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Long-Term Impact of a Postdischarge Community Health Worker Intervention on Health Care Costs in a Safety-Net System

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Objective. Patient navigators (PNs) may represent a cost-effective strategy to improve transitional care and reduce hospital readmissions. We evaluated the impact of a PN intervention on health system costs in the 180 days after discharge for high-risk patients in a safety-net system.

Data Source/Setting. Primary and secondary data from an academic safety-net health system.

Study Design. We compared per-patient utilization and costs, overall and by age, for high-risk, medical service patients randomized to the PN intervention relative to usual care between October 2011 and April 2013. Intervention patients received hospital visits and telephone outreach from PNs for 30 days after every qualifying discharge.

Data Collection/Extraction Methods. We used administrative and electronic encounter data, and a survey of nurses; costs were imputed from the Medicare fee schedule.

Principal Findings. Total costs per patient over the 180 days postindex discharge for those aged ≥60 years were significantly lower for PN patients compared to controls ($5,676 vs. $7,640, $p = .03$); differences for patients aged <60 ($9,942 vs. $9,046, $p = .58$) or for the entire cohort ($7,092 vs. $7,953, $p = .27$) were not significant.

Conclusions. Patient navigator interventions may be useful strategies for specific groups of patients in safety-net systems to improve transitional care while containing costs.

Key Words. Hospital readmission, safety net, community health worker, patient navigator, cost analysis

Hospital readmissions are common and costly (Jencks, Williams, and Coleman 2009). Much attention has focused on reducing 30-day readmission rates (Centers for Medicare and Medicaid Services 2016a, b; National Quality Forum 2017). However, hospital systems are keen to identify strategies that decrease readmissions and other associated health care costs beyond just the 30-day postdischarge window, especially in an environment in which they increasingly bear financial risk for the full spectrum of patient care. Postdischarge care coordination interventions have been shown to reduce readmissions in the short and long term (Rich et al. 1995; Naylor et al. 1999, 2004; Thompson, Roebuck, and Stewart 2005; Coleman et al. 2006) for some groups of patients and to offer the potential to create cost savings through reductions in readmissions and improvement in outpatient management.

However, evidence is mixed about the impact of transitional care programs on health care costs. Some studies of interventions led by nurses or other clinical personnel, mostly among older populations, have shown lower costs (Naylor et al. 1994, 1999, 2004; Rich et al. 1995; Coleman et al. 2006; Graves et al. 2009; Polinski et al. 2016), while others have found no differences (Laramee et al. 2003). None of these studies have included safety-net hospitals with at-risk patient populations. Postdischarge programs using community health workers (CHWs) may be particularly appealing to safety-net health care systems seeking lower cost strategies to reduce readmissions while addressing the complex social needs that drive readmissions in their diverse patient populations. CHWs are trained laypeople from the community who share the patient's language and culture and may be uniquely effective at engaging vulnerable patients and connecting them to community resources. Data suggest that providing language-concordant care is associated

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with reduced readmission rates and hospital costs for older limited English proficient patients (Karliner, Perez-Stable, and Gregorich 2017). Limited data on the use of CHWs for postdischarge care have shown improvements in transition care quality and reduction in 30-day readmission rates (Kangovi et al. 2014; Balaban et al. 2015), but evidence is inconclusive about their cost-effectiveness (Viswanathan et al. 2010). Some delivery systems have reported a favorable return on investment after implementing a postdischarge CHW intervention (Morgan et al. 2016), but there is no rigorous evidence on the long-term cost impact of CHW interventions for postdischarge care in a safety-net system.

In this study, we evaluate the impact of a CHW-based postdischarge care transition intervention on total inpatient and outpatient costs in the 180 days after an index discharge for high-risk safety-net patients in a risk-sharing payment environment. We examine the impact on costs for subgroups defined by age, given that our prior studies of this CHW intervention found reductions in 30-day readmissions and 180-day hospital-based utilization for older patients but higher rates in younger patients (Balaban et al. 2015, 2017).

METHODS

Design and Setting

We conducted a study of the costs associated with a randomized, controlled trial of a CHW intervention to reduce readmissions among high-risk patients, the Patient Navigator (PN) trial. Details about the trial can be found elsewhere (Balaban et al. 2015). Briefly, the trial was set within Cambridge Health Alliance (CHA), an academic public safety-net system with an ethnically diverse and traditionally underserved patient population. CHA is an integrated health care provider comprising two hospitals, three emergency departments (ED), and 10 community health centers. This study was approved by the institutional review boards at CHA and Harvard Pilgrim Health Care.

Intervention

The PN intervention included hospital visits and weekly outreach calls in the 30 days after discharge by three PNs, two of whom spoke Portuguese, the most common non-English language in our study population (Balaban et al. 2015); telephone interpreters were used for other languages. Prior to discharge, the PNs conducted introductory visits with the patient and caregivers to assess postdischarge needs; assist patients with communication related to postdischarge concerns; discuss the importance of obtaining new medications, having timely outpatient follow-up with the patient's PCP in the CHA system, and reporting concerning symptoms; and arrange for follow-up. They also alerted the patient's PCP about the discharge.

After discharge, through weekly telephone contacts, the PNs confirmed follow-up appointments with the CHA PCP; addressed barriers to taking medications; identified concerning symptoms and facilitated communication with PCP offices; assisted with insurance, transportation, and home care needs; made connections to community services; supported patient self-management; and helped patients navigate the health care system. The intervention protocol had as its goal one hospital visit and three completed calls. PNs summarized each call in a brief note in the EMR, which was sent to the patient's primary care nursing staff. Our intervention did not involve additional training or tasks for nursing, and nurses were involved in the intervention only in responding to PN EMR notes, queries, or concerns about a patient. The PNs attempted to coach patients to independently direct their health care, but actively coordinated care for patients for whom self-management was more difficult. The PNs role was to facilitate, not substitute for, access to primary care with the patient's PCP in the CHA system. Intervention patients who had additional qualifying discharges within 180 days of the index discharge received PN services for the 30 days after these subsequent discharges.

Control patients received usual inpatient and outpatient care, which included a phone call from a nurse at the patient's primary care site within 48 hours of discharge.

Population

Patients were recruited between October 2011 and April 2013. We randomized patients to the PN intervention or control group during their index hospitalization. The index hospitalization was the first admission in the study period that met the following qualifying criteria: the patient had at least one risk factor for readmission (age > 60; admitted to a CHA hospital within the past 6 months; length of stay [LOS] ≥3 days; or admission diagnosis of heart failure or chronic obstructive pulmonary disease); had a primary care provider (PCP) within CHA; and had an observation stay or inpatient admission on CHA's general medicine service.

Eligible patients were electronically identified daily, using the hospital electronic medical record (EMR). PNs determined how many intervention patients to enroll each day, aiming to maintain a panel of 30–35 patients per full-time PN. A computer algorithm randomly assigned the PN-selected number of eligible patients to the intervention group and remaining eligible patients to the controls.

During the 180 days following the index hospitalization, PNs provided services to PN study patients for 30 days after each qualifying hospitalization that resulted in a discharge to the community. PN services were not available when a patient was discharged to a noncommunity setting. As a result, our study excluded patients after randomization if they died in hospital or were discharged from the index hospitalization to another inpatient service (e.g. psychiatry or surgery), another acute care hospital, skilled nursing facility (SNF), long-term care, or to law enforcement. For this study, which measures utilization and costs for 180 days after the index hospitalization, we also excluded patients whose index discharge was <180 days before the trial ended and patients who died during the index hospitalization.

Data Sources

Using CHA's electronic medical record (EMR), we extracted patient utilization data for inpatient care, office visits, ED visits, and outpatient provider and nurse phone contacts. Data also included inpatient and outpatient service dates, service types, and diagnosis and procedure codes, as well as phone contacts by primary care nurses and providers made to or on behalf of study patients. Data on standardized costs for health care utilization based on DRG and procedure codes were obtained from the 2012 CMS Medicare Fee Schedule and linked to CHA utilization data (described further below).

Data on the amount of time spent by nurses on postdischarge care of study patients were obtained through a survey of nurses, and they were used to estimate labor costs. In a brief in-person written survey, nurses from five CHA primary care practices were asked to estimate time spent on specific postdischarge activities for study patients discharged to home in the prior 4 weeks. To help with recall, nurses were provided lists of study patients and EMR print-outs of their contacts or attempted contacts in the prior week with study patients. Nurses were asked to think about their most recent phone contact or attempted contact with each patient and estimate time spent reviewing the chart, attempting to contact the patient, talking on the phone with the patient, talking with other providers and the PN about the patient, and documenting. Nurses were given a $5 gift card for completing the survey. Eleven nurses provided data on 22 patients (15 control and 7 PN), with a range of 1–6 patients per nurse.

Variables

Outcome Variables. We calculated utilization rates per patient for inpatient and outpatient encounters in the 180 days after the index discharge. For emergency department visit rates, we included only visits that did not result in a hospitalization.

To determine the overall costs of the intervention, we calculated the average cost per patient in the 180 days after their index discharge and categorized costs for each patient as billable and nonbillable. We defined billable costs as the costs for medical care that study patients received in the CHA system. We calculated costs using DRG and CPT codes from CHA encounter data (Epstein et al. 2014). We used the CPT codes for each encounter to assign a standardized price from the CMS Medicare Fee Schedule for hospitals in CHA's geographic area (Epstein et al. 2014). For inpatient DRG codes, we assigned a cost calculated based on DRG rates for CHA specifically from the CMS Acute Inpatient Prospective Payment System (PPS) fee schedule. For both DRG and CPT costs, we assigned values based on the CHA site. For outpatient costs, we totaled the facility and professional fees associated with all CPT codes assigned to that visit. For ED visits that did not result in a hospitalization, the same methodology was used. Professional fees for ED visits that resulted in a hospitalization were included in calculating the cost of the hospitalization, and the facility fees from these ED visits were subsumed in the inpatient DRG price, following standard CMS billing practices. For inpatient visits, the DRG price was assigned as the facility fee for each discrete inpatient stay, and CPT codes for inpatient procedures were used to calculate the inpatient professional prices. We then calculated the total billable costs per patient by summing the costs for each type of encounter for each patient during the 180-day postdischarge follow-up period.

We defined nonbillable costs as the costs of the PN program (i.e., the salaries of the PNs) and the cost of nurse and provider time for telephone outreach. Each phone contact between a physician and a patient was assigned the cost of one-third of a Level 1 E&M CPT code for CHA providers. Data from the nurse survey found that the average time spent by nurses per patient per phone contact was 31 minutes for PN patients and 22 minutes for control patients. We proportionally assigned the average hourly wage for a nurse in

Cambridge, MA ($42.35/hour), based on data from the Bureau of Labor Statistics (2012).

We used the PN salary of $50,000 per year per FTE to calculate PN costs, with an average of 1.5 FTE of PN effort in place at any given time. Given that PN effort and the number of patients followed varied during the start-up of the trial and toward the end when new patients were no longer being enrolled, we calculated the PN cost per patient served averaged over a one-year period (calendar year 2012) when the intervention was fully operational at 1.5 FTE of PN effort. To do this, we divided the PN costs ($75,000 for 1.5 FTE) by the number of patients with qualifying discharges who received PN services during calendar year 2012 (574 patients with 867 admissions), making the cost per admission $86.50 and the cost per patient $131. Each PN patient was assigned this cost, which was added to each patient's unique cost for telephone outreach to determine the total nonbillable costs for each patient. We then summed the total billable and nonbillable costs for each patient to determine the total costs.

Independent Variables. To describe the study population and adjust for residual imbalances in characteristics between randomized groups, we measured and used in our statistical models the baseline demographic and clinical characteristics obtained from CHA electronic data, including age; gender; race/ethnicity; whether the patients were English-speaking; insurance type; Charlson score; and history of psychiatric or substance abuse diagnoses in the index hospitalization or in the 6 months prior.

Statistical Analyses

We used chi-square for categorical variables and *t*-tests for continuous variables to determine baseline differences between the randomized groups. As in our previous studies (Balaban et al. 2015, 2017), we stratified all analyses by age group (<60 and ≥60 years). In the first study (Balaban et al. 2015), we had revised our original analytic plan to conduct subgroup analyses based on Medicare enrollment to instead stratify based on age group, as patients aged ≥60 years could have qualified solely based on age, while those under 60 had to have had at least one other risk factor, resulting in very different risk profiles of the two groups and differences in response to the intervention according to age. Unadjusted comparisons were performed using *t*-tests, but our primary analyses used a generalized linear model (GLM) to adjust for residual differences in patient characteristics between the PN and control groups with respect to predisposing, enabling, and need factors that could affect health care utilization according to Andersen and Aday's conceptual model of health care utilization (Andersen 1968). These GLM models included covariates for age group (for unstratified models only), gender, race/ethnicity, language, insurance type, Charlson score, history of psychiatric or substance abuse diagnoses, and qualifying risk factor at index (prior hospitalization, diagnosis of heart failure, diagnosis of chronic obstructive pulmonary disease). All GLM models used a log link and a Poisson distribution; a log link is an appropriate strategy for zero-inflated data that does not require post hoc adjustment for heteroscedasticity (Buntin and Zaslavsky 2004). The Poisson distribution was assigned based on a modified park test (Manning and Mullahy 2001), and we applied a generalized chi-square scale parameter to address overdispersed data in the Poisson distribution (McCullagh and Nelder 1989). To facilitate interpretation of our results, we use the regression coefficients to estimate the adjusted mean utilization rates and costs per patient. All analyses were conducted using *STATA* Version 13 (College Station, TX).

RESULTS

Overall, 1,937 patients (747 in the PN group and 1,190 in the control group) were randomized as part of the PN trial; details of patient inclusion and exclusion can be found elsewhere (Balaban et al. 2015). Among those randomized, we excluded 16 patients (eight in each study group) who died before discharge from the index hospitalization, and 416 (154 PN and 262 controls) who did not have a qualifying discharge to the community at the end of the index hospitalization. Of the 1,505 patients (585 PN and 920 controls) who did have a qualifying discharge to the community after the index hospitalization, 975 had 180 days of follow-up before the trial ended and comprised our population for this study (448 PN and 527 controls).

Table 1 presents descriptive characteristics of the study population by age category. Despite the randomized design, patients in the PN group had a significantly higher average age and were less likely to speak English, have psychiatric or substance use diagnoses, or have length of stay ≥3 days in the index hospitalization compared to controls. Among those aged ≥60, PN patients were less likely to have substance use diagnoses than controls, while there were no significant differences between PN and control patients among those <60.

Table 1: Characteristics of the Study Population

	Full Sample		*Under 60*		*60 and Older*	
Characteristic	*PN (n = 448)*	*Control (n = 527)*	*PN (n = 121)*	*Control (n = 196)*	*PN (n = 327)*	*Control (n = 331)*
% ≥age 60	**73.0**	**62.6**	–	–	–	–
Age (mean)	**66.7**	**63.8**	46.9	46.0	74.0	74.3
% Female	56.9	56.0	47.9	51.5	60.2	58.3
Race/ethnicity						
% White	57.6	60.5	53.7	63.3	59.0	58.9
% Black	15.9	13.9	14.1	10.2	16.5	16.0
% Hispanic	14.7	14.6	21.5	18.9	12.2	12.1
% Other	11.8	11.0	10.7	7.7	12.2	13.0
% English speaking	**58.3**	**65.3**	74.4	79.1	52.3	57.1
Insurance						
% Medicare	31.3	25.6	1.7	2.6	42.2	39.3
% Medicaid	48.7	51.8	72.7	67.4	39.8	42.6
% Dual eligible	12.5	16.5	13.2	18.9	12.2	15.1
% Commercial/ Other	7.6	6.1	12.4	11.2	5.8	3.0
Charlson score (mean)	2.19	2.09	1.88	2.02	2.27	2.13
% with psychiatric diagnoses	**46.0**	**52.6**	66.9	67.4	38.2	43.8
% with substance abuse diagnoses	**24.8**	**38.3**	53.7	60.7	**14.1**	**25.1**
% with COPD	8.3	5.5	9.1	5.1	8.0	5.7
% with heart failure	7.4	4.9	5.0	2.6	8.3	6.3
% with ≥3 day LOS at index	**45.5**	**53.9**	64.5	72.5	38.5	41.4

$p < .05$ in bold.

Adjusted inpatient, ED and outpatient utilization rates for the entire study population in the 180 days after index discharge were not significantly different between PN and control patients (Table 2). However, among patients aged ≥60 there were nonsignificant trends toward lower ED and hospitalization rates for PN patients versus controls (0.44 visits per patient vs. 0.65, $p = .06$, and 0.44 vs. 0.53, $p = .15$, respectively).

In the overall population, the adjusted mean costs per patient for hospitalizations, ED visits, and outpatient visits were not significantly different for PN and control patients (Table 3). There were no significant differences between PN and control patients in the adjusted mean LOS (7.9 vs. 8.4 days, respectively; $p = .26$) or cost per hospital day ($545 vs. $564; $p = .77$). However, among patients aged ≥60, the PN group had significantly lower average

Table 2: Adjusted Mean Utilization Rates

	Events per Patient in the 180 days Postindex Discharge (95% CI)		
	PN	*Control*	*p-Value*
Full population sample	n = 448	n = 527	
Hospitalizations	0.54 (0.45–0.62)	0.55 (0.47–0.62)	.85
ED visits	0.91 (0.71–1.11)	0.95 (0.77–1.13)	.80
Outpatient visits	8.10 (7.48–8.73)	7.94 (7.37–8.51)	.71
Under 60 sample	n = 121	n = 196	
Hospitalizations	0.74 (0.54–0.93)	0.61 (0.47–0.75)	.31
ED visits	1.95 (1.42–2.47)	1.57 (1.19–1.95)	.27
Outpatient visits	9.41 (7.98–10.84)	8.46 (7.41–9.52)	.31
60 and older sample	n = 327	n = 331	
Hospitalizations	0.44 (0.35–0.52)	0.53 (0.44–0.62)	.14
ED visits	0.45 (0.31–0.58)	0.65 (0.49–0.81)	.06
Outpatient visits	7.62 (6.97–8.27)	7.63 (6.98–8.27)	.99

costs per patient for hospitalizations (\$4,558 vs. \$6,794, p = .01) and ED visits (\$48 vs. \$73, p = .04), and they had lower total costs (\$5,653 vs. \$7,626, p = .03), compared to controls. These costs were not significantly different between PN patients and controls among patients aged <60. Results from adjusted models of utilization and costs did not differ substantively in magnitude or significance from unadjusted results (Tables S1 and S2).

DISCUSSION

This randomized trial of a PN intervention for postdischarge care for high-risk safety-net patients found no significant differences in the overall study population in total costs over a 180-day period between patients assigned to a PN compared to usual care controls. However, among the subgroup of study patients aged 60 and older, we found significantly lower total costs in the 180 days after the index discharge.

Our findings of lower costs among older PN patients are consistent with other studies of nurse-based transitional care programs in non-safety-net populations (Coleman et al. 2006; Graves et al. 2009), and consistent with other studies in urban populations that have found reduced costs after discharge among older patients using nurse-based interventions (Naylor et al. 1994, 1999, 2004). Our findings are also consistent with the limited data suggesting

Table 3: Adjusted Mean Costs per Patient in the 180 days Postindex Discharge

	Predicted Mean Cost per Patient (95% CI)		
	PN	*Control*	*p-Value*
Full population sample	n = 448	n = 527	
Billable costs			
Hospitalizations	$5,857 ($4,802–6,911)	$7,081 ($6,034–8,129)	.11
ED visits	$103 ($81–125)	$108 ($88–128)	.75
Outpatient visits	$408 ($371–444)	$405 ($371–444)	.90
Total billable costs	$6,580 ($5,518–7,642)	$7,739 ($6,699–8,780)	.13
Nonbillable costs			
PN costs*	$131	$0	
Phone call costs	**$351 ($320–382)**	**$253 ($230–277)**	**<.01**
Total nonbillable costs	**$483 ($450–516)**	**$254 ($232–276)**	**<.01**
Total cost per patient	$7,073 ($5,992–8,153)	$7,986 ($6,950–9,023)	.24
Under 60 sample	n = 121	n = 196	
Billable costs			
Hospitalizations	$8,433 ($6,136–10,731)	$8,026 ($6,157–9,895)	.79
ED visits	$223 ($162–284)	$183 ($139–227)	.31
Outpatient visits	$465 ($376–553)	$416 ($351–482)	.40
Total billable costs	$9,383 ($7,067–11,699)	$8,771 ($6,918–10,624)	.69
Nonbillable costs			
PN costs*	$131	$0	
Phone call costs	**$437 ($373–501)**	**$281 ($242–320)**	**<.01**
Total nonbillable costs	**$571 ($501–641)**	**$280 ($243–317)**	**<.01**
Total cost per patient	$9,942 ($7,556–12,327)	$9,046 ($7,180–10,912)	.58
60 and older sample	n = 327	n = 331	
Billable costs			
Hospitalizations	**$4,553 ($3,488–5,617)**	**$6,841 ($5,566–8,117)**	**.01**
ED visits	**$48 ($34–63)**	**$73 ($55–90)**	**.04**
Outpatient visits	$389 ($352–426)	$395 ($358–432)	.83
Total billable costs	**$5,189 ($4,111–6,268)**	**$7,447 ($6,184–8,710)**	**.01**
Nonbillable costs			
PN costs*	$131	$0	
Phone call costs	**$312 ($277–346)**	**$243 ($213–272)**	**<.01**
Total nonbillable costs	**$447 ($410–484)**	**$241 ($214–267)**	**<.01**
Total cost per patient	**$5,676 ($4,553–6,799)**	**$7,640 ($6,372–8,907)**	**.03**

*Patient navigators (PNs) costs are not derived from regression models; each PN patient is assigned the same PN cost. $p < .05$ in bold.

that CHW-based postdischarge transitional care programs have a favorable return on investment for hospital systems (Morgan et al. 2016).

As in prior studies from this trial (Balaban et al. 2015, 2017), we found a differential impact of the PN intervention based on patient age. Our prior studies found lower 30-day readmission rates and 180-day hospital-based utilization rates for PN patients aged 60 or older, but higher rates among those under age 60 (Balaban et al. 2015, 2017). The lower costs among older PN patients versus controls may be due in part to the trend toward lower rates of ED visits and hospitalizations or may reflect lower cost per encounter if PN services mitigate some health issues or facilitate patients to return to care when they require less intensive services and shorter lengths of stay (Thompson, Roebuck, and Stewart 2005; Bryant-Lukosius et al. 2015). We did find lower adjusted mean length of stay and adjusted mean cost per hospital day for PN patients compared to controls, although these differences were not statistically significant. The lower costs in the presence of similar utilization rates could also reflect outlier costs, but when these analyses were repeated using a 99 percent winsorization of hospital costs to limit the impact of outliers (Hastings et al. 1947), the resulting cost differences were smaller in magnitude but no different in terms of statistical significance or directionality.

Our study found that postdischarge care from a PN did not lower costs for high-risk patients under age 60 in our safety-net setting. Younger socioeconomically vulnerable patients often have significant morbidity and health care utilization, and they have higher readmission rates than their older counterparts overall for CHF and COPD (Barrett et al. 2015; Fingar and Washington 2015). This is supported by our finding of higher rates of hospitalizations and ED visits for those under 60 than for those 60 and older in this study. The prevalence of mental health and substance use comorbidities in the younger population at CHA and other safety-net settings is substantial, and this subgroup may represent a particularly at-risk population. Our initial study from the trial found a significant *increase* in readmissions within 30-day postdischarge for patients under age 60 (Balaban et al. 2015). Other care transition interventions have also noted increased rates of readmission among young patients and among those with substance use and other complex medical and social issues (Einstadter, Cebul, and Franta 1996; Weinberger, Oddone, and Henderson 1996; Tracy et al. 2011). Thus, it is reassuring that our study did not find significantly *increased* hospitalizations or total costs over the longer term course of the intervention. If interventions like ours can be shown to improve transition quality, they may be worthwhile for delivery systems to implement if there is no significant additional cost. Alternatively, other interventions with more intensive case management services that address psychosocial needs or programs targeting the level of services based on needs might be able to address the diverse needs of younger patients with complex medical and behavioral health conditions and create cost savings (Frank and Epstein 2014; Polinski et al. 2016).

The initial increase in 30-day utilization for younger patients in our prior short-term study (Balaban et al. 2015) could reflect PNs identifying and addressing unmet health care needs. This increased utilization may level off over time as needs are met, as suggested by our follow-up study of 180-day hospital-based utilization (Balaban et al. 2017). This lagged effect may explain the lack of significant cost difference for younger PN patients in this study. Other studies of intensive care management of socially and medically high-risk patients have shown a lack of cost savings with improved access and increased utilization in the short term (Bell et al. 2015). However, over several years, there may be a cost savings from care management programs for patients with behavioral health issues (Unutzer et al. 2008). Longer term interventions and more in-depth studies of the drivers of utilization in this younger, high-risk population are needed to see if the downward utilization trend following an initial uptick eventually leads to lower utilization and total costs for younger patients receiving PN services.

Our findings are relevant to delivery systems that must decide whether to invest in CHW-based transitional care programs. Our study takes the perspective of a safety-net delivery system in an environment in which delivery systems, including CHA, are increasingly at risk for the total cost of care through ACOs and other capitated models. While safety-net hospitals may be less likely to utilize strategies for reducing readmission (Figueroa et al. 2017), our study demonstrates that investing in strategies like CHW postdischarge transition programs may be a financially viable and cost-effective option. Utilizing CHWs who share a language with patients maybe a particularly efficient means of delivering a postdischarge intervention in a population like ours where a substantial proportion of patients do not speak English; our findings may not generalize to other settings with different language capabilities. As delivery systems move away from fee-for-service models and begin to assume more risk and enter ACO arrangements, a PN intervention would be more attractive for reducing costs for high-risk older safety-net patients, while remaining cost-neutral for younger patients. The per-patient cost savings of our PN intervention for patients aged 60 and older would represent 16.7 percent of the per capita Medicare spending in Massachusetts (Kaiser Family Foundation 2017), although this percentage may be lower for a high-risk subgroup like ours.

For hospital administrators focused on reducing total medical expense in a risk-bearing environment, the investment in a PN program may be worthwhile. The modest increases in labor costs for physicians and nurses from phone contacts in the PN intervention could be reflected in negotiated capitation amounts. Furthermore, the reduction in 30-day readmission rates for older patients shown in our original analysis (Balaban et al. 2015) may reduce health system exposure to Medicare Hospital Readmission Reduction Program penalties. Thus, CHW-based programs may be an attractive strategy for delivery systems facing risk-bearing contracts, quality performance rating, and readmission penalties (Morgan et al. 2016). The challenge of reducing costs for high-risk younger patients observed in our study and others raises the question of whether risk-bearing payment arrangements alone are enough to incentivize care innovations that address unmet needs in these populations, and whether other strategies, such as interventions that provide nonmedical supports or funding for integrated behavioral health resources, would be more effective.

Limitations

Several limitations of our study should be noted. Because randomization occurred before the final discharge disposition was determined, our study sample excluded randomized patients who were not discharged to the community. The determination of discharge disposition was made relatively soon after randomization and before discharge, and it was not likely to be affected by the intervention itself. Only a few (3 percent) of these randomized patients had a subsequent qualifying discharge to the community during the study period and received PN postdischarge services after this subsequent discharge. Calculations of the PN cost per patient included PN effort for this small group of patients who had subsequent qualifying discharges to the community after not having one with the index hospitalization.

Our study was not able to measure actual health care costs for study patients. We instead used estimated standardized costs for patients' utilization based on the Medicare fee schedule, as done in other cost studies (Epstein et al. 2014). We were not able to measure utilization and costs for health care services received outside the CHA system, such as admissions for study patients to other hospitals. We were also unable to measure the costs of postdischarge care in other settings such as home health, nursing homes, skilled nursing facilities, so our study cannot fully assess the cost impact of the intervention in an ACO environment, in which these costs would be borne by the ACO. Not including such costs could affect our conclusions to the extent that the PN intervention affects the use of these services; for example, cost impacts may be misestimated if the availability of the PN intervention reduced the number of patients discharged to SNF or referred for home health services, or, conversely, if PNs facilitated patients' obtaining home health visits. Lastly, the generalizability of our findings should be interpreted in light of the evolving health care financing environment at CHA and in the larger health care market.

CONCLUSIONS

A postdischarge intervention using community health workers as Patient Navigators to provide transitional care for high-risk patients in a safety-net setting reduced 180-day costs for older patients, and it did not significantly increase costs overall or for younger patients. Leveraging PNs may be a useful strategy for safety-net systems working toward addressing the postdischarge needs of vulnerable patients while containing costs, especially within a risk-bearing payment model.

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Supporting Information

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix.

Table S1: Unadjusted Mean Utilization Rates.

Table S2: Unadjusted Mean Costs per Patient in the 180 days Postindex Discharge.