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Nutrition Care for Poorly Nourished Outpatients Reduces Resource Use and Lowers Costs

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Abstract

Background and Objectives: Over 25% of United States (US) community-dwelling, older adults are at nutritional risk. Health and cost burdens of poor nutrition can be lowered by nutrition programs for hospital inpatients, but few studies have looked at the impact on outpatients. The objective of our study was to assess outcomes of a nutrition focused quality improvement program (QIP) on healthcare resource use and costs in poorly nourished outpatients. **Methods:** This pre-post QIP study was implemented at 3 US healthcare system clinics. Included patients (n = 600) were ≥45 years old, had ≥2 chronic conditions, and were enrolled over a 15-month interval. For comparison, historical (n = 600) and concurrent control (n = 600) groups were used. Assessment of poor nutritional status was performed during each patient's baseline visit. Healthcare resource use (hospitalizations, emergency department visits, and outpatient clinic visits), medication use, and costs were determined for a 90-day interval. **Results:** QIP patients (mean age 61.6 years) were predominantly female (62.5%) and overweight/obese (81.7%). The proportion of QIP outpatients presenting for healthcare services was significantly reduced compared to both historical and concurrent controls—relative risk reduction (RRR) versus historical (11.6%, $P < .001$) and versus concurrent (8.9%, $P = .003$). Of those who presented, RRR for healthcare resource use by QIP was significant in comparison with historical (12.9%, $P = .022$) but not concurrent controls. No significant differences were observed for medication usage. Lower resource use among QIP patients yielded total cost savings of $290 923 or per-patient savings of $485. **Conclusions:** Nutrition QIPs in outpatient clinics are feasible and can reduce healthcare resource use and cut costs. Such findings underscore benefits of nutritional interventions for community-dwelling outpatients with poor nutritional status.

Keywords

cost-savings, outpatients, nutrition, oral nutritional supplements, patient outcomes

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Introduction

Nutrition is an important determinant of health in middle-aged and older people, a population seen frequently in primary care as well as in acute care settings. As such, primary care physicians and other outpatient healthcare practitioners are ideally positioned to identify and treat poor nutrition in their at-risk patients. In fact, survey results have found that family physicians recognize the importance of diet in management of chronic diseases and are willing to provide nutrition counseling, yet their efforts may fall short because of inadequate time, training, or compensation.[1,2]

In hospital studies, researchers reported that 30% to 50% of all adult inpatients were malnourished or at risk upon admission, with prevalence highest among those who are older and have complicating health conditions.[3-5] In community settings, the presence of malnutrition or its risk is estimated to be between 20% and 30%[6,7] but can be as high as 70% in some older adult populations.[8] Nutrition care matters because poor nutritional status has a marked impact

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in terms of both health outcomes and healthcare resource utilization.

Malnutrition is defined as an imbalance, deficiency, or suboptimal intake of nutrients.[9] Malnutrition—or "poor" nutrition—is divided into 2 broad types: undernutrition (underweight or specific macro- or micro-nutrient deficiencies) and overnutrition (overweight or obesity).[9] Overweight individuals, such as those prominent in this study, have excessive caloric intake, but intake may be deficient in certain macronutrients (eg, protein) or micronutrients (eg, vitamin D, calcium, magnesium).[10-13] Overnutrition can result from poor food choices, limited access to healthy foods, energy imbalance related to low physical activity, and/or to genetic predisposition to certain metabolic abnormalities.[14,15] Overnutrition and obesity are both risk factors for the development of chronic conditions such as type 2 diabetes mellitus, metabolic syndrome, atherosclerosis, and cardiovascular disease.[15] By contrast, undernutrition can occur as a result of decreased intake or inadequate absorption/utilization of nutrients, which often occurs in the presence of gastrointestinal diseases or inflammation related to chronic diseases.[16]

Both underweight and overweight/obesity have been associated with adverse health outcomes related to loss of muscle mass and strength, which can affect functional status and quality of life.[11,17] In older adults, poor nutritional status is commonly associated with an increased risk of falls and frailty.[17,18] Hospital care is more frequently needed and length of stays are longer for malnourished patients; these patients are at an increased risk for adverse complications during and after discharge from the hospital, including 30-day readmission rates.[19] Costs of hospital care have been reported to be 31% to 38% higher for patients with moderate-to-severe malnutrition,[4] and may be as much as two times higher,[20] in comparison with hospital stays for patients without malnutrition. The annual cost of disease-related malnutrition in the United States (US) is estimated to be more than $156 billion.[21]

In healthcare, real-world quality improvement programs (QIPs) are designed to incorporate systematic, continuous, and sustainable actions that lead to measurable improvements in healthcare services and the health status of targeted patient groups. QIPs have been increasingly applied to nutrition care in hospital and home care-settings.[22-24] For this outpatient study, we proposed that nutrition focused QIPs could be used in care of middle-aged and older community-living adults to help identify patients at nutritional risk and to guide nutrition interventions. We examined the impact of a nutrition focused, mainly physician-implemented QIP on medication needs and on use of healthcare resources (hospital admissions, emergency department [ED] visits, and outpatient clinic visits); we also determined associated healthcare costs. Specifically, we hypothesized that a nutrition focused QIP would result in reduced overall healthcare resource use over the 90-day study period, which would in turn lead to cost savings.

Methods

Study Sites and Design

This study was implemented at 3 outpatient clinics (Internal Medicine or Family Medicine) of an academic healthcare system in the Los Angeles, California metropolitan area, US. The opportunity to participate in the study was presented to all eligible healthcare providers at the 3 targeted clinics. A total of 5 family or internal medicine physicians, 2 physician assistants, and 2 registered dietitians (RDNs) opted to participate and implement the QIP with their eligible patients.

The design was a pre-post, nutrition focused QIP intervention with 2 control groups for comparison. Patients with malnutrition or its risk were identified by the 9 participating healthcare providers for enrollment into the QIP study between September 26, 2018 through December 19, 2019. These patients were advised by their healthcare provider to incorporate condition-specific oral nutritional supplements (ONS) as part of their daily dietary intake. Two unmatched comparison groups—historical control (September 26, 2017-December 19, 2018) and concurrent control (September 26, 2018-December 19, 2019)—were used. The study is registered in ClinicalTrials.gov as number NCT03628196.

Study Patients

Inclusion criteria for QIP enrollees were: (1) 45 years and older, (2) poor nutritional status as defined by the Nutrition Care Pathway with ONS Decision Tree (Supplemental Appendix A), (3) with 2 or more chronic conditions as defined in the National Ambulatory Medical Care Survey,[25] (4) able to consume both food and beverages orally, and (5) with an estimated life expectancy of 90 days or more. Exclusion criteria were pregnancy, normal nutritional status, dementia, or delirium without dedicated caregiver, allergies, or intolerance to ONS ingredients, declined participation, or had no existing relationship with the outpatient clinics.

Due to sample size limitations, propensity matching of QIP patients with historic and concurrent control patients was not possible; therefore, other criteria were used to support best-possible between-group comparisons. Historic controls included at-risk/malnourished patients who received care at the same outpatient clinics during the 12 months prior to the QIP start and who met similar study inclusion criteria. Concurrent controls included at-risk/malnourished patients who received care at the same outpatient clinics during the QIP period but were not under the care of the participating healthcare providers and therefore did not

participate in the QIP. Proxy measures identified at-risk and malnourished patients in the historic and concurrent control groups, as the Nutrition Care Pathway was not in regular use prior to the QIP. Proxy measures were malnutrition-related diagnoses (International Classification of Diseases, Tenth Revision [ICD-10] codes E43-E46, E64), ONS orders, or malnutrition-related documentation in physician notes of outpatient medical records.

Baseline Characteristics and Outcomes

Baseline socio-demographic and clinical variables included: patient characteristics (age, sex, race); marital status, occupational status, health insurance (private, public, other/unknown); body mass index (BMI) category, primary diagnosis as well as ONS type recommended.

The primary endpoint was overall healthcare resource utilization, which included hospital admissions, ED visits, and outpatient clinic visits (primary care or specialty) within the healthcare system network during the 90 days following QIP enrollment. Healthcare resource utilization data were collected mainly via electronic medical record (EMR) data abstraction and supplemented via the self-reported survey data. Healthcare resource utilization was measured in 2 ways: (1) the proportion of outpatients presenting for care at the different care settings (hospital admissions, ED visits, and outpatient clinic visits), and (2) the average number of visits at any of the 3 settings of care during the study follow-up period. The secondary endpoint included medication utilization over 90-days; such data were collected via EMR abstraction at baseline visit and 90-days post QIP enrollment. In addition, cost savings were also calculated (as outlined in the Economic Analysis section).

Nutrition Program

The key characteristics of the QIP included: (1) periodic education of healthcare providers on the importance of identifying and treating poor nutritional status; lead physician-directed training for incorporation of nutrition screening and care into practice, (2) conducting nutritional screening at baseline patient visit, (3) incorporation of the Nutrition Care Pathway into EMR (healthcare providers had the flexibility using either paper or EMR-cued versions), (4) recommendation of appropriate and disease-specific ONS (as a supplement in addition to regular food for the undernourished patients or as a snack replacement for the overnourished patients) by the healthcare provider after he or she identifies poor nutritional status (per Nutrition Care Pathway, Supplemental Appendix A), (5) education of poorly nourished patients about ONS use, and (6) monthly patient follow-up calls for 90-days post QIP enrollment (or baseline visit).

Patient nutritional risk screening was assessed via the Nutrition Care Pathway which included the Malnutrition Screening Tool (MST)[26,27] questions plus other "red flag" observations that indicated disease-related malnutrition, including acute changes in weight, appetite, or physical examination findings. The nutrition screening was completed during the baseline outpatient clinic visit by the study healthcare provider.

Patients at nutritional risk received a nutrition care plan, which was informed by their dietary needs during the baseline clinic visit. Patients were recommended 1 to 2 bottles of ONS per day either as standard formulation (eg, Ensure Enlive or Ensure Max [Abbott, Chicago, IL]) or as a condition-specific formulation (eg, Glucerna for diabetes or Nepro for dialysis or non-dialysis dependent kidney disease [Abbott, Chicago, IL]) for a 90-day intervention period. The provider also had discretion to prescribe another ONS of their choice based on specific patient needs. Additionally, 1 free Abbott voucher (for a multipack) and $3.00 multipack discount coupons for use at any retail store were distributed to QIP patients to replicate current practice and to simulate real-world patient experience. However, there were no restrictions on patient use of other discounts (eg, from manufacturer website, newspaper, or Supplemental Nutrition Assistance Program [SNAP]).

Patients were educated on the importance of nutrition and the benefits of ONS. During and after the 90-day intervention, study enrollees were contacted via phone by the study dietitian or another member of the research team to discuss and assess the patient experience, ONS consumption, and satisfaction with the QIP.

Of the 3361 identified as potential patients during the QIP timeframe, 608 (18%) patients were enrolled in the study; other patients were not enrolled for reasons noted (Figure 1). In the final analysis, 600 QIP patients were included, along with 600 patients in each of 2 control groups, for a total sample size of 1800 patients.

Statistical Analysis

Descriptive statistics were calculated for patients' socio-demographic and clinical characteristics, healthcare resource utilization, medication utilization, and ONS consumption. Between-group univariate analyses were performed by comparing QIP patients with historic and concurrent controls using the chi-squared test for categorical variables and Student's *t*-test for continuous variables. Analyses were performed with SPSS 22.0; a two-tailed P-value $<.05$ was considered statistically significant.

Economic Analysis

Costs incurred from healthcare resource utilization and for QIP implementation were analyzed in a descriptive manner

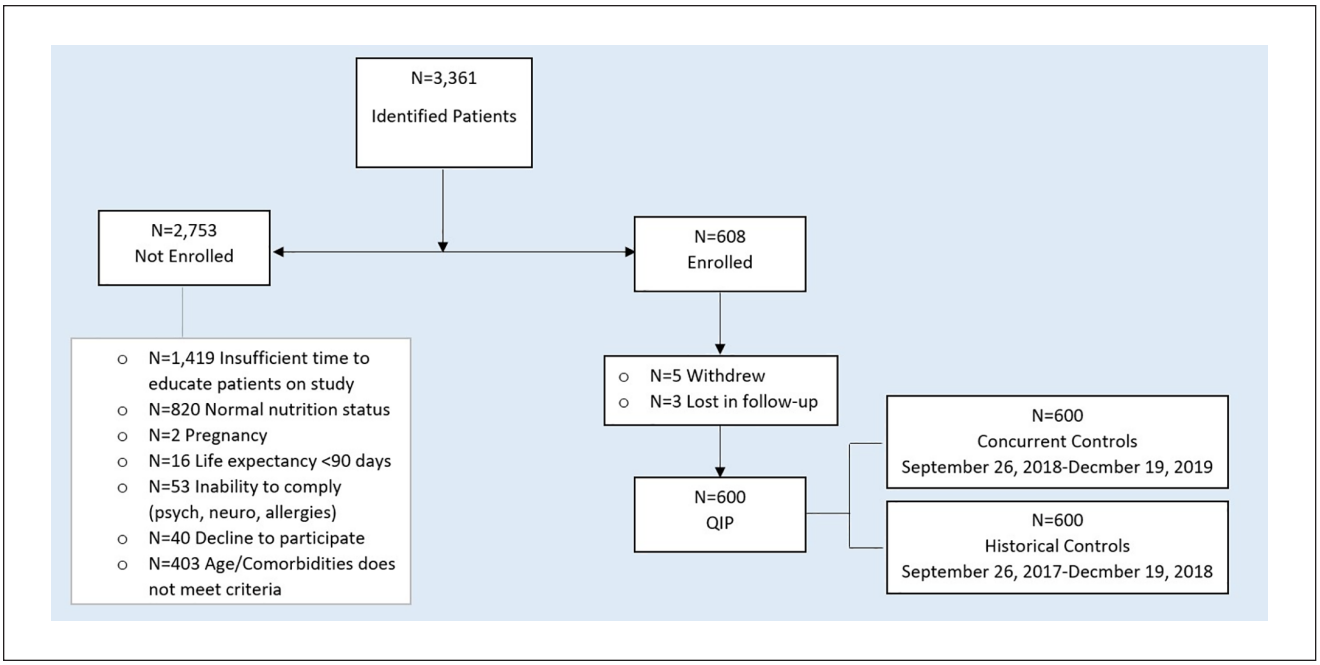

Figure 1. Patient flow chart.

for QIP and control groups. QIP implementation costs were estimated using records of staff time for conducting QIP processes and hourly-wage rates for staff positions from the 2019 Bureau of Labor Statistics Occupational Employment Statistics (BLS OES).[28] Fixed costs for implementation (ie, costs not varying by the number of participants) totaled $4324, and included support with information technology management and education of participating study healthcare providers. Variable costs for per-patient implementation totaled $26 925, including healthcare provider time spent screening and educating participants, and administrative staff time spent managing the QIP (patient pre-screening and follow-up). Healthcare resource utilization costs per patient were estimated by a weighted average of the cost of inpatient stays, ED visits, and office-based physician visits. Costs for each type of healthcare resource as well as medication costs, were taken from the Medical Expenditure Panel Survey (MEPS) 2017.[29] Weights reflected the share of patients who utilized a particular combination of healthcare resources (eg, 2.3% of patients had a hospital admission and an outpatient clinic visit).

Results

Patient Demographics

There were some differences in the baseline socio-demographic characteristics between the QIP and control groups (historical, concurrent). The QIP patients were younger compared to the historical and concurrent controls (61.6 vs 68 vs 67.1 years old), respectively; $P < .001$). In addition, the majority of QIP patients were female (62.5%), white (47.3%), overweight/obese (81.7%), married (53.8%), and retired (37.5%). While QIP patients had multiple medical conditions, hypertension (23.2%) and diabetes mellitus (18.9%) were the most common. The types of medical conditions were similar for QIP and historical controls (Table 1).

Nutritional Needs and ONS Recommendations

Underlying health conditions varied among the patients who were at risk for malnutrition, which necessitated individualized recommendations for an appropriate ONS intervention in the QIP. Health conditions included overweight or obesity (81.7%), diabetes (28.5%), renal disease (16.7%), underweight conditions (6.7%), and other non-specified conditions (6.3%). Recommended by condition, a high-protein/low calorie ONS was advised for poorly nourished patients with overweight/obesity, a calorie-limited, low glycemic index ONS for those with diabetes, a renal-specific ONS for individuals with kidney disease, and a high calorie/high protein ONS for underweight patients.

Based on the survey responses from a subset of QIP patients (N = 309), high rates of ONS use (51.8%; N = 160) were confirmed.

Healthcare Resource Utilization

Reducing the utilization of unnecessary healthcare services improves the management of patients while reducing cost. A significantly lower proportion of QIP patients used healthcare services over 90-days, as compared to patients in

Table 1. Baseline Socio-Demographics by Group: QIP, Control Historical, and Control Concurrent.

	QIP (N = 600)	Control historical (N = 600)	Control concurrent (N = 600)
Age, mean (SD)	61.6 (10.0)	68.0 (11.1)	67.1 (10.7)
Age, n (%)			
<65	367 (61.2)	225 (37.5)	229 (38.2)
≥65	233 (38.8)	375 (62.5)	371 (61.8)
Sex, n (%)			
Male	225 (37.5)	282 (47.0)	322 (53.7)
Female	375 (62.5)	318 (53.0)	278 (46.3)
Race, n (%)			
Black	38 (6.3)	43 (7.2)	49 (8.2)
White	284 (47.3)	260 (43.3)	285 (47.5)
Asian	50 (8.3)	79 (13.2)	70 (11.7)
Other/unknown	228 (38.0)	218 (36.3)	196 (32.7)
Health insurance, n (%)			
Public	309 (51.5)	430 (71.7)	371 (61.8)
Private	286 (47.7)	160 (26.7)	224 (37.3)
Uninsured/other	5 (0.8)	10 (1.7)	5 (0.8)
Medical conditions, n (%)			
Hypertension	139 (23.2)	181 (30.2)	208 (34.7)
Obesity	59 (9.8)	1 (0.2)	7 (1.2)
Type 2 diabetes	106 (17.7)	199 (33.2)	151 (25.2)
Type 1 diabetes	7 (1.2)	3 (0.5)	1 (0.2)
Hyperlipidemia	36 (6.0)	21 (3.5)	34 (5.7)
Liver disease	23 (3.8)	6 (1.0)	3 (0.5)
Kidney disease	16 (2.7)	31 (5.2)	29 (4.8)
Heart disease	16 (2.7)	3 (0.5)	1 (0.2)
Protein malnutrition	26 (4.3)	1 (0.2)	0 (0.0)
Vitamin D deficiency	13 (2.2)	0 (0.0)	0 (0.0)
Musculoskeletal	17 (2.8)	10 (1.7)	20 (3.3)
Other	142 (23.7)	144 (24.0)	146 (24.3)

Abbreviations: QIP, quality improvement program; SD, standard deviation.

control groups (73.8% in QIP vs 83.5% in historical control and 81% in concurrent control; $P < .001$, $P = .003$), which corresponded to an 11.6% relative risk reduction (RRR) when compared to the historical group, and an 8.9% RRR compared to the concurrent group (Figure 2A). Of those who did present for care, patients in the QIP group had significantly fewer visits, as compared to the historical (12.9%, $P = .022$) control group but not the concurrent (0%, $P = .977$) control group (Figure 2B).

Medication Utilization

The use of therapeutic medications reflects illness severity and contributes to healthcare costs. While the number of medications at baseline visit was lower for the QIP group as compared to both historical and concurrent controls, we observed important differences in the change in medication utilization at 90 days for QIP and control groups. At 90 days, the average number of medications continued to differ significantly between QIP and controls (5.80 QIP vs 8.83 historical control; 34.3%, $P < .001$; vs concurrent control 8.35; 30.5%, $P = .001$). However, when assessing differences in medication use at baseline versus 90-days post QIP enrollment for all 3 individual groups separately, the benefits of QIP were confirmed. Medication usage remained constant from baseline to 90 days for the QIP group (5.81 vs 5.80, −0.2%, $P = .878$), while medication usage in the control groups increased significantly over the 90-day period (historical group 8.50 vs 8.83, +3.9%, $P = .001$; concurrent group 7.81 vs 8.35, +6.9%, $P = .001$). This reflects an increased need for additional pharmaceutical interventions in control groups (but not in QIP), which is associated with higher costs of care (Figure 3).

Cost Savings

Utilization of healthcare services contributes to the overall cost of care. With the implementation of QIP programs, costs can be reduced and patient outcomes optimized. Differences in healthcare resource utilization costs between the QIP and control groups were estimated for the 90-day follow-up period, as potential cost savings from the QIP. Differences in

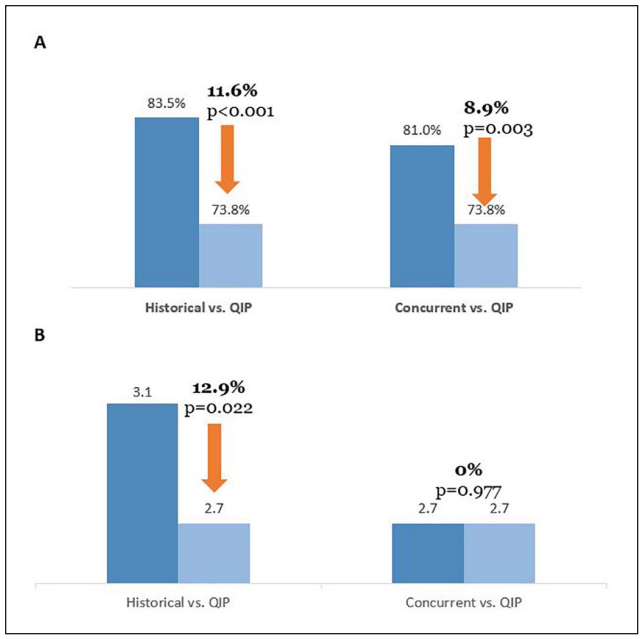

Figure 2. Proportion of QIP patients with healthcare resource utilization (A) and average number of healthcare visits over 90-days (B) when compared to control groups.

utilization costs were calculated by multiplying the difference in utilization rate (eg, 83.5%-73.8% for historical control vs QIP), the number of patients in the QIP group (n = 600), and the weighted average cost of healthcare resource utilization per patient ($1537). Similarly, differences in medication costs were calculated by multiplying the difference in medication utilization (8.83-5.80 medications/patient for historical control vs QIP), the number of patients in the QIP group (n = 600), and the average cost per medication ($128).

Lower utilization by QIP patients translated to $89 468 lower healthcare utilization costs compared to the historical control group and $66 409 lower healthcare utilization costs compared to the concurrent control group. QIP patients' lower utilization of medications over the 90-day follow-up period resulted in $232 704 lower medication costs compared to the historical control group and $195 840 lower medication costs compared to the concurrent control. Net savings on total healthcare costs (combined utilization and medication cost savings minus $31 249 in QIP implementation costs) for the QIP were $290 923 compared to the historical control and $231 000 compared to the concurrent control. Corresponding per-patient savings were $485 and $385 compared to historical and concurrent controls, respectively (Table 2).

Discussion

Key Findings and Clinical Implications

For community-living adults with poor nutrition or those at-risk, our results showed that those who took part in a nutrition focused QIP intervention were overall less likely to require healthcare services (hospital admissions, ED visits, and outpatient clinic visits) than were those in control groups who received routine care during the 90-day study interval. Of those patients who presented for care, the average number of healthcare-related visits needed was also significantly lower by almost 13% for QIP patients in comparison with historical controls, although there was no significant difference when comparing QIP patients with concurrent controls. While there remains room for progress in care for all poorly nourished patients living in the community, it is possible that the standard of care may have already improved for concurrent control patients over historical controls. Increasingly more healthcare providers are in fact becoming aware of the importance of nutrition interventions to better health outcomes for their patients. We also found that the number of medications needed by control patients increased significantly during the 90-day study interval, but there was no increase in medication use in the QIP group.

Based on lower use of healthcare resources and medications by our poorly nourished but ONS-intervention QIP patients (n = 600), we estimated total cost savings of nearly $300 000 in the 15-month study or $485 per patient. Such findings suggest that attention to nutrition care can improve patient health status to the extent that healthcare resources are spared and healthcare costs are cut. While a savings of $485 per patient may seem modest, the number of older, community-living adults in the US is rising rapidly. The population aged 65 and over was about 50 million in 2016 and is expected to almost double to 98 million by 2060.[30] Recent trends suggest that Americans are increasingly likely to "age in place" at home, especially with technology advances making it possible to do so. Thus, the potential for future cost savings by maintaining or restoring health with nutrition is immense.

Comparison with Other Studies on Nutrition, Health, and Economic Costs

Today's healthcare providers must deal with the dual burdens of under- and over-nutrition. There are ever-increasing numbers of people who are overweight or obese, while other patients may present with disease-related poor or undernutrition.[5,10,15] While awareness of malnutrition among hospitalized patients is increasing in the US and elsewhere,[3,31-36] few US researchers to date have tackled systematic identification and treatment of nutrition issues among people living in the community by using real-world QIP study methods.[8,23,37]

There is, however, a clear rationale for early intervention with malnutrition care in community-living adults or outpatients. Results of a United Kingdom (UK) community study showed that managing malnutrition could significantly reduce healthcare use, with a positive budget impact, in older malnourished patients in primary care.[38] In support, a randomized, controlled trial in the UK specifically examined

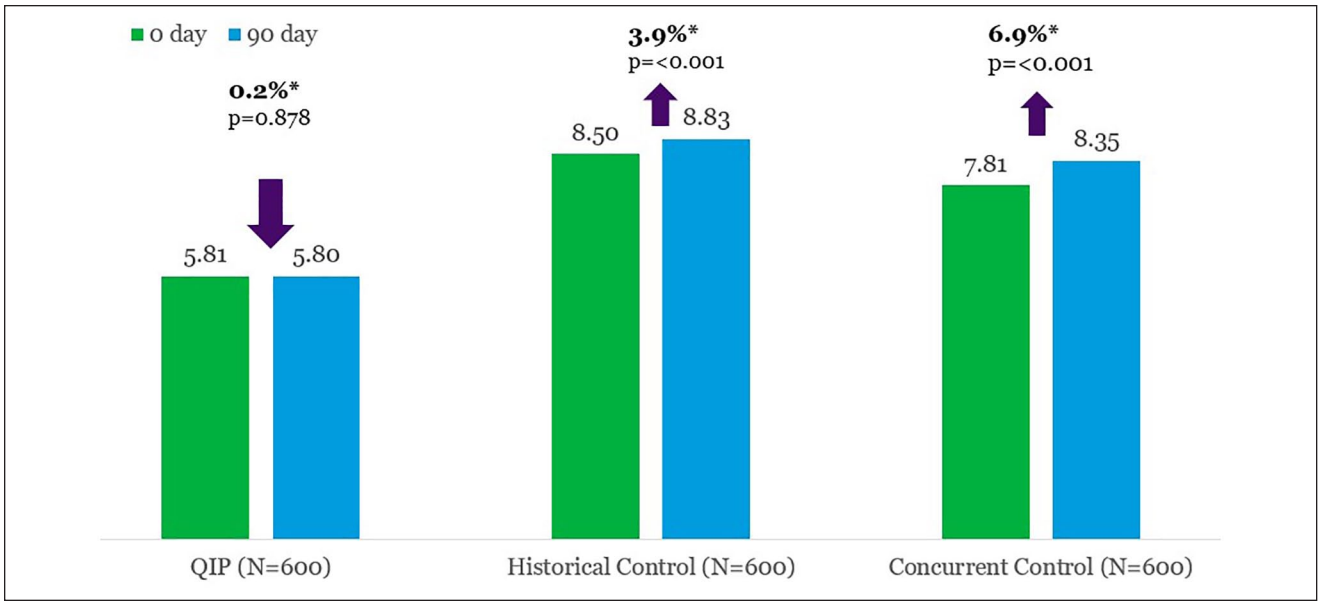

Figure 3. Medication utilization at baseline visit versus 90-days by group.
*Number represents relative reduction in medication utilization.

Table 2. Healthcare Resource Utilization Costs and QIP Savings.

	QIP vs historical control	QIP vs concurrent control
Implementation costs	$31 249	$31 249
Healthcare provider training		
Patient screening, education, and follow-up		
Weighted average per patient cost of healthcare utilization	$1537	$1537
Average cost per medication	$128	$128
Difference in utilization (Control-QIP)	9.7%	7.2%
Difference in medication utilization (Control-QIP)	3.03 medications/patient	2.55 medications/patient
Total savings (n = 600)	$290 923	$231 000
Net savings per patient	$485	$385

Abbreviation: QIP, quality improvement program.

use of ONS plus dietary advice to treat older undernourished people living in the community.[39] Results showed that nutrition care reduced visits to healthcare providers, lowered the frequency of ED visits, and shortened length of stay when hospitalization was needed.[39] Use of ONS as part of nutrition care has been shown to improve health outcomes and cut costs in the hospital,[40] in home-care services,[23] and in the community.[8,37,41,42] Further, nutrition focused QIP strategies by physicians, RDNs, and nurses have been used to improve nutrition care in hospitals[22,43,44] and recently in home care as well.[23]

Study Strengths and Limitations: Insights for Design of Future Studies

This is the first-ever study to evaluate the costs and clinical benefits of a real-world, nutrition focused QIP over a 90-day period in US outpatient clinics. We feel that our findings of reduced healthcare resource utilization and costs are compelling. The study engaged physicians, physician assistants, and RDNs, all of whom serve as important healthcare providers and are part of the care team in outpatient clinics. The healthcare providers implemented the nutrition care process within the context of patients' routine visits. Notably, the QIP implementation steps did not require additional time with the patient or an "extra" visit or additional staffing resources. We thus showcased how outpatient clinics are uniquely positioned to provide early nutrition interventions for populations with a wide range of chronic conditions and socio-demographic characteristics.

However, our study interpretations have some limitations. First, this study used an observational, real-world QIP methodology rather than a randomized design; observational studies have inherent limitations. Second, results

from outpatients at clinics of our academic medical center may not be generalizable to all outpatient populations. Third, due to the limited size of our control group databases, we were not able to perform multivariate analyses or propensity-score matching, so imbalances between QIP and control groups (eg, age, sex, race) could not be fully corrected. Fourth, we did not directly assess ONS compliance over the 90-day period, and data were not available for all participants. However, patient self-reported compliance data from 160 patients supported high rates of ONS use (51.8%), and the coupon-redemption rate was almost 2-times higher than the national average (range: 4.7%-21.1% depending on ONS coupon utilized). While reliance on self-reported ONS compliance data has limitations, this is the most practical way to collect patient compliance information and ensure simulation of real-world patient experiences. Fifth, the QIP intervention did not include physical activity (eg, exercise counseling), a factor reported by others to be important for maintenance and recovery of health in poorly nourished community dwellers, especially in older people.[45] Finally, administrative institution-level data were mainly used to confirm healthcare resource utilization, so it is possible that healthcare visits outside of the institution or its network were not fully captured. However, due to self-reported survey data also being utilized to supplement healthcare resource utilization, we believe that we have captured all possible healthcare visits.

Based on limitations of our study design, we offer insights for design of future studies that may be used to extend our findings. For this initial study, we used a pragmatic real-world design that followed standard QIP methodologies. A randomized study design comparing standard nutrition care versus QIP-trained providers offering targeted ONS could offer definitive results. Although expensive to conduct, we advise design of large-scale studies that will allow study-control matching techniques and multivariate analytics. Further, we propose use of direct measures of patient compliance with ONS intake, such as provision of product with counting of remaining supplies at various intervals during the study period. To address the issue of physical activity, future studies could be designed to add guidance on increased physical activity to the QIP protocol. Future studies could also use claims data to ensure comprehensive analysis for in-network and out-of-network healthcare resource utilization.

Potential Next Steps for Healthcare in This Area

For primary care physicians and other practitioners, it is generally agreed that the sooner a poorly nourished patient is identified and treated, the more likely the intervention will be able to help prevent or delay adverse health outcomes. To this end, we call upon physician leaders to determine how they can facilitate early identification of malnutrition (under- and overnutrition) in their community clinics and

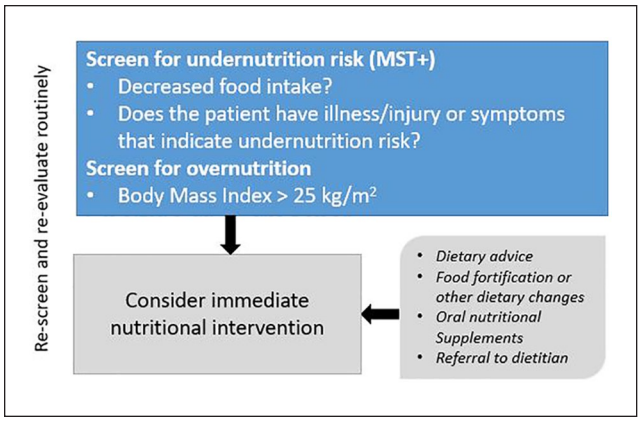

Figure 4. Nutrition Screening Pathway to identify risk of under- and overnutrition in the community.
Abbreviation: MST, Malnutrition Screening Tool.

practices.[46] Clearly, there is a need for medical education on nutrition at all levels of training—medical school, residency practices, and continuing education for practicing physicians, physician assistants, and other healthcare provider groups.[46-48] Even RDNs do not all use consistent nutrition practices, so it may be helpful to engage them in streamlining screening and care in order to help address such practice variations.[49]

We propose consideration of a simple solution—routine use of the 3-question Malnutrition Screening Tool (MST) to identify undernutrition in everyday practice,[26,50] in combination with other "red flag" observations that indicate disease-related poor nutrition (this would be applicable even in overweight/obese patient population). For example, while MST is used to identify undernutrition or its risk, we further suggest use of BMI greater than 25 kg/m^2 with 2 or more comorbid diseases as a simple and fast way to screen for overnutrition or its risk. For future research, we also propose testing the practice of using the Nutrition Screening Pathway at every routine care visit, much as conventional a "vital sign" like blood pressure or heart rate is done (Figure 4). This can be implemented quickly by medical assistants at time of patient visits or as part of their routine health care monitoring. Logical follow-up care by the physician could incorporate dietary advice, food fortification for undernutrition or diet changes for overnutrition, condition-specific ONS, or referral to a dietitian for further care when such resources are available.

Conclusions and Next Steps

Our study findings underscored the value of providing appropriate nutritional interventions for community-dwelling patients who are poorly nourished in terms of under- and overnutrition. Based on our study experiences, we encourage leaders of other health systems to use QIPs to inform, enhance, and quantify the benefits of nutrition

focused care in primary care settings. Our results showed that better nutrition care was associated with reduced healthcare resource use and lower costs. These findings form a sound rationale for primary care physicians to step up efforts to identify and treat nutritionally at-risk patients and serve as educators for other practitioners to optimize overall outpatient care.

Primary care physicians and other community-based healthcare providers are in a unique position to help patients achieve better health through better nutrition while also lowering costs for patients and providers in general. As such, we call on primary care physician leaders to promote and enrich training on nutrition care at all levels of medical education—medical students, doctors-in-training, and practicing doctors and collaborate with RDNs and nurses to offer comprehensive nutrition care for their patients. For practitioners in the outpatient community, we encourage use of sustainable QIPs to incorporate nutrition care into primary care practice. Finally, as overnutrition and obesity among COVID-19 patients is associated with poor health outcomes, the results of this study highlight the importance and urgency of implementing outpatient nutritional programs for at risk outpatient populations.

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Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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