% of hospitalized patients and contributes to adverse health and economic outcomes, but often remains unrecognized or undertreated.

Objective This study assessed the utilization of oral nutritional supplements (ONS) and its association with the number of 30-day unplanned hospital readmissions of adult malnourished patients in comparison with the readmissions rates of their malnourished counterparts who did not receive ONS.

Design This was a retrospective cohort study.

Participants/setting Of 153,161 inpatient encounters analyzed, a total of 8,713 (5.7%) malnourished adults admitted to an academic medical center hospital in the United States between October 1, 2016, and September 30, 2017 were included in the analyses. The study utilized records of patients at risk of malnutrition on admission and subsequently diagnosed as malnourished by a registered dietitian following established criteria.

Main outcomes measures ONS utilization rate, hospital length of stay (LOS), and 30-day unplanned hospital readmissions data were obtained from electronic medical records.

Statistical analyses performed The associations between the number of 30-day unplanned hospital readmissions and ONS use were analyzed using mixed-effects negative binomial regression models, with coefficients and 95% CIs reported. Important covariates such as age, sex, and the severity of illness index were included in the regression models.

Results Only 3.1% of malnourished patients received ONS. ONS users had 38.8% fewer readmissions compared with non-ONS counterparts (P=0.017). The reduction in hospital readmissions by ONS was even greater for oncology patients (46.1%, P<0.001). A 50% reduction in time from hospital admission to ONS provision was associated with a 10.2% (P<0.01), 10.2% (P=0.014), and 16.6% (P<0.01) decrease in LOS for overall, oncology, and intensive care unit encounters, respectively.

Conclusions In a large cohort of malnourished adult inpatient encounters, ONS provision rate was low, but when used, ONS intervention was associated with 38.8% fewer 30-day readmissions. This association was more pronounced for oncology encounters. Shorter LOS was observed when the interval between admission and ONS initiation was shorter. Reduced LOS and readmissions rates could result in financial benefits for health care systems prioritizing hospital nutrition care, in addition to informing significant medical benefits for their patients.
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APPROXIMATELY 30% TO 50% OF PATIENTS ARE malnourished at the time of hospital admission, and 38% of well-nourished patients experience a nutritional decline during their hospital stay.[1-3] Malnutrition has been shown to contribute to higher hospital morbidity, mortality, length of stay (LOS), and readmission.[4,5] Hospitalized patients with poor but unrecognized or undertreated nutritional status continue to lose weight after discharge, putting them at an increased risk of readmission 30 days after their initial hospital admission and posing an

additional economic burden on families and hospitals.[1,6,7] Screening for malnutrition upon hospital admission and intervening with a proper nutrition care plan are vital to the optimization of both the health and economic outcomes of malnourished patients or those at risk of malnutrition.[8-11]

Adequate early nutrition intervention can improve the outcomes of hospitalized patients by preserving patients' lean body mass to optimize functional capacity and prevent sarcopenia, which portends to higher morbidity, mortality, and costs.[12-15] A recent systematic review reported that use of oral nutritional supplements (ONS) in the acute-care setting was associated with an overall financial savings of 12.2% with reduced mortality (risk ratio 0.65), lower morbidity (35% reduction), fewer complications (35.3% reduction), and shorter mean LOS (2-day reduction).[16] Streamlined nutrition protocols utilizing ONS with and without other nutrition interventions (eg, nutrition screening, dietitian consultation, postdischarge follow-ups) for hospitalized patients were found to decrease 30-day hospital readmissions.[8,11,17] However, other studies found no between-group readmission or LOS differences among the malnourished patient population with provision of ONS (with and without other interventions).[10,18-21]

Given the inconsistent findings regarding the association between ONS provision and health and economic outcomes of malnourished hospitalized patients, we aimed to assess both the utilization of ONS as well as its association with the number of 30-day unplanned hospital readmissions for malnourished patients admitted at a large academic medical center in the mid-Atlantic region of the United States.

METHODS

Study Design and Participants

This was a retrospective cohort study of 153,161 inpatient encounters at the hospital level, of which 8,713 (5.7%) malnourished adults (18 years and older) were admitted for a medical or surgical diagnosis in any of the general and surgical wards (excluding pediatric and pregnant patients, and those not malnourished) between October 1, 2016, and September 30, 2017. A waiver of consent from the institution's internal review board was utilized for the data abstraction. All data were obtained from the electronic medical records.

Patients at risk of malnutrition had been identified in screening by a registered nurse by the following institutional criteria: (1) unplanned weight loss of more than 10 lbs in the previous 3 months or (2) decreased oral intake for 5 days prior to hospital admission. Each criterion is reported to be one of the five main diagnostic criteria of malnutrition by the Global Leadership Initiative on Malnutrition.[22]

Patients who screened positive for malnutrition risk were further assessed for malnutrition by a registered dietitian. The same team of dietitians was used consistently across all cases, and all dietitians underwent hospital training to use malnutrition diagnostic criteria of the Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition.[23-25] Patients were confirmed as malnourished if they satisfied a minimum of two of the six criteria related to (1) energy intake, (2) weight loss, (3) body fat, (4) muscle mass, (5) fluid accumulation, or (6) low grip strength.[23-25]

RESEARCH SNAPSHOT

Research Question: Is use of oral nutritional supplements (ONS) among hospitalized adult malnourished patients associated with fewer 30-day unplanned hospital readmissions compared with their malnourished counterparts not receiving ONS?

Key Findings: In this retrospective cohort study of 8,713 malnourished adult inpatient encounters, ONS use was associated with 38.8% fewer 30-day readmissions for all encounters, with the association being more pronounced for oncology encounters.

Patients with ONS prescribed during their hospital stay were identified by orders entered in the electronic medical record.

Outcome Variables

Malnutrition prevalence was characterized by descriptive statistics. To demonstrate the incremental burden of malnutrition, mean hospital LOS and 30-day readmission rates for all patients and for patients with malnutrition diagnoses were recorded.

For regression analyses, the primary outcome variable was the number of 30-day unplanned readmissions. The explanatory variable for the primary analyses was binary—yes or no to ONS orders placed during the hospital stay. Regression analyses were also separately conducted to analyze how time from hospital admission to ONS order is associated with LOS.

Covariates and Confounding Variables

Covariates and confounding variables included those commonly reported in the hospital readmissions literature, including sociodemographic characteristics (ie, sex, age, race, marital status) and clinical characteristics (hospital-acquired conditions [HACs], the severity of illness index [SOI], body mass index [BMI]).[25] The HAC variable denoted whether a HAC was present or the patient was at risk for a HAC. The SOI ranged from one to four, with one being the least severe. Wards or departments described whether the patient episode was an admission to the intensive care unit (ICU), surgical, psychiatric, oncology, research, rehabilitation, or medical ward. Living arrangements prior to hospital admission were indicated as the inpatient encounters admission source and included other hospitals (transfer), cancer center or units or wards, home, psychiatric hospitals or centers, nursing facility, rehabilitation facility, hospice, and other arrangements, including whether the patient had previously left a hospital against medical advice. Finally, health insurance was included in the regression analysis to control for differences in access to health resources. Out-of-state insurance covered hospitals that were out of the subject's state of residence. Priority or national health insurance denoted state-level health insurance, which is similar to Medicaid in that the state government provides free or reduced-price health insurance to low-income people in need of affordable health care services.

Table 1. Characteristics of malnourished patients who received ONS[a] and those who did not (non-ONS) admitted to an academic medical center hospital between October 1, 2016 and September 30, 2017 (n=8,713)

Variables	ONS (n=274; 3.1%)	Non-ONS (n=8,439; 96.9%)	Unadjusted P value
	←————————mean±SD[b]————————→		
Length of stay	17.1±24.8	8.5±10.4	<0.001
Number of 30-day readmissions	1.7±3.4	1.7±3.9	0.862
	←————————n (%)————————→		
Female	113 (41.2)	4,331 (51.3)	0.001
	←————————mean±SD————————→		
Age (y)	60.8±16.3	55.6±17.0	<0.001
	←————————n (%)————————→		
Race or ethnicity			
Native American	0 (0.0)	7 (0.1)	0.633
Asian American	9 (3.3)	217 (2.6)	0.465
African American	93 (34.0)	3,491 (41.4)	0.014
White	155 (56.6)	4,196 (49.7)	0.026
Hispanic	2 (0.7)	92 (1.1)	0.570
Other[c]	15 (5.5)	436 (5.2)	0.821
Married	126 (46.0)	3,466 (41.1)	0.104
Hospital-acquired conditions[d]	46 (16.8)	671 (8.0)	<0.001
	←————————mean±SD————————→		
Severity of illness index	3.2±0.8	2.73±0.9	<0.001
Body mass index	22.8±6.2	32.0±381.9	0.689
	←————————n (%)————————→		
Wards or departments			
Intensive care unit	18 (6.6)	614 (7.3)	0.657
Surgical	46 (16.8)	1,469 (17.4)	0.790
Psychiatric	1 (0.4)	518 (6.1)	<0.001
Oncology	68 (24.8)	1,783 (21.1)	0.142
Research	5 (1.8)	189 (2.2)	0.647
Rehabilitation	4 (1.5)	110 (1.3)	0.823
Medical	132 (48.2)	3,756 (44.5)	0.229
Living arrangement before hospital admission			
Other hospital	7 (2.6)	237 (2.8)	0.802
Cancer center or unit or ward	2 (0.7)	83 (1.0)	0.674
Home	178 (65.0)	5,289 (62.7)	0.440
Left hospital against advice	3 (1.1)	168 (2.0)	0.293
Psychiatric hospital or center	2 (0.7)	84 (1.0)	0.662
Nursing facility	7 (2.6)	77 (0.9)	0.006
Rehabilitation facility	5 (1.8)	87 (1.0)	0.206
Hospice	0 (0.0)	8 (0.1)	0.610

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Table 1. Characteristics of malnourished patients who received ONS[a] and those who did not (non-ONS) admitted to an academic medical center hospital between October 1, 2016 and September 30, 2017 (n=8,713) (continued)

Variables	ONS (n=274; 3.1%)	Non-ONS (n=8,439; 96.9%)	Unadjusted P value
	←————————n (%)————————→		
Health insurance			
Out-of-state insurance	19 (6.9)	601 (7.1)	0.905
Medicare	150 (54.7)	3,484 (41.3)	<0.001
Priority health insurance	16 (5.8)	662 (7.8)	0.223
National health insurance	13 (4.7)	452 (5.3)	0.658

[a]ONS=oral nutritional supplements.
[b]SD=standard deviation.
[c]Includes individuals who identified their race or ethnicity as "other."
[d]Postadmission complications that may result from hospital care and treatment, such as accidental puncture or laceration during an invasive procedure or infections related to central venous catheters. In contrast to complications resulting from underlying disease progression, hospital-acquired conditions are considered potentially preventable.

Statistical Analyses

The associations between the number of 30-day unplanned hospital readmissions and ONS use were analyzed using mixed-effects negative binomial regression models, with coefficients and 95% CIs reported. Mixed-effects models allow encounters of the same patient to have the same intercept, and therefore allow encounters to be correlated within the same patient. Negative binomial regression models were performed to analyze count data and account for overdispersion (ie, variance greater than means of the dependent variable). The coefficients of mixed-effects negative binomial regression models and Poisson regression models should be interpreted as the change in the log of the dependent variable associated with a one-unit change in the explanatory variable, holding all other predictors constant. The regression coefficient β could be approximately interpreted as follows: for a one-unit change in the explanatory variable, the dependent variable is expected to change by $100 * \beta$ percentage points. Given the easier interpretation, regression coefficients instead of incidence rate ratio (exponentiated regression coefficients) were reported.

Separate regression results were reported for all malnourished encounters, oncology encounters, and ICU encounters. Mixed-effects Poisson regression models were used for oncology and ICU encounters because mixed-effects negative binomial regression models failed to converge and yield results. Similarly, a mixed-effects negative binomial model was used for all encounters and for oncology encounters when analyzing the association between time to ONS and LOS. But due to failure of convergence by the mixed-effects negative binomial model, the mixed-effects Poisson model was used for ICU encounters.

T tests were used to compare the means of the variables and calculate the unadjusted P values of the difference in the descriptive analyses. Z tests were used to assess the significance of variables in the regression models, and a P value<0.05 was deemed as statistically significant. To assess the goodness of fit of the model, likelihood ratio tests were conducted to assess the presence of overdispersion in the data and whether the mixed-effects model was preferred over the pooled model. All likelihood ratio tests confirmed the presence of overdispersion and supported that mixed-effects model was better than the pooled model. All analyses were conducted with STATA 15.1 software (Stata Corp).[26]

RESULTS

Mean hospital LOS for malnourished patients was 8.3 (±10.3) days. The 30-day readmission rate was 37.9%. ONS utilization among malnourished patients was reported to be 3.1%, and the average time from admission to ONS provision was more than 3 days: 84.6 (±140.2) hours.

The average hospital LOS was significantly longer for ONS patients compared with non-ONS patients (17.12 vs 8.54 days, respectively; P<0.001; Table 1). The average number of 30-day hospital readmissions was 1.66 for ONS and 1.70 for non-ONS patients, respectively (P=0.862). ONS encounter patients were significantly older than non-ONS encounter patients (60.8 vs 55.6 years, respectively, P<0.001). African Americans (P=0.014) and females (P<0.001) were less likely to receive ONS orders. Also, sicker patients and those with a HAC were more likely to receive ONS orders (16.8% vs 8.0%, P<0.001). The average SOI was 3.16 among ONS encounters vs 2.73 among non-ONS encounters (P<0.001). Marital status and average BMI between ONS and non-ONS patients were not statistically different (P=0.104 for marital status; P=0.689 for BMI).

There was no difference in the percent of patients admitted in the ICU, surgical, oncology, research, rehabilitation, or medical wards between ONS and non-ONS encounters (all P<0.05). However, the percent of patients admitted in psychiatric wards was significantly lower among ONS encounters compared with non-ONS encounters (0.4% vs 6.1%, P<0.001). In addition, significantly more ONS patients resided in a skilled nursing facility prehospital admission compared with non-ONS encounters (2.6% vs 0.9%, P=0.006). The proportion of ONS patients who had Medicare as their health insurance was higher compared with that of non-ONS patients (54.7% vs 41.3%, P<0.001).

Table 2 reports the coefficients and 95% CIs of the mixed-effects regressions on the number of 30-day unplanned hospital readmissions. Using the regression model to adjust for key sociodemographic and clinical characteristics covariates, ONS orders were found to be associated with 38.8% fewer

Table 2. The association between encounters with patients who received ONS[a] and the number of 30-day hospital readmissions among malnourished inpatients admitted to an academic medical center hospital between October 1, 2016, and September 30, 2017[b]

Variables	All encounters (n=8,713)	Oncology encounters (n=1,851)	ICU[c] encounters (n=632)
	←————————coefficients (95% CIs)————————→		
ONS	−0.388* (−0.706, −0.069)	−0.461** (−0.716, −0.206)	−0.588 (−1.566. 0.391)
Female	−0.253 (−0.560, 0.053)	−0.245** (−0.409, −0.081)	−0.109 (−0.391, 0.174)
Age	−0.006 (−0.018, 0.005)	−0.011** (−0.018, −0.004)	−0.011 (−0.022, 0.000)
Race or ethnicity			
Native American	—	1.163 (−1.630, 3.955)	−0.135 (−2.771, 2.500)
Asian American	0.871 (−0.371, 2.112)	0.304 (−0.184, 0.791)	0.191 (−0.815, 1.197)
African American	−0.042 (−0.729, 0.645)	0.143 (−0.215, 0.500)	−0.132 (−0.792, 0.528)
White	0.330 (−0.342, 1.002)	0.114 (−0.217, 0.445)	0.079 (−0.560, 0.719)
Hispanic	1.991 (−1.983, 5.966)	−0.497 (−1.263, 0.269)	0.053 (−1.369, 1.475)
Hospital-acquired conditions	−0.067 (−0.243, 0.109)	−0.092 (−0.213, 0.028)	0.218 (−0.150, 0.586)
Living arrangement before hospital admission			
Other hospital	0.160 (−0.203, 0.522)	0.008 (−0.002, 0.018)	0.304 (−0.364, 0.973)
Cancer center or unit or ward	0.623 (−0.322, 1.567)	−19.360 (−8,425, 8,386)	0.074 (−1.262, 1.411)
Home	0.003 (−0.112, 0.118)	0.178** (0.080, 0.277)	0.071 (−0.230, 0.372)
Left hospital against advice	0.019 (−0.362, 0.400)	0.379 (−1.589, 2.346)	0.521 (−0.530, 1.572)
Psychiatric hospital or center	0.143 (−0.425, 0.710)	—	−17.540 (−16,687, 16,652)
Nursing facility	0.555 (−0.069, 1.180)	−0.643 (−1.811, 0.524)	−0.271 (−1.732, 1.189)
Rehabilitation facility	0.050 (−0.418, 0.518)	0.853 (−0.116, 1.822)	−1.350 (−3.497, 0.798)
Hospice	0.503 (−0.613, 1.618)	0.996 (−0.428, 2.421)	—
Health insurance			
Out-of-state insurance	−0.099 (−0.553, 0.353)	−0.133 (−0.395, 0.129)	−0.0781 (−0.641, 0.485)
National health insurance	−0.565* (−1.085, −0.046)	−0.141 (−0.473, 0.191)	0.190 (−0.482, 0.862)
Priority health insurance	0.017 (−0.359, 0.394)	−0.022 (−0.382, 0.337)	0.119 (−0.507, 0.746)
Medicare	0.012 (−0.269, 0.292)	−0.312** (−0.491, −0.134)	0.0271 (−0.301, 0.356)

[a]ONS=oral nutritional supplements.
[b]All values are reported as coefficients from mixed effects negative binomial regression models (column 1) and mixed effects Poisson regression models (columns 2 and 3). The 95% CIs are in the parentheses. Marital status, body mass index, severity of illness index, and the hospital wards categorical variables are also included in the regression analyses.
[c]ICU=intensive care unit.
*$P<0.05$.
**$P<0.01$.

30-day readmissions ($P=0.017$). Patients with national health insurance had 56.5% fewer 30-day hospital readmissions than those who had other health insurance ($P=0.033$).

Among oncology patients, ONS users were associated with 46.1% fewer 30-day hospital readmissions after controlling for other covariates and confounding variables for these patients ($P<0.001$). In addition, patients who had been directly admitted from home settings or from rehabilitation facilities were found to have more 30-day readmissions compared with those with other living arrangements (homes, 0.178, $P<0.001$; rehabilitation, 0.853, $P=0.084$). Oncology patients who had Medicare had 31.2% fewer 30-day readmissions than those who had other types of health insurance ($P=0.001$).

Among ICU patients, those with ONS orders had 58.8% fewer 30-day hospital readmissions than those without ONS orders after accounting for relevant covariates and confounding variables ($P=0.239$). However, the cohort of ICU encounters was small, with only 632 encounters included in the analysis.

Factors associated with LOS among malnourished inpatient encounters (overall, oncology, and ICU encounters, respectively) are shown in Table 3. A 50% reduction in time to ONS was associated with a 10.2% ($P<0.01$) decrease in LOS. Similarly, a 50% reduction in time to ONS is associated with a reduction in LOS of 10.2% ($P=0.014$). The largest association of shorter time to ONS is seen among ICU encounters, for whom

Table 3. The association between time to ONS[a] and length of stay (LOS) among malnourished inpatient encounters admitted to an academic medical center hospital between October 1, 2016 and September 30, 2017[b]

Variables	All encounters (n=141)	Oncology encounters (n=23)	ICU[c] encounters (n=11)
	coefficients (95% CIs)		
Log time to ONS	0.204** (0.101, 0.307)	0.204* (0.042, 0.366)	0.332** (0.180, 0.484)
Female	0.098 (−0.168, 0.363)	0.445 (−0.024, 0.915)	0.352 (−0.548, 1.253)
Age	0.003 (−0.006, 0.013)	0.014 (−0.018, 0.045)	0.089* (0.006, 0.171)
Race or ethnicity			
Native American	—	—	—
Asian American	1.084* (0.120, 2.048)	—	—
African American	0.466 (−0.135, 1.066)	−0.489 (−2.340, 1.363)	3.303** (1.679, 4.928)
White	0.428 (−0.155, 1.010)	−0.541 (−2.433, 1.351)	2.814** (1.774, 3.854)
Hispanic	0.024 (−1.493, 1.541)		
Married	−0.023 (−0.324, 0.278)	0.083 (−0.678, 0.844)	0.869 (−0.388, 2.127)
Severity of illness index	0.723** (0.502, 0.945)	0.465* (0.002, 0.928)	0.444 (−0.521, 1.409)
Health insurance			
Out-of-state insurance	0.280 (−0.185, 0.744)	−0.054 (−0.889, 0.781)	−0.864* (−1.702, −0.025)
National health insurance	−0.255 (−0.874, 0.363)	—	—
Priority health insurance	−0.611* (−1.168, −0.053)	−1.039 (−2.326, 0.247)	0.850 (−0.312, 2.011)
Medicare	−0.163 (−0.487, 0.162)	−0.579 (−1.191, 0.034)	1.610 (−0.363, 3.582)

[a]ONS=oral nutritional supplements.
[b]All values are reported as coefficients from mixed-effects negative binomial regressions (columns 1 and 2) and mixed-effects Poisson regressions (column 3). The 95% CIs are in the parentheses.
[c]ICU=intensive care unit.
*$P<0.05$.
**$P<0.01$.

a 50% reduction in time to ONS was associated with a 16.6% reduction in LOS ($P<0.01$).

DISCUSSION

This study found that only 3.1% of malnourished patients received an ONS order during their hospitalization. Although the low utilization rate of ONS observed is consistent with previous studies,[9,27] the prevalence of malnutrition was found to be slightly lower than that reported in previous literature. More recently, national surveillance data from 2016 suggest that 8% of adult hospitalizations across the United States have a malnutrition diagnosis documented in their medical records.[28] However, the prevalence of hospital malnutrition is frequently underestimated.[3] Therefore, the different estimates reported to date are likely due to heterogeneity in both use of tools and mechanisms for screening, assessment, and diagnosing malnutrition in US hospitals.[29]

Our analyses revealed sex and racial disparities in the provision of ONS. In comparing the characteristics between ONS and non-ONS encounters, we found that older, sicker patients and those having Medicare were more likely to receive ONS orders, and African Americans and females were less likely to receive ONS orders. These results are consistent with those of previous research,[10,28]

and they reinforce concerns about potential health disparities in the delivery of specialized nutrition support in the hospital setting. For example, Nguyen and colleagues reported that African Americans with inflammatory bowel disease were less likely to receive total parenteral nutrition than were whites, whereas there was no difference between Hispanics and non-Hispanic whites.[30] These investigators found that there were longer time intervals to the initiation of parenteral nutrition for African Americans, suggesting that the recognition of malnutrition may be more delayed in some minority populations.

This study found that the use of ONS by malnourished patients was associated with a significant reduction in the number of 30-day readmissions across all encounters. After controlling for key sociodemographic and clinical characteristics, ONS patients had 38.8% fewer 30-day hospital readmissions than their non-ONS counterparts. Although the retrospective study design employed is only able to imply correlations between the assessed factors, the current findings are consistent with previous studies showing that ONS use, with or without other nutrition interventions, can reduce readmissions of nutritionally vulnerable inpatient populations, including oncology patients.[9,17,20,31,32]

The results also suggest an association between time to ONS ordering from hospital admission and hospital LOS;

shorter intervals to ordering ONS were associated with shorter LOS. Furthermore, a 50% reduction in the time to ONS order was associated with a 10.2% decrease in overall LOS, including 10.2% and 16.2% decreases for patients in the oncology and ICU departments, respectively, who had confirmed malnutrition. These results collectively suggest that providing timely and appropriate nutrition support to address malnutrition status of all hospitalized patients, and particularly those at higher risk, such as oncology and ICU patients, is associated with improved health outcomes.

Overall, the association we found between ONS use and decreased readmissions and LOS is consistent with previous studies that found timely and appropriate ONS use significantly lowered readmission rates and shortened LOS, in turn leading to reduced health care costs.[9,17,32,33] For example, implementation of a comprehensive nutrition-focused quality improvement program that consisted of prompt (24 to 48 hours) initiation of ONS for at-risk patients in addition to malnutrition risk screening at admission and nutrition education for the inpatient and caregivers resulted in reduced 30-day readmission and LOS,[13] which were monetized with cost savings reported to be over $4.8 million total, or $3,858 per patient treated.[11,17] The improved health outcomes observed in this quality improvement program study can also be reflected in cost savings, primarily as a result of reduced readmissions (which can cost as much as $18,478 per patient),[25] but also shorter LOS (a day in the hospital costs on average $1,770).[5] These findings are therefore relevant to the annual total direct and indirect costs of disease-associated malnutrition in the United States, which have been shown to add up to $156.7 billion nationally.[25,27,32]

Study Limitations

The study findings rely on data from a single academic medical center and may not be generalizable. Furthermore, readmissions to hospitals outside the medical center system would not be detected, so readmission findings may be underestimated. In addition, data were unavailable regarding ONS consumption and compliance during hospital stay and following discharge. It was also not possible to determine how oral diets were maximized prior to or as an adjunct to the use of ONS. In this study, malnutrition assessment was confirmed using the criteria jointly established by the Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition. Although the established characteristics help facilitate recognition of malnutrition and more reliable estimates of its prevalence,[23,24] their use can also be viewed as a limitation because they are yet to be universally implemented. In fact, the need for validation studies of malnutrition diagnosis criteria are proposed.[22] Despite these limitations, the current research study included records of a large number of patient encounters as a way to study associations between ONS and important health outcomes such as readmission and LOS in a real-world hospital setting.

CONCLUSION

This analysis found that ONS administration to malnourished hospitalized patients was associated with lower 30-day readmissions. This correlation was found to be particularly more pronounced for oncology patients. Also, a shorter interval between admission and ONS initiation was associated with shorter LOS. Future research is warranted to assess the impact of ONS provision, alone and in combination with other nutrition-focused interventions (ie, nutrition consultation, postdischarge follow-up) on health outcomes of malnourished patients regardless of diagnoses.

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