Nutrition-Focused Quality Improvement Program Results in Significant Readmission and Length of Stay Reductions for Malnourished Surgical Patients

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Abstract

Background: Addressing nutrition needs of inpatients results in improved health outcomes. We conducted a post hoc analysis of previously published data. The aim of this analysis was to evaluate the clinical benefits of a nutrition quality improvement program (QIP) in surgical patients when compared with medical patients. Methods: Data were collected from 1269 QIP patients and 1319 historical controls. These combined 2588 patients were categorized into surgical (390, 15%) and medical (2198, 85%) patient subgroups. Results: Readmission rate relative risk reductions were significantly higher among surgical patients when compared with the medical patients (46.9% vs 20.6%, \( P < .001 \)). Average length of stay decreased significantly for both groups (29.0% and 29.6%, \( P = .8 \)). Conclusion: Malnourished hospitalized surgical and medical patients experienced improved readmission rates and length of stay. However, surgical patients saw a significantly greater reduction in the readmission rate when compared with the medical patients, thus highlighting the importance of nutrition on surgical outcomes. The ClinicalTrials.gov Identifier for this study is NCT02262429. (JPEN J Parenter Enteral Nutr. 2018;42:1093–1098)

Keywords

length of stay; nutrition support; quality improvement program; readmissions; surgical patients

Clinical Relevancy Statement

Up to 50% of patients are at risk/malnourished upon hospital admission. Surgical patients in particular are vulnerable to a decline in nutrition status during hospitalization. The clinical implications of our findings are the following: (1) validated malnutrition risk screening and immediate oral nutrition supplement use can improve readmission rates and length of stay in at-risk hospitalized surgical patients (lowered readmission rates and shorter length of stay), and (2) expanded nutrition education and training is needed.

Introduction

Around the world, up to 50% of patients are at risk/malnourished on admission to the hospital1,2 and some experience a decline in nutrition status during their hospital stay. Surgery is a risk factor for a decline in nutrition status, especially for patients hospitalized for at least 7 days.3 For surgical patients, the risks associated with malnutrition include delayed wound healing, surgical site infections and other postoperative complications,4 a longer length of stay (LOS),1,3 and higher rates of hospital readmission.1,3

Hospitalized patients with any primary diagnosis who receive nutrition care can experience better clinical outcomes with lower healthcare costs. In a recent study, Sriram...
et al found that readmission and LOS were significantly reduced for malnourished inpatients with any diagnosis who were part of a nutrition-focused quality improvement program (QIP). When compared with baseline patients, QIP patients were screened with a validated screening tool (on admission), provided oral nutrition supplements (ONS) faster (<48 hours), and supported with nutrition information for both patient and caregiver.

When compared with patients with a medical diagnosis, surgical patients in particular are more vulnerable to a decline in nutrition status during hospitalization, and the avoidance of nutrition therapy bears the risk of underfeeding, which will in turn result in significant postoperative complications. Weimann et al suggest that the success of surgery not only depends on technical surgical skills but also on metabolic interventional therapy, that is, a patient’s ability to carry a metabolic load and receive appropriate nutrition support. Surgical patients have experienced improved health outcomes when consuming ONS before and/or after their surgical procedure. To determine if surgical patients benefit from nutrition interventions when compared with the general medicine patient population, we conducted a post hoc analysis of data from Sriram et al (where additional details are described). Specifically, in this paper we further examine the impact of the nutrition-focused QIP on the readmission rate and LOS of surgical patients when compared with medical patients.

Methods

Study Design and Participants

Eligible participants were hospitalized patients with any diagnosis, 18 years of age or older, at risk for malnutrition (Malnutrition Screening Tool [MST] score ≥ 2) at admission, and able to consume food and beverages orally (including patients with dysphagia or swallowing issues). Exclusion criteria included pregnancy, intubation, tube feeding or parenteral nutrition, advanced cancer with brain metastases, neurological or psychiatric disorders, or other conditions that could interfere with ONS consumption. A total of 1269 patients were enrolled in the QIP during the 6 months between October 13, 2014, and April 2, 2015. Historical controls included 1319 patients admitted to the same hospitals between October 13, 2013, and April 2, 2014. Patients in both the QIP and control groups were categorized into surgical (390/15%) and medical (2198/85%) patient subgroups based on the documentation of the primary discharge diagnoses by the coding department of the participating hospitals per standard of practice clinical documentation and coding guidelines (Figure 1). This multisite pre-QIP and post-QIP was approved by the Advocate Health Care (Downers Grove, IL) Institutional Review Board.

Interventions

A total of 4 hospitals implemented the QIP–2 teaching hospitals and 2 community hospitals. In the original study, patients were enrolled in a basic or an enhanced QIP, and these programs were independently tested. In this post hoc analysis, basic and enhanced QIP patients were combined into a single QIP group to create a large enough sample size to yield statistically reliable conclusions. Taken together, the 2 QIPs consisted of malnutrition risk screening at admission via electronic medical record, prompt initiation of ONS for at-risk patients, and nutrition education for the inpatient and caregivers (see Table 1). All QIP patients were screened at hospital admission using the MST. The electronic medical record upgrade was also designed to trigger appropriate dietitian consultations and the selection of standard or disease-specific ONS for all at-risk patients by the admitting nurse as long as there was no physician order to keep the patient nil by mouth. The electronic medical record was programmed to match the ONS formula type to the patient’s overall dietary orders (i.e., standard, clear liquid, diabetes-specific, or renal-specific ONS). For example, patients with dysphagia or swallowing issues were treated based on standard of care, which included thickened ONS or pudding. The QIP was standardized across specialties; both medical and surgical patients were screened using the MST, had ONS orders placed per the QIP guidelines, and provided the same education materials.

The control patients were screened for nutrition risk by nurses using a nonvalidated, internally developed tool. The tool was not used consistently, and there was not a clear link between the results of the screening and the decision to place an ONS order. Instead of solely relying on the results of the nonvalidated nutrition tool used prior to QIP implementation, 2 proxy measures were used to identify eligible control patients. The proxy measures included...
Table 1. Differences in Study Interventions.

| Characteristic                          | Control Group | QIP Group                  |
|-----------------------------------------|---------------|----------------------------|
| **Hospital admission**                  |               |                            |
| (6 months, from to April 2, 2013)       |               | (6 months, from to April 2, 2015) |
| **Nutrition screening**                 |               |                            |
| Internally developed, non-validated tool | MST           |
| Up to 72 hours after admission          | On admission, as part of EMR |
| Administered by RN                      | Administered by trained RN |
| **ONS ordered by**                      | Admitting RN, a MD, or RD | Admitting RN, MD, RD, and/or auto-drop |
| **ONS received by patient**             | After RD consultation | Before or after RD consultation |
| **Time to ONS order in hours**          | Up to 72 hours after RD consultation | Within 48 hours of admission |

EMR, electronic medical record; MD, medical doctor; MST, Malnutrition Screening Tool; ONS, oral nutrition supplements; QIP, quality improvement program; RD, registered dietitian; RN, registered nurse.

The key differences between the QIP and control cohorts included the screening tool used, the time to initiation of ONS, and the nutrition education given to patients and staff.

Outcome Measures

The primary outcome measure was 30-day unplanned readmission (all causes) to any Advocate Health Care system hospital. The secondary outcome was hospital LOS, calculated by subtracting admission day from discharge day.

Statistical Analysis

Descriptive statistics were calculated for all variables. Pre-group and postgroup differences for readmission rates and LOS were performed using the $\chi^2$ and Student $t$-test, respectively. Similar tests were performed to compare other categorical and continuous variables, and z-tests were performed for aggregate baseline readmission and LOS results. The analyses were performed using SPSS 22.0 (IBM Corp., Armonk, NY), and a z-test calculator. A 2-tailed $P$ level < .05 was considered statistically significant.

Results

Of the 1269 patients enrolled in the QIP, 288 (22.7%) were surgical patients, and 981 (77.3%) were medical patients (see Table 2). Control and QIP cohorts were similar in terms of gender for both patient groups, and by age for surgical malnutrition-related diagnoses (International Classification of Diseases, Ninth Revision (ICD-9) codes 263.0–263.9) and ONS orders recorded in the patients’ medical chart.

Table 2. Demographic and Clinical Characteristics.

| Characteristic                          | Surgical Patients, n = 390 | Medical Patients, n = 2198 |
|-----------------------------------------|-----------------------------|-----------------------------|
|                                         | Control, n = 102            | QIP, n = 288                | Control, n = 1217 | QIP, n = 981 | P Value |
| Gender, n (%)                           |                             |                             |                  |               |         |
| Male                                    | 40                          | 117                         |                   | 582           | 435      | .803    |
|                                         | (39.2)                      | (40.6)                      |                   | (47.8)        | (44.3)   |         |
| Female                                  | 62                          | 171                         |                   | 635           | 546      | .104    |
|                                         | (60.8)                      | (59.4)                      |                   | (52.2)        | (55.7)   |         |
| Age group, n (%)                        |                             |                             |                   |               |         |
| <65 years                               | 55                          | 125                         |                   | 582           | 392      | .067    |
|                                         | (53.9)                      | (43.4)                      |                   | (47.8)        | (40)     | .001*   |
| ≥65 years                               | 47                          | 163                         |                   | 635           | 589      |         |
|                                         | (46.1)                      | (56.6)                      |                   | (52.2)        | (60)     |         |
| Race, n (%)                             |                             |                             |                   |               |         |
| White                                   | 72                          | 194                         |                   | 793           | 699      | <.001*  |
|                                         | (70.6)                      | (67.4)                      |                   | (65.2)        | (71.3)   |         |
| Black                                   | 6                           | 70                          |                   | 179           | 207      |         |
|                                         | (5.9)                       | (24.3)                      |                   | (14.7)        | (21.1)   |         |
| Other                                   | 24                          | 5                           |                   | 226           | 33       |         |
|                                         | (23.5)                      | (1.7)                       |                   | (18.6)        | (3.4)    |         |
| Declined/unknown                        | 0                           | 19                          |                   | 19            | 42       |         |
|                                         | (0.0)                       | (6.6)                       |                   | (1.6)         | (4.3)    |         |

QIP, Quality Improvement Program.

*Significant $P$ values.
patients. There were some differences, however, between the age group distribution for control and QIP cohorts in medical patients, and in race/ethnicity for both patient groups.

**Readmission Rates**

The 30-day readmission rate declined significantly for all patients in the QIP cohort, but the decline was steepest for the surgical patients. Among the surgical patients, the 30-day readmission rate dropped nearly in half, down to 10.4% from 19.6%, a relative risk reduction (RRR) of 46.9% ($P < .01$). Among the medical patients, the readmission rate declined from 22.3% for the control group to 17.7% for the QIP cohort, RRR 20.6% ($P < .01$; see Figure 2 and Table 3).

**Length of Stay**

When compared with the control group, there was a significant reduction in LOS for the QIP patients (see Figure 2 and Table 3). LOS for the surgical patients dropped 2.7 days from the control patients to the QIP cohort (9.3 days to 6.6 days, RRR 29.0%, $P < .01$). The medical patients had a similar decline of 2.1 days (from 7.1 days to 5.0 days, RRR 29.6%, $P < .01$).

### Table 3. Results: 30-Day Readmissions and Length of Stay in Days.

| Readmissions, 30-day | Surgical Patients | Medical Patients |
|----------------------|-------------------|-----------------|
| Control, n = 102     | QIP Cohort, n = 288 | Control, n = 1217 | QIP Cohort, n = 981 |
| Percent readmissions (no.) | 19.6 (20) | 10.4 (30) | 22.3 (271) | 17.7 (174) |
| Length of stay in days, mean ± SD | 9.3 ± 7.1 | 6.6 ± 5.3 | 7.1 ± 8.1 | 5.0 ± 4.4 |

Total number of patients: control, n = 1319; QIP cohort, n = 1269. QIP, Quality Improvement Program.

**Discussion**

The results of the post hoc analysis showed that improved nutrition screening with MST and prompt ONS provision as part of a hospital nutrition-focused QIP could successfully reduce 30-day readmission rates and LOS in both surgical and medical patients. However, the decline in readmission rates was particularly striking for the surgical patients, with the readmission rate dropping nearly in half. LOS reductions of >2 days were recorded for both the surgical and medical patients in the QIP cohort.

These findings are consistent with earlier studies, where ONS use was linked to healthcare cost savings as a result of shorter LOS, lower costs of care during hospitalization, and a reduced risk of readmission. Underlying these economic benefits are the positive clinical outcomes and improved quality of life that may result when at-risk/malnourished hospitalized patients receive ONS. In particular, studies have shown that surgical patients who receive ONS have been able to maintain their body weight, improve their nutrition status, and suffer fewer postsurgical complications.

Surgeons have long been aware that malnourished surgical patients risk poorer postoperative health outcomes and that nutrition therapy can offer them better clinical outcomes, shorter LOS, and fewer readmissions. In Europe and the United States, major nutrition societies strongly recommend preoperative nutrition optimization. Nonetheless, <20% of European surgeons and 43% of American surgeons actually perform nutrition screenings of their patients before gastrointestinal and/or cancer surgeries. The Enhanced Recovery After Surgery protocols include several nutrition-related initiatives and can be easily incorporated with protocols for postoperative nutrition care through similar comprehensive QIPs that facilitate automatic provision of ONS when not contraindicated.

Compounding the issue is that many doctors do not get adequate training in clinical nutrition. In the United States, the Accreditation Council for Graduate Medical Education acknowledge that an understanding of surgical nutrition is essential to competency for surgeons. In a recent survey, 72% of managers of U.S. medical residency programs stated that an advanced course in nutrition should be required of residents. However, only a quarter of residency programs
include a formal course in nutrition, and half of those are taught to family practitioners, not surgeons. In addition, incorporating adequate training in clinical nutrition into their programs, physicians and hospital administrators can partner together to build nutrition support into their processes of care.

This study makes clear that improved nutrition interventions, as part of a hospital QIP, can positively impact all hospitalized patients, and including surgical patients. The improved health outcomes can also be reflected in significant total cost savings of $4,896,758 and per patient cost savings of $3858 resulting from avoided readmissions and reduced LOS, thus highlighting the importance of further assessing similar nutrition-focused QIP for surgical patient populations.

This study has several limitations. An inherent limitation of all post hoc analyses is the inability to attribute causation; however, no efforts were focused on patients at risk for malnutrition at the targeted hospitals during the QIP period. Also, the readmission rate and LOS of non-QIP patients admitted at the QIP hospitals during the life of the study remained generally constant, thus confirming the effectiveness of the nutrition interventions on observed outcomes. This study also inherits the limitations of the original study, namely a real-world QIP with a risk of bias and that data on ONS consumption was not collected. However, significant reductions in readmissions and LOS were seen even without monitoring consumption and compliance rate, which are common issues observed in any interventional trials. It would be expected that similar if not greater reductions would be seen if measurement and adjustment of ONS intake were included as part of the QIP. The QIP program was targeted to a specific population, specifically, noncritically ill patients who were able to consume ONS, thus limiting the generalizability of the study findings to critically ill patients unable to consume ONS. Also, as the MST was not implemented prior to the start of the QIP, it is not possible to identify a historical control group based on MST score. The historical control group was selected via the ICD-9 coding for malnutrition and ONS orders, which are the closest proxy measures available. Also, statistical adjustments for severity of illness and diagnosis for differences in readmission rates and LOS were limited by the sample size and were out of the scope for the current study. Regardless of these limitations, QIP methodologies emulate real-world experiences and provide important information about the effectiveness of nutrition programs in real-world settings while providing additional areas that warrant further investigation.

Conclusions

Among malnourished patients hospitalized for surgical and medical procedures, readmission rates and LOS can be significantly decreased by (1) enhanced screening for malnutrition risk and (2) facilitated use of ONS to promote nutrition adequacy. Because of the potential for greater improvements in health outcomes and cost savings as a result of reduced readmission rates and LOS among surgical patients, we particularly call surgeons to action—to raise awareness of the importance of nutrition on surgical outcomes, to partner with hospital administration to obtain appropriate support for nutrition care processes, and to expand nutrition education and training in residency and continuing medical education programs.

Acknowledgment

Portions of this study were presented at the 2017 Clinical Nutrition Week in Orlando, Florida, USA. We thank C. Hofmann and Associates for critical review and editing of the manuscript.

Statement of Authorship

K. Sriram, S. Sulo, G. VanDerBosch, W.T. Summerfelt, J. Partridge, and R. Hegazi contributed equally to the conception and design of the research; S. Kozmic and S. Sulo contributed to the acquisition, analysis, and interpretation of data; K. Sriram, S. Sulo, and S. Kozmic drafted the manuscript with input from all authors as necessary; M. Sokolowski and S. Nikolic contributed to the interpretation of data; All authors read and critically revised the manuscript and gave final approval; and K. Sriram, S. Sulo, and S. Kozmic agree to be accountable for all aspects of work ensuring integrity and accuracy.

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