

Research

Nutritional Support for Outpatients at Risk of Malnutrition Improves Health Outcomes and Reduces Healthcare Costs

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ABSTRACT

Purpose: Approximately 1 in 3 older adults living in the community experience malnutrition or its risk. Only a few studies have examined the impact of nutrition interventions on this population. We hypothesized that proper nutrition care for outpatients can help alleviate healthcare needs and lessen the overall burden to healthcare systems.

Methods: This study was a multisite, pre-post quality improvement program (QIP) implemented at 2 branches of an Illinois-based home health agency. The QIP included 203 patients who were referred to receive home health care services by a physician during an outpatient visit. A historic control group of 722 patients were used for comparison.

Results: Hospitalization relative risk reduction rate was 38.9%, 48.7%, and 44.7% at 30, 60, and 90 days, respectively, when

compared with the historic control group. Total cost savings from reduced 90-day healthcare resource utilization including hospitalization, emergency department and outpatient visits was \$472,433, or \$2,327 per patient treated.

Conclusions: Hospitalization rate and overall healthcare resource utilization were significantly reduced through the implementation of a nutrition-focused QIP targeting the nutrition needs of outpatient adults at risk of malnutrition. These improvements resulted in significant cost savings, thus highlighting the importance of nutrition care for improving the health of outpatients and for reducing healthcare costs.

Keywords: Cost-savings; Outpatients; Home health; Nutrition; Older adults; Oral nutritional supplements; Patient outcomes.

Introduction

Malnutrition is common among hospitalized patients, especially those who are older. Published studies consistently underscore the association between poor nutritional status at the time of hospital admission and subsequent negative outcomes—longer lengths of stay in hospital, increased readmission rates, and higher overall healthcare costs [1-5]. For patients hospitalized in the United States (US), inpatients with a diagnosis of malnutrition incur hospital costs that are up to 2 times higher than those of adequately-nourished inpatients [6].

Studies of non-hospitalized patients have also uncovered alarmingly high rates of malnutrition (or its risk) among older adults living in the community [7-9]. While there is clear evidence supporting the benefits of nutrition interventions

for hospitalized patients, far fewer studies have examined the impact of nutrition interventions for older community-dwelling adults [10-12].

As the largest integrated healthcare delivery system in Illinois, Advocate Health Care (“AHC”) provides both inpatient and outpatient services, including home health services, in the metropolitan Chicago area. AHC is uniquely positioned to evaluate the need for more emphasis to nutritional assessment, interventions, and services for community-dwelling adults receiving care in outpatient clinic settings. In this study, AHC’s primary care physicians referred outpatients with malnutrition or its risk to the AHC Home Health Agency (HHA) where they received nutrition-focused care. We aimed to evaluate the impact the nutrition-focused quality improvement program (QIP) would have on the health and economic outcomes of the

participating outpatients. While we approached malnutrition as a modifiable risk factor that, when treated, may help improve health outcomes, existing research has demonstrated malnutrition as a modifiable risk factor of quality of life [13] and even survival [14]. We also hypothesized that proper nutrition care for outpatients can ease their health care needs, and lessen the overall burden to healthcare systems [15].

Methods

Study site, methodology and population

This was a pre-post, nutrition-focused QIP implemented at two branches of the HHA of AHC, a not-for-profit, integrated-care provider for individuals, families, and communities in Illinois. As previously reported, patient nutritional risk screening was completed during the initial HHA visit by the admitting clinician - a nurse or physical therapist. Different training methods (e.g., small group based scenarios), which were developed and led mainly by the lead registered dietitian of AHC were used to inform and train the professional caregivers on how to enhance nutrition-care practices [16].

Patients found to be at nutritional risk received a customized nutrition care plan informed by their dietary needs. An allergy-based algorithm to inform product selection was also used by the HHA clinicians, and patients were given different flavor choices. Standard (Ensure®, 2 bottles/day), or disease-specific (Glucerna®, 2 bottles/day or Nepro®, 1 bottle/day) Oral Nutritional Supplements (ONS) were provided to patients at no cost and were delivered to their home within 48-72 post HHA admission for up to 30 days. Patients nutrition care plan was reviewed and documented at each patient visit, whilst patients were also educated on the importance of nutrition and ONS benefits. Finally, QIP patients were provided with ONS coupons and were contacted via phone between days 30-45 post HHA admission during which their experience, ONS consumption, likelihood of ONS use post HHA discharge, satisfaction with the QIP, and physician nutrition practices were assessed. Additional details of the overall nutrition-focused QIP were previously published [16].

The full QIP (intervention) group consisted of more than 1,500 adult patients who were enrolled into the study between December 27, 2016 and December 7, 2017. All QIP participants were: (1) either admitted to the HHA from an AHC hospital, enrolled in the HHA through an affiliated skilled nursing facility (SNF), or referred by a physician during an outpatient visit; (2) at-risk or malnourished at the time of hospital discharge (based on a score of ≥ 2 on the Malnutrition Screening Tool or a score of ≥ 30 on the Nutritional Health Screen at the time of HHA admission); and (3) able to consume both food and beverages orally. Of these, 203 patients had been directly referred to the HHA by a primary care physician in an outpatient clinic. The current analysis considers the outcomes for 203 QIP patients and 722 historic controls. Historic control group included at-risk and malnourished patients who received HHA care during the 12 months prior to the QIP start (December 27, 2015 to December 26, 2016). Proxy measures were used to identify at-risk and malnourished patients in the historic control group, as the Nutrition Health Screen was not in regular use prior to the QIP. Proxy measures included malnutrition-related diagnoses

(International Classification of Diseases, Ninth Revision [ICD-9] codes 263.0–263.9); ONS orders during hospital admission (for hospital discharged patients); or malnutrition-related documentation in physician notes in outpatient medical records. Exclusion criteria were previously described [16].

Statistical analyses

Descriptive statistics were calculated for all patient characteristics and healthcare resource utilization. Between-group analyses were performed by comparing QIP patients with historic controls using the chi-square test for categorical variables and the Student t-test for continuous variables. A generalized linear regression model with a Poisson distribution and log link was used to estimate any risk reduction in resource utilization between the two groups. Analyses were performed with SPSS 22.0, and a two-tailed p -value ≤ 0.05 was considered statistically significant. Specific discussions of propensity score matching, sensitivity analysis, cost analysis, and sample size calculations are available in Riley et al [16].

Cost-savings estimation

Total healthcare resource utilization (HCRU) costs were estimated based on costs incurred from hospitalizations, emergency department (ED) visits, and outpatient visits. The QIP implementation costs were estimated based on the professional time needed for patient nutrition screening and assessment ($n=5,688$, \$67,043), patient education, follow-up, and other program requirements ($n=203$, \$63,071), as well as provision and delivery of ONS ($n=203$, \$22,490). The hospitalization cost of \$18,296 was extracted from the Healthcare Cost and Utilization Project (HCUP) report [17], which reported costs for malnourished adult patients using 2013 data for US hospital admissions, and then inflated to 2017 US dollars using the Consumer Price Index (CPI) [18]. The average costs of ED and outpatient visits of \$1,312 and \$535, respectively, were from the 2013 Medical Expenditure Panel Survey (MEPS), which was also inflated to 2017 US dollars using the CPI [19].

Results

Patient demographics

The average age of participants in both the QIP and historic control groups was approximately 78 years. Nearly half of the participants in both groups were White, with fewer Blacks in the intervention group (33.0%) compared with the historic control group (42.1%), as shown in Table 1. Both groups were approximately two-thirds female. Over half of all participants had public insurance, though the QIP group included a significantly greater number of patients with private insurance (39.9% vs. 20.8%, respectively; $p<0.001$; **Table 1**). QIP group had statistically significant higher percentage of congestive heart failure (42.8% vs. 30.0%; $p=0.02$) and diabetes (40.2% vs. 30.0%; $p=0.09$), but statistically significant lower percentage of surgery (1.1% vs. 3.4%; $p=0.02$) outpatients. Most participants in the QIP group consumed Ensure® (60.1%), while 35.5% received Glucerna® (glycemia-targeted nutrition) and 4.4% received Nepro® (patients with chronic kidney disease).

Table 1: Demographic characteristics: qip and historic control groups.

Characteristic	Control group (n=722)	QIP group (n=203)	p-value
Mean age, years (SD)	78.2 (11.9)	78.1 (12.1)	0.908
Age group, %			
<65	100 (13.9)	25 (12.3)	0.572
≥65	622 (86.1)	178 (87.7)	
Gender, %			
Female	466 (64.5)	128 (63.1)	0.696
Male	256 (35.5)	75 (36.9)	
Race, %			
White	370 (51.2)	93 (45.8)	<0.001
Black	304 (42.1)	67 (33.0)	
Other	48 (6.6)	43 (21.2)	
Insurance, %			
Private	150 (20.8)	81 (39.9)	<0.001
Public	569 (78.8)	119 (58.6)	
Other	3 (0.4)	3 (1.5)	
ONS type during home health, %			
Ensure®	NA	122 (60.1)	NA
Glucerna®		72 (35.5)	
Nepro®		9 (4.4)	
Surgical patients, %			
Yes	8 (1.1)	7 (3.4)	0.020
No	714 (98.9)	196 (96.6)	
Myocardial infarction, %			
Yes	22 (3.0)	6 (3.0)	0.946
No	700 (97.0)	197 (97.0)	
Congestive heart failure, %			
Yes	309 (42.8)	61 (30.0)	0.001
No	413 (57.2)	142 (70.0)	
COPD, %			
Yes	196 (27.1)	48 (23.6)	0.317
No	526 (72.9)	155 (76.4)	
Diabetes, %			
Yes	290 (40.2)	61 (30.0)	0.009
No	432 (59.8)	142 (70.0)	
Malignancy, %			
Yes	23 (3.2)	7 (3.4)	0.852
No	699 (96.8)	196 (96.6)	
Abbreviations: QIP=Quality Improvement Program; SD=Standard deviation; ONS = Oral nutritional supplement; COPD=Chronic obstructive pulmonary disease; NA= Not Applicable.			

Healthcare resource utilization

Hospitalization rates were lower for patients who were referred by their primary care physician to the nutrition-focused QIP in home health care. Lower rates were observed at all three time points (30, 60, and 90 days post QIP enrollment) as compared to historic controls. The greatest relative risk reduction occurred

at 60 days, with almost 50% fewer hospitalizations in the QIP group compared with the control group (**Figure 1**).

In addition, the mean number of inpatient and outpatient visits per patient were statistically significantly lower in the QIP group (**Table 2**). While the number of ED visits was not significantly different between the two groups, the need for any

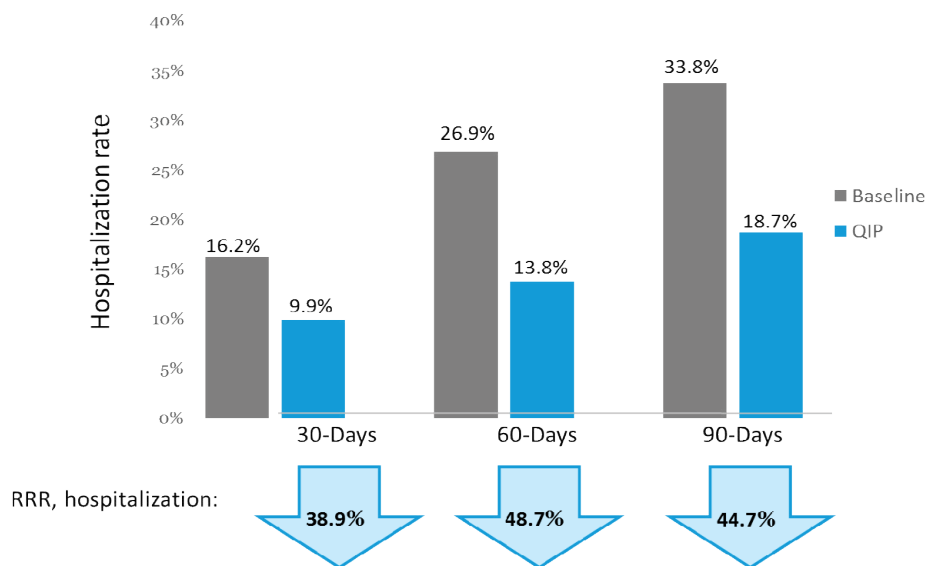


Figure 1: Hospitalization rates were lower for patients who were referred by their primary care physician to nutrition-focused QIP in home health care and followed for 90 days, as compared to Historic Controls.

Abbreviations: QIP = Quality Improvement Program; RRR = Relative Risk Reduction

Table 2: Healthcare utilization.

Variable	Control, mean value of per-patient HC utilization incidents (n=722)	QIP, mean value of per-patient HC utilization incidents (n=203)	RRR, %	p-value
Inpatient Visits	0.57	0.43	0.76	0.0002
Emergency Department Visits	1.07	0.70	1.62	0.73
Outpatient Visits	0.73	0.67	0.79	<0.0001
Overall	0.87	0.81	0.92	<0.0001

The use of healthcare resources was evaluated in terms of mean per-patient visits for inpatient care, emergency care, outpatient care, and need for any type of healthcare (overall).

Abbreviations: HC, healthcare, QIP, quality improvement program; RRR, relative risk reduction

Table 3: Healthcare utilization costs estimated and potential cost savings.*

QIP	Amount, USD
Total HCRU Costs	\$1,856,317
Total QIP Resource Costs	\$ 152,604
Per Patient QIP Resource Cost	\$ 752
QIP Total Cost Per-patient Cost	\$ 9,896
Historical Controls	Amount, USD
Total HCRU Costs	\$8,825,309
Total QIP Resource Costs	\$0
Per Patient QIP Resource Cost	\$0
Control Per-patient Cost	\$12,223
Potential Cost Savings with QIP	Amount, USD
Savings for QIP population (n=203)	\$472,433
Per-patient	\$2,327

*Total HCRU costs are estimated as costs incurred from hospitalizations, emergency department and outpatient visits. QIP resource costs were estimated as costs incurred for QIP implementation, including patient screening and assessment, patient education, follow-ups, and other program requirements, and oral nutritional supplement provision and delivery. Costs are reported in 2017 USD.

Abbreviations: QIP: Quality Improvement Program; HCRU: Healthcare Resource Utilization; USD: United States Dollar.

type of healthcare (overall resource utilization) was significantly reduced in the QIP group (RRR, 0.92; $p < 0.0001$; **Table 2**).

Potential cost savings

The cost savings associated with the significant reductions in overall HCRU 90-days post-QIP are broken down in **Table 3**. The total cost savings resulting from reduced overall HCRU were \$472,433, with net savings per patient treated of \$2,327.

Discussion

Longer life provides extended opportunities for personal fulfilment and community contributions, yet aging itself can also be associated with illness, disability, and dependency - factors that contribute to poorer quality of life [20]. Age-related health problems are also associated with poor nutritional status, especially among older people living alone in the community [1]. Such health problems—and the medications used to treat them—can lead to poor food intake. On the other hand, poor dietary intake can increase the risk for acute health problems (infections, poor recovery from illness), chronic conditions (diabetes, cardiovascular disease, mobility limitations), the need for hospitalization, and mortality [9,21-23].

Key findings from QIP study

Using a nutrition-focused QIP, we aimed to raise primary care physicians' awareness of malnutrition in older community-dwelling adults and guided them to refer at-risk patients to community-based nutrition care. Our QIP involved routine screening for malnutrition risk with validated tools, along with referral for nutrition status evaluation and care as needed. The QIP utilized standard protein-energy ONS formulations or condition-specific ONS (diabetes, kidney disease) to help offset nutrition risks. Results of our QIP study showed that these nutrition practice changes nearly halved the incidence of hospital admissions, thus affording potential savings of over \$2,300 per at-risk/malnourished older patient due to overall avoidance of hospitalization and outpatient visits.

The current sample of community-dwelling older patients with malnutrition or its risk extended previous findings by demonstrating the potential for improved outcomes and cost savings as a result of a comprehensive nutrition-focused intervention. This is in contrast to earlier studies, which have focused mainly on the added use of healthcare resources by malnourished, older, hospitalized patients [4,12,24-26]. Our nutrition-focused QIP model also allowed for the prompt identification of malnutrition risk and its immediate management, before allowing older patients to become severely malnourished and frail [23,27]. Third, since AHC primary care physicians were empowered to refer directly from an outpatient visit to the HHA, nutrition care was not deferred until patients became sicker or were so functionally impaired that they were admitted to a HHA by way of a hospital or skilled nursing facility [28,29].

Results of our nutrition-focused study represent a positive change toward improving healthcare in a vulnerable population. By facilitating person-centered care for especially older adults who are living at home, the QIP helped to strengthen the relationship between the patient and the healthcare team [30-

32]. We also increased social support for these adults through the HHA visits [8,33]. Social support is expected to help older community-dwelling individuals, especially those living alone [34].

Comparison with results of related studies

Prior studies have associated malnutrition with higher healthcare costs in institutionalized or community-dwelling older adults, and suggested that nutritional interventions such as ONS can have an important impact on reducing annual per-patient healthcare costs [15]. Results of a study in Spain showed that an older person who was adequately nourished had an average annual cost of €1,542 for use of health resources, compared to €3,492/year for a malnourished older person, and €2,744/year for one at risk for malnutrition [12]. In a national-level study in the Netherlands, an economic model estimated a total annual healthcare cost savings of €13 million (18.9% savings) when ONS was used in care of community-dwelling adults (>65 years) with disease-related malnutrition [11].

In another study, UK researchers identified barriers to “screen-and-treat” policies in an effort to improve nutrition care for at-risk and malnourished older people. The principal barriers identified were the time needed to screen and reservations about screening; both healthcare professionals and patients shared these concerns. Patients' physiological and practical barriers, such as impaired chewing and swallowing, can also hinder the effectiveness of nutritional interventions, as can difficulties in shopping for and preparing foods. Psychosocial barriers were identified as the most frequent yet most difficult to address: older adults may not consider nutrition to be an important part of their care, or may fail to recognize the problem in themselves [35].

Limitations

This study has several limitations which are mainly attributed to the utilization of an observational, QIP study design as outlined by Riley et al [16]. Similarly, inability to attribute causation is a major limitation of this post-hoc analysis. However, during the QIP period, no other institutional initiatives were focused on patients at risk for malnutrition at the participating HHA locations enrolling patients in the QIP. Similar to most studies of older people in the community, our study is limited by generalizability to other populations. Overall, our participants were undernourished. Under- and over-nutrition represent poor nutrition, and both are associated with adverse health consequences [36]. Our findings cannot be generalized to the US population as a whole, as this population is predominantly over-nourished [37], while our study focused on undernutrition. Separate studies are needed to determine whether adverse health consequences of both under and over-nutrition can be prevented or treated by nutrition-focused QIPs in the community.

Clinical implication: Primary care physicians play key roles in supporting nutrition care

Primary care physicians who practice in the community are well-positioned to play key roles in the nutrition care of older adults. They can advocate for prompt attention to nutrition care in older adults, thus helping lessen or delay declines in

disease conditions, functional abilities, and quality of life. In this way, they are becoming “physicians-as-leaders” family physicians who are on the leading edge of a new approach to the identification, prevention, and treatment of malnutrition. Similarly, primary care physicians-as-leaders can help call attention to the need for better nutrition education in both medical school curricula and postgraduate medical education [38-41].

Conclusion

For older adults living at home, identifying and treating malnutrition or its risk can help them maintain their health and function longer, speed recovery when illness occurs, and lessen the need for hospitalization and other healthcare services. Within integrated healthcare systems such as AHC, physicians—especially primary care physicians—are in a unique position to harness the health benefits of nutrition care by emphasizing nutrition education, training, and accountability. Nutrition-focused QIPs have proven effective for changing nutritional practices, as shown by this and other AHC studies. By improving the overall health and function of community-dwelling / outpatient older adults with malnutrition or its risk, healthcare systems can ease the burden of high healthcare use among older people and can likewise lower healthcare costs.

Financial Disclosure

This study was supported by a research grant to Advocate Health Care from Abbott.

Conflicts of Interest

Ms. VanDerBosch has received consultancy fees from Abbott apart from the present work. Dr. Sulo is an employee and stockholder of Abbott. Mr. Lanctin was an employee of Abbott when study was conducted.

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