

# How a Malnutrition Quality Improvement Initiative Furthers Malnutrition Measurement and Care: Results From a Hospital Learning Collaborative

Angel F. Valladares, MPH<sup>1</sup>; Karl M. Kilgore, PhD<sup>2</sup>; Jamie Partridge, PhD<sup>3</sup>; Suela Sulo, PhD<sup>4</sup>; Kirk W. Kerr, PhD<sup>5</sup> ; and Sharon McCauley, MS, RDN<sup>6</sup>

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## Abstract

**Background:** Malnutrition in hospitalized patients can adversely affect health outcomes and increase the cost of care. Real-world strategies are needed for prompt identification and treatment of patients at risk of malnutrition. **Objectives:** The aim of this quality improvement (QI) study was to measure the impact of a nutrition-focused program on the malnutrition care processes of participating hospitals. Secondary objectives were to determine whether improvements in these nutrition-related processes reduced hospital readmissions and length of stay (LOS) in patients  $\geq 65$  years. **Methods:** A group of 27 US hospitals (“The Collaborative”) implemented the Malnutrition Quality Improvement Initiative (MQii), as guided by a Malnutrition QI Toolkit and 4 electronic clinical quality measures (eCQMs), including (1) nutrition screening; (2) nutrition assessment following detection of malnutrition risk; (3) nutrition care plan for patients identified as malnourished after completed nutrition assessment; and (4) documentation of malnutrition diagnoses. Multivariate analyses identified the variables best correlated with patient outcomes. **Results:** Improvements were observed for all 4 eCQMs. The greatest improvements were achieved as a result of timely nutrition assessment ( $P = .06$ ) and malnutrition diagnosis ( $P = .02$ ). Patients  $\geq 65$  years with a malnutrition diagnosis and nutrition care plan had a 24% lower likelihood of 30-day readmission but a longer mean LOS than did those without a care plan. **Conclusions:** In this study, the implementation of MQii practices significantly improved the identification of malnutrition. The prompt identification and treatment of patients at malnutrition risk can improve patient care and health, as well as reduce costly readmissions. (*JPEN J Parenter Enteral Nutr.* 2021;45:366–371)

## Keywords

electronic clinical quality measure (eCQM); electronic health record (eHR); malnutrition; outcome assessment; quality research

## Clinical Relevancy Statement

In hospitals, malnutrition is common and costly. This study used a Malnutrition Quality Improvement Initiative, by The

Academy of Nutrition and Dietetics and Avalere Health, to improve in-hospital nutrition care processes. In our study of patients  $\geq 65$  years, the greatest improvements were

From the <sup>1</sup>Senior Manager, The Center for Healthcare Transformation, Avalere Health, Washington, DC, USA; <sup>2</sup>Health Economics and Advanced Analytics, Avalere Health, Washington, DC, USA; <sup>3</sup>Global Scientific Affairs, Abbott Nutrition R&D, Columbus, Ohio, USA; <sup>4</sup>Global Health Economics and Outcomes Research, Abbott Nutrition, Abbott Park, Illinois, USA; <sup>5</sup>Global Health Economics and Outcomes Research, Abbott Nutrition, Columbus, Ohio, USA; and the <sup>6</sup>Quality Management, The Academy of Nutrition and Dietetics, Chicago, Illinois, USA.

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Conflicts of interest: A. F. Valladares and K. M. Kilgore are employees of Avalere Health. S. Sulo and K. W. Kerr are employees and stockholders of Abbott. J. Partridge was an employee and stockholder of Abbott during the study conduct. S. McCauley is an employee of the Academy of Nutrition and Dietetics.

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## Corresponding Author:

Angel F. Valladares, MPH, Avalere Health, 1350 Connecticut Avenue, Suite 900, Washington, DC 20036, USA.  
Email: avalladares@avalere.com

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achieved in making (1) timely nutrition assessments and (2) malnutrition diagnoses when indicated. Malnourished patients with nutrition care plans had a 24% relative risk reduction for 30-day readmissions compared with those without care plans.

## Introduction

Although malnutrition, or its risks, are common among hospitalized patients, and often result in worse clinical outcomes and increased costs of care, the recognition and treatment of malnutrition in US hospitals remains limited.<sup>1</sup> To address this shortcoming, acute-care providers need relevant, interdisciplinary tools and measures that can help promote best-practice nutrition care for hospitalized patients.<sup>2</sup>

The Academy of Nutrition and Dietetics, in partnership with Avalere Health, developed the Malnutrition Quality Improvement Initiative (MQii).<sup>3</sup> The MQii is composed of 2 parts: (1) a toolkit of interdisciplinary strategies to help hospitals implement best-practice malnutrition care<sup>4</sup> and (2) 4 malnutrition-focused electronic clinical quality measures (eCQMs). The eCQMs are intended to help hospitals electronically document and measure improvements in their nutrition care processes.<sup>5,6</sup> This is important because recent evidence supports benefits of using the nutrition-focused MQii to improve nutrition care processes in hospital settings.<sup>7</sup> Although the eCQMs are being reviewed by Centers for Medicare and Medicaid Services (CMS) for potential adoption, selected eCQMs have been incorporated into 2 qualified clinical data registries.<sup>8</sup>

The primary objective of this quality improvement (QI) study was to determine whether the participating hospitals could measurably improve adherence to best-practice processes for care of patients with malnutrition. A secondary objective was to explore whether key malnutrition variables could improve the fit of 30-day readmission risk and average length of stay (LOS) models, specifically by ascertaining whether having a nutrition care plan had a significant association with these outcomes. The nutrition-focused QI study was conducted in an MQii Learning Collaborative of 27 hospitals, and it analyzed over 40,000 hospitalizations of patients  $\geq 65$  years. This report describes how systematic implementation of specific MQii processes translated into improved malnutrition care processes and patient outcomes (as reflected by 30-day readmission rates and LOS).

## Methods

### *Study Design and Participants*

Electronic health record (EHR) data were collected on 4 malnutrition eCQMs from 27 US hospitals that had implemented a web-based, malnutrition-focused QI toolkit (MQii Toolkit) in 2017. The MQii Toolkit was developed

by the partnership between the Academy of Nutrition and Dietetics and Avalere Health. The eCQMs were as follows: (1) performance measurement on malnutrition screening within 24 hours of admission; (2) nutrition assessment within 24 hours when risk was found; (3) nutrition care plan for malnourished patients; and (4) malnutrition diagnosis.<sup>5,6</sup> Baseline and postimplementation scores were calculated for each eCQM, provided the participating hospital had reported  $\geq 20$  admissions for that eCQM. Eligible patients were  $\geq 65$  years at the time of admission and were hospitalized for any reason. Patients were excluded if their LOS was  $< 24$  hours or if they left the hospital against medical advice.

### *Interventions and Outcomes*

Prior to the QI program, participating hospitals used materials from the MQii Toolkit to both increase nutrition awareness and provide best-practice nutrition-care training.<sup>9</sup> Each hospital's QI project targeted improvement in at least 1 of the 4 eCQMs.

### *Analysis*

Three separate analyses were conducted: (1) measurement and quantitative comparisons of eCQM performance 2 months before and 2 months after implementation of the 4-month QI at each hospital; (2) estimation of the explanatory power of malnutrition variables on 30-day readmissions and LOS using multivariate analyses; and (3) exploration of the relationship of a nutrition care plan with 30-day readmissions of patients diagnosed with malnutrition. A  $P$ -value  $\leq 0.05$  was considered statistically significant. Additional detail on each analysis can be found in Appendix A.

The first analysis assessed relative differences between baseline and postimplementation eCQMs at participating hospitals. A paired  $t$ -test measured the direction and statistical significance of any differences.

For the second analysis, the impact of the eCQM malnutrition variables on 30-day readmissions and LOS was assessed using hierarchical regression analysis. Independent variables included in the models were categorized as "demographic and clinical" and "malnutrition."<sup>10</sup> A stepwise approach was taken to measure the explanatory power of the malnutrition variables. The hospital 30-day readmissions and LOS models were initially estimated using only the demographic and clinical variables. Next, the models were reestimated including the malnutrition variables. This approach allows the estimation of the incremental improvement in goodness-of-fit from including the malnutrition variables. Model goodness-of-fit was reported as adjusted- $R^2$  for the hospital LOS model and the concordance statistic (c-statistic) for the 30-day readmissions model. The statistical significance of the improvement of model fit was tested using the change in  $-2$  residual log-likelihood.

**Table 1.** Average Performance Change<sup>a</sup> in Hospitals Reporting Malnutrition eCQMs After Hospital QI Implementation.

eCQM	Pre-implementation	Postimplementation	Relative change post-QI ( <i>P</i> -value)
<i>eCQM #1</i> Completion of a malnutrition screening within 24 hours of admission (N = 26)	Avg: 88% Med: 90% 65%–100%	Avg: 90% Med: 91% 64%–100%	↑2% ( <i>P</i> = .07)
<i>eCQM #2</i> Completion of a nutrition assessment for patients identified as at risk for malnutrition within 24 hours of a malnutrition screening (N = 16)	Avg: 50% Med: 47% 28%–100%	Avg: 60% Med: 57% 31%–100%	↑20% ( <i>P</i> = .06)
<i>eCQM #3</i> Nutrition care plan for patients identified as malnourished after a completed nutrition assessment (N = 17)	Avg: 96% Med: 99% 64%–100%	Avg: 98% Med: 100% 87%–100%	↑3% ( <i>P</i> = .13)
<i>eCQM #4</i> Appropriate documentation of a malnutrition diagnosis (N = 17)	Avg: 63% Med: 70% 7%–100%	Avg: 72% Med: 78% 6%–100%	↑13% ( <i>P</i> = .02)

eCQM, electronic clinical quality measure; QI, quality improvement.

<sup>a</sup>Performance change reflects the change in the average score across included sites. A minimum of 20 admissions was required for site inclusion in the change calculation. N refers to the number of hospital sites that met the inclusion criterion.

The third analysis focused on the association between a documented nutrition care plan with readmissions of malnourished patients. Patients with a malnutrition diagnosis were divided into 2 groups: those who had received a nutrition care plan and those who had not. Patients from these groups were matched to control for patient characteristics following the matching procedure outlined in Appendix A. Then, the odds ratio (OR) comparing the odds of readmission given a nutrition care plan with the odds of readmission in the absence of a nutrition care plan were calculated. It was hypothesized that malnourished patients with a nutrition care plan will be less likely to be readmitted to the hospital within 30 days, which would be indicated by an OR < 1.

## Results

Data on a total of 43,074 unique patients from 45,524 hospitalizations that occurred before, during, or after implementation of the hospitals' QI projects were collected. The final sample of eligible patients used for this analysis totaled 26,354 patient records for the 30-day readmission models and 28,116 patient records for the LOS models.

### Assessment of eCQM Performance Changes

Improvements, with respect to the 4 eCQMs, are reported as average relative changes from pre-QI program to post-QI program (Table 1). Improvements of 2% (*P* = .07), 20% (*P* = .06), 3% (*P* = .13), and 13% (*P* = .02) were observed for eCQMs #1, #2, #3, and #4, respectively. The largest improvements were in nutrition assessment (eCQM #2) and documentation of malnutrition diagnosis (eCQM #4). The

**Table 2.** Association Between Individual Malnutrition Variables and Outcomes of Interest.<sup>a</sup>

Malnutrition variables in model	Association with 30-day readmissions risk	Association with LOS
Malnutrition risk (identified via screening)	+37%	+1.59 days
Completed nutrition assessment	+38%	+3.32 days
Documented nutrition care plan	+33%	+4.10 days
Diagnosis of malnutrition	+33%	+4.21 days

<sup>a</sup>Results were statistically significant (all *P* < .0001).

level of improvement reached statistical significance for only eCQM #4 (*P* = .02). It is important to note that nutrition screening (eCQM #1) and documentation of a nutrition care plan (eCQM #3) had high pre-QI rates (88% and 96%, respectively), which helps explain the relatively low post-QI changes.

### Multivariate Analysis for 30-day Readmissions and LOS

Prior to completing multivariate analyses of model fit, the relationships between the individual malnutrition variables and risk of 30-day readmissions and average hospital LOS were analyzed (see Table 2). The analysis showed that any increase in any of the eCQMs was associated with an increase in the LOS and likelihood of 30-day readmission.

In the multivariate analyses, model fit was significantly improved by the addition of the set of malnutrition variables in both the 30-day readmission and hospital LOS models. In the 30-day readmission model, the *c*-statistic improved from 0.614 before inclusion of the malnutrition variables to 0.625 after their inclusion ( $P < .01$ ). For the LOS model, the adjusted- $R^2$  statistic in the hospital LOS model improved from 0.063 before inclusion of the malnutrition variables to 0.288 after their inclusion ( $P < .001$ ).

### *Nutrition Care Plan Analysis*

The analysis of the relationship between a documented nutrition care plan and risk of 30-day readmission in patients with a malnutrition diagnosis showed a statistically significant relative risk reduction of 24% (21.4% vs 26.5%, respectively) in the likelihood of 30-day readmissions (OR, 0.74; 99% CI, 0.558–0.941). For LOS, hospitalized patients with a malnutrition diagnosis who had a nutrition care plan had, on average, a 3-day longer LOS than malnourished patients without a nutrition care plan (LOS of 9.46 vs 6.46 days, respectively;  $P < .001$ ).

### **Discussion**

Numerous studies have demonstrated that malnutrition can increase the costs of care through longer hospital stays and increased hospital readmission rates.<sup>11–14</sup> Attention to nutrition care during hospitalization has been found to reduce LOS and readmissions and improve the overall quality of care.<sup>15–20</sup> Timely nutrition intervention has been shown to decrease complications, slow disease progression, and speed recovery.<sup>16–20</sup> Yet many cases of malnutrition may go undiagnosed and untreated because of inconsistent identification and assessment practices.<sup>1,14</sup>

This study demonstrates that implementation of MQii processes can be broadly and effectively used to improve nutrition care of nutrition-vulnerable older adults in hospitals.<sup>21,22</sup> Clinicians at the participating hospitals applied MQii tools and monitoring to guide process improvement with the aim of better recognizing and treating malnutrition.

The study contributes to the growing body of evidence supporting the need for continued monitoring of malnutrition care in hospitals,<sup>1</sup> including use of MQii's tools and specific eCQMs.<sup>7</sup> Tobert et al identified the issue of missed malnutrition diagnoses using a large, multi-institutional database of US university hospitals (6 million hospitalizations, 105 institutions, 2-year interval); only 5% of patients had a malnutrition diagnosis during their stay even though global data suggest that the prevalence is higher.<sup>1</sup> Additionally, they showed that higher rates of malnutrition diagnosis were associated with higher patient volumes, hospital rankings, and patient satisfaction scores.<sup>1</sup> Silver et al conducted a pilot study of older patients admitted to a

tertiary care center and found that use of the MQii program increased hospital professionals' knowledge of malnutrition and also improved their skills relevant to screening, diagnosis, intervention, and timeliness of malnutrition care.<sup>7</sup>

This study underscores the utility of embedding eCQMs in EHRs to facilitate best-practice nutrition care. Implementation of the malnutrition eCQMs provided interdisciplinary teams the ability to monitor hospital-wide malnutrition care processes with a lower administrative burden than traditional manual chart review. The EHR-based MQii work of the Learning Collaborative sites increased visibility and communication about each patient's nutrition status and malnutrition care by integrating malnutrition screening and assessment components into the EHR, establishing alerts and prompts for provider handoffs, and incorporating nutrition status into care-team reports.

Lastly, this study examines the link between malnutrition care and clinical outcomes. Regression models showed that malnutrition-related characteristics (risk and diagnosis) are significantly correlated with 30-day readmissions and LOS. Strong concordance linking malnutrition to 30-day readmission (0.625 *c*-statistic) was comparable to the results from Hudson et al (0.634 *c*-statistic).<sup>23</sup> Furthermore, analysis of 30-day readmission risk and nutrition care plan development highlights the importance of best-practice nutrition care for malnourished patients. Although prior studies have reported shorter LOS with early nutrition interventions,<sup>7,16,19,20,24</sup> this study observed longer LOS for malnourished patients with nutrition care plans. This may have occurred because hospital nutrition care plans could not reverse malnutrition during a relatively short hospital stay, because it takes time for hospital staff to implement the nutrition care plan and patients to follow it or because patients who received a nutrition care plan were more ill than those who did not receive a nutrition care plan.

### *Study Limitations*

This study inherits the limitations of any real-world, observational, QI study. The data do not report patient compliance with malnutrition interventions. Confirmation of compliance or noncompliance during hospitalization and postdischarge would provide additional insights into the impact of nutrition interventions. The data utilized were a convenience sample of participating hospitals, and no formal sample-size calculation was performed. Therefore, the results may not be generalizable to nonparticipating hospitals. However, this study includes the largest number of hospitals and unique patients studied to date compared with previously published nutrition QI studies.<sup>7,16,18</sup> The brief study period of 4 months and the nonconcurrent implementation of hospital QI also limit the generalizability of our results. Examining changes over longer implementation periods and tying cohorts of hospitals to implementation

cycles could yield additional findings on sustained malnutrition QI programs.

## Conclusions and Future Work

This study showed that hospitals in the MQii successfully improved the identification and treatment of malnourished patients. Such findings support the concept that all stakeholders—hospitals, electronic medical record providers, and payers—can and should work toward establishing better nutrition reporting and care, especially for older adults. It also showed that malnutrition screening, diagnosis, and treatment are important determinants of hospital LOS and 30-day readmission, and that a nutrition care plan was associated with a lower likelihood of 30-day readmissions for malnourished patients.

Future research should include measures of care plan use and nutrition intervention compliance during hospitalization and postdischarge. Additionally, future studies should develop sample sizes powered to detect the effect of nutrition care measures and interventions on outcomes that could support a causal relationship between nutrition care and patient outcomes. Finally, economic studies are also needed to demonstrate the potential cost savings of effective nutrition care initiatives for healthcare systems and their patients.

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## Statement of Authorship

A. F. Valladares, K. M. Kilgore, J. Partridge, and S. Sulo equally contributed to the conception and design of the research; S. McCauley contributed to the design of the research; A. F. Valladares and K. M. Kilgore contributed to the acquisition and analysis of the data; A. F. Valladares, K. M. Kilgore, J. Partridge, and S. Sulo contributed to the interpretation of the data; A. F. Valladares and K. M. Kilgore drafted and revised the manuscript. All authors critically revised the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

## Supplementary Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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