Reducing 30-day readmission rates in a high-risk population using a lay-health worker model in Appalachia Kentucky

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Abstract

This exploratory study aimed to address the effectiveness of a lay-health worker (LHW) model in addressing social needs and readmissions of high-risk patients admitted in a rural community hospital. A quasi-experimental study design assessed implementation of a LHW model for assisting high-risk patients with their post-discharge social needs. Outcome measures included 30-day hospital readmissions rates during a 4-month baseline period compared with a 6-month post-implementation period. The LHW intervention involved assessment and development of a personalized social needs plan for enrolled patients (e.g. transportation and community resource identification), with post-discharge follow-up calls. There was a 47.7% relative reduction of 30-day hospital readmissions rates between baseline and intervention phases of the study. Simple regression analyses demonstrated a 56% decrease in odds (90% confidence interval 0.20–0.98) in being readmitted within 30-days among those in the intervention phase compared with those in the baseline phase. Once adjusting for education, transportation cost and anxiety symptoms, there was a 77% decrease in odds among those exposed to the LHW program. LHWs offer an effective hospital-based model to improve transitions in care from the hospital setting, especially those at high-risk with persistent social needs.

Introduction

Patients and caregivers experience uncertainty and vulnerability when discharged after a prolonged hospitalization. These patients shift from being dependent and complacent while hospitalized to having significant home self-care responsibilities which can potentially affect patient's risk for readmission [1]. Roughly 20% of all Medicare fee-for-service patients are readmitted within 30-days of hospital discharge, costing the healthcare system an estimated $17 billion annually [2]. It is also estimated that a large majority of these readmissions are avoidable [2].

Studies have demonstrated that care transition interventions can result in cost avoidance of nearly $4000 per patient over a 6-month period [3], and decrease acute healthcare resource utilization (rehospitalizations and total hospital days) [4]. These interventions are based on multidisciplinary approaches that incorporate a personal coach model. This model has proven effective in reducing post-hospital discharge costs, while also improving patient quality of life measures [5–8]. This cost decrease has been shown to persist beyond the 90-day post-hospitalization mark [7]. Other programs have

successfully reduced hospital readmissions through hospital initiated, navigator-type interventions employing skilled professionals [6, 9, 10]. Readmission rates are highly impacted by a range of socioeconomic and personal factors, which may account for the success of these interventional models [11–13]. However, many rural hospitals are limited in their ability to up-front costs for a skilled workforce solely dedicated to care transition efforts. Hence, this study aimed to address such factors through a hospital-based model utilizing a lay-health worker (LHW) as part of the transition of care process.

LHWs are trusted members of the community who act as a link between formal health services and the community. Performing specific, delineated tasks, LHWs can be deployed much faster than more highly trained health professionals. Often, LHWs can improve patient experiences through culturally sensitive, community-based health services [14]. As examples, LHWs can provide psychosocial preventive interventions and facilitate behavior modification and shared decision-making [15]; they also serve as an effective resource for patients wishing to obtain health education or navigate the healthcare system and gain a more appropriate use of health resources [16–18]. Although limited, one study using a community-based LHW intervention found that 30-day hospital readmission rates were marginally reduced when assessing the general population but that the impact was far greater for those who had previous readmissions (high-risk patients) [19].

A health people 2020 objective of promoting good health through social and environmental factors, such as food and transportation access, living conditions and neighborhood characteristics [20] may be addressed through a LHW model. The World Health Organization and other national strategies share this focus with Centers for Medicare and Medicaid Services and are now assessing payments methods based on social needs [20–23]. Although encouraging results of LHW interventions on health outcomes in community settings has been shown [15, 16], a hospital-based LHW model, specifically one focused on the social needs of high-risk patients and targeted to reduce readmissions, has not been well-studied. The basis of this focus is

evidence that while medical advances and proper care impact ~20% of the health of a population, a greater proportion is impacted by the social determinants that the population experiences [24]. Individuals who reside in rural areas, such as Appalachia, may experience even greater need for psychosocial interventions than that of the general population. The aim of this study was to reduce 30-day hospital readmission rates in a community hospital in Appalachia Kentucky utilizing a LHW model to assess and assist with the unique needs of hospitalized high-risk patients.

Research design and methods

Population selection

The study was conducted in St. Claire Regional Medical Center (SCRM) in Morehead, KY, in Northeast Appalachia Kentucky. Hospitalized patients (males and females over 18 years old of any racial/ethnic group and admitting diagnosis) at high-risk of a 30-day readmission to the hospital were targeted for the study. This group was identified as 'high-risk' using the LACE index [25], which SCRM performs for all patients that are admitted after presenting to the emergency department (ED) or admissions office. Only patients admitted to the general medical/surgery floor were approached; patients from long-term care, skilled nursing facilities or hospice or who were unstable, in isolation rooms or who had a condition with a 'do not enter' designation on their door were excluded.

There were 506 eligible patients that were approached to participate in the study. Of these, 145 participants agreed to participate representing a 28.7% recruitment rate. Of the 145 consented participants, 107 (73.8%) completed all steps of the study: 46 patients in the baseline phase and 61 in the intervention phase, as will be discussed later. The other 38 consented patients (primarily males) failed to complete the study either because they refused to complete the 30-day evaluation (29) or were deceased (9). There were no significant differences, other than gender, between those who completed the study compared with those who did not.

Patient measures

Demographics, healthcare and health insurance information, socioeconomic factors, social history and past medical histories were collected. The LACE is a validated [26] instrument that calculates a re-admission risk score based on length of stay, number of acute admissions through the ED within the past 6 months, chronic co-morbidities and emergency department visits in the past 6 months. Scores range from 0 to 19 (score $\geq$7 categorized as high-risk) [25, 26]. Since only patients with LACE scores $\geq$7 (i.e. high-risk) were included in the study, this helps ensure that populations across study groups where similar in their chronicity of disease as the Charlson co-morbidity index is one of the measures used in calculating the LACE score. The Wellness Needs Assessment (WNA) is a composite instrument assessing various psychosocial constructs that identify the patients' needs and guided the LHW's efforts. This included anxiety and depression screening [22] and various social considerations (transportation factors, housing status, community safety and home safety—both environment and personal) and financial barriers to medical services (medications, visits, co-pays, etc.).

Procedures

One LHW, hired and trained by the Kentucky Homeplace program, received a daily census of new 'high-risk' admissions (from 8.00 a.m. of the preceding day). The LHW checked with each patient's floor nurse to determine if the patient was stable and available to be approached. Consented participants underwent study assessments (i.e. WNA) and the LHW obtained all post-discharge instructions, orders and follow-up appointments. The LHW then contacted the patient 4-weeks after hospital discharge to review their status, compliance to orders and appointments and any hospital admissions in the previous 30-days. The LHW also accessed SCRM administrative data to determine whether the patient had been readmitted within 30-days from their discharge date. These same procedures were conducted during both the baseline and intervention periods described next.

Baseline period (February 2015–May 2015)

The LHW obtained consent to conduct the baseline WNA assessment. However, the LHW did not link patients to community resources or intervene in care based on the WNA responses. Patients received standard medical/nursing care and discharge planning during their hospitalization. The LHW tracked patients when they were discharged from the hospital and called them 30-days later to assess for study outcomes. Other than collecting WNA assessments and 30-day outcomes, the LHW did not intervene in the care of the patients during this 4-month baseline period.

Intervention period (May 2015–October 2015)

Following the 4-month baseline period, the LHW initiated the intervention phase by commencing daily rounds on identified high-risk patients. Once consent and patient assessment were performed, the LHW now placed the completed WNA in the patient's medical chart and met with the care manager (CM) to review the patient's problems and needs.

A plan for all enrolled patients was developed and tasks were assigned based on the WNA-identified needs, and interactions among the CM, LHW and any other appropriate staff. The LHW primarily focused on the patient's out-of-hospital daily social needs, such as transportation and community resources (e.g. medication bridging or programs, housing and utilities and support services), and specifically worked to assist in linking patients to these resources. The LHW communicated regularly with the patient during the hospital stay on the progress and status of identified needs and problems. The LHW also coordinated with the patient's floor nurse and CM during all discharge planning meetings. These interactions, the patient's self-identified needs (from WNA), and all post-discharge instructions, orders and follow-up appointments served in developing a 'Client-centered care plan' or '3CP'.

The 3CP was provided to the patient upon discharge, including the LHW's contact information. The LHW conducted a follow-up call 24–48 h after discharge to review any issues during the interim

post-discharge period, assess patient follow-through in engaging with identified community resources and review plans for appropriate follow-up visits.

Outcome measures. The primary outcome was dichotomized as being readmitted to a hospital within 30-days. A positive 30-day readmission was defined as a patient that was discharged from SRMC and then readmitted (to any hospital) in the following 29-days [2].

Data analyses. All statistical analyses were performed using SPSS version 21.0 [27]. Descriptive statistics included counts and frequencies for categorical data, and means and standard deviations for continuous variables. Chi-square analyses were performed to test for differences across phases of the study for the primary outcome. Regression was also performed and unadjusted and adjusted odds ratios (ORs) and 90% confidence intervals (CIs) were calculated. Factors with a *P*-values of <0.2 in the unadjusted analyses were included in the adjusted model. Statistical significance was assessed at the alpha = 0.1 level due to a small sample size, yet, the study was conducted in a controlled environment (one hospital floor) with no other care transition efforts in place [28].

Results

Demographics of study participants are found in Table I. Almost all participants were Caucasian, reflecting the predominate population found in Appalachia Kentucky; also, most participants had only a high school education or less (70%) and over 55% had either Medicare or Medicaid as their primary insurance.

The results of the patient-reported psychosocial and health measures are provided in Table II. Most patients (93.5%) reported having a personal doctor and rated their health as fair or poor (88.8%) while 29% reported being an active or past smoker. In addition, 32.7–46.7% screened positive for anxiety and depression, respectively. Notable social factors reported by participants included transportation cost and/or access as a reason for missing appointments or not picking up medication (~16% of the individuals). Cost was a reason for not getting food in over

Table I. *Demographics*

	Total	(N = 107)
	n	*%*
Age (mean, SD)	58.77	13.6
Gender		
Male	45	42.1
Female	62	57.9
Race/ethnicity		
Caucasian	106	99.0
Other	1	1.0
Highest grade		
Some college or higher	32	29.9
Graduated high school or less	75	70.1
Marital status		
Married/in a relationship	54	50.5
Single/widowed/separated/divorced	53	49.5
Insurance type		
Medicaid	38	35.5
Medicare	22	20.6
Private/other	47	43.9

27% of the individuals. Close to 16% reported having their household utilities turned off occasionally or frequently, while 64.5% reported having a medical condition requiring electricity. When comparing baseline and intervention populations, they did not differ by LACE score, which utilizes the Charlson co-morbidity index in its calculation, body mass index (BMI), having a personal doctor, or by general health status self-report. The baseline population compared with the intervention population had, although small numbers, higher rates in anxiety, depression, costs as a reason for not getting tests done or paying for utilities or having a condition requiring electricity.

Thirty-day readmission rates decreased from 28.3 to 14.8% ($P = 0.09$) between the baseline and intervention phases, which represents a 47.7% relative reduction (28.3–14.8/28.3) (Table III). Regression analyses (Table IV) found that exposure to the LHW program (i.e. intervention phase) was associated with a 56% decrease in odds of being readmitted within 30-days. When adjusted for education, transportation cost and a positive anxiety screen, the odds of being readmitted within 30-days further decreased to 77% (OR 0.33; 90% CI 0.14–0.81) among those exposed the LHW program. In

Table II. *Health measures/factors*

	Total (N = 107)		Baseline (n = 46)		Intervention (n = 61)		
	N	%	n	%	n	%	P-value
LACE score (mean, SD)	9.1	1.90	9.3	2.0	8.9	1.8	0.32
BMI (mean, SD)	31.01	9.11	30.30	7.6	31.40	9.8	0.61
Has a personal doctor	100	93.5	44	95.7	56	91.8	0.43
Self-reported general health status							0.55
Excellent/very good/good	12	11.2	4	8.7	8	13.1	
Fair/poor	95	88.8	42	91.3	53	86.9	
Smoking status							0.77
Never	76	71.0	32	69.6	44	72.1	
Past/Current	31	29.0	14	30.4	17	27.9	
Positive screen for general anxiety disorder	50	46.7	27	58.7	23	37.7	0.03
Positive screen for depression	65	32.7	20	43.5	15	24.6	0.04
Transportation access has been a reason for missing medical appointments or not picking up medications	17	15.9	11	23.9	6	9.8	0.05
Transportation cost has been a reason for missing medical appointments or not picking up medications	18	16.8	11	23.9	7	11.5	0.09
Cost is a reason for not going to medical appointments, such as co-pays and deductibles	16	15.0	12	26.1	7	11.5	0.05
Cost is a reason for not getting tests done	13	12.1	9	19.6	4	6.6	0.04
Cost is a reason for not getting the medical treatment, services or supplies you need	18	16.8	11	23.9	7	11.5	0.09
Cost is a reason for not getting food	29	27.1	14	30.4	15	24.6	0.50
Cost is a reason for not paying utilities	13	12.1	12	26.1	1	1.6	<0.001
Utilities are frequently/occasionally turned off because of inability to pay	17	15.9	11	23.9	6	9.8	0.05
Has a medical condition which requires electricity	69	64.5	35	76.1	34	55.7	0.03

Table III. *Univariate analysis of the LHW program on 30-day readmission rate* (N = 107)

	Study phase			
	Baseline (n = 46) (%)	Intervention (n = 61) (%)	Relative reduction (%)	P-value
30-day readmissions	28.3	14.8	47.7	0.09

addition, those with transportation cost barriers were over three times more likely to be readmitted within 30-days, while those who screened positive for anxiety were significantly less likely to be readmitted (OR 0.23; 90% CI 0.08–0.64).

Discussion

This study adds to existing literature demonstrating that LHWs can improve health outcomes comparable to other hospital initiatives (e.g. using skilled nurses or social workers) [29–31]. Knowledgeable of community-linkages and available local social supports, LHWs help transition patients from the hospital to their home by assuring that patients sustain healthy behaviors and access needed services. Also, because they serve the community in which they live, they often share a similar socioeconomic status and are able to relate to the psychosocial and economic stressors met by their

Table IV. *Adjusted logistic regression analyses associated with 30-day readmission*

	OR	90% CI	*P*-value
Exposure to the LHW program/study phase	0.33	0.14–0.81	0.04
Highest grade[a]			
°Some college or higher	. . .	. . .	. . .
°Graduated high school or less	0.49	0.19–1.23	0.20
Positive screen for general anxiety disorder[a]	0.23	0.08–0.64	0.02
Transportation cost has been a reason for missing medical appointments or not picking up medications[a]	3.14	1.09–9.08	0.08

[a]Covariates with a *P* < 0.2 in the simple regression analyses were included.

clients. Effectiveness of LHWs within a transitional care role stands to benefit from these characteristics over other models that rely on episodic encounters with healthcare professionals who lack a long-standing community relationship and are less knowledgeable about community resources.

Our study showed a statistical impact of the LHW model in reducing 30-day hospital readmission rates, while a randomized clinical trial conducted by Kangovi *et al.* [19] in 2012 did not. This is likely due to the fact that our study included only individuals who were at high-risk for 30-day hospital readmission, and started at a higher overall baseline rate of readmissions (28.3 versus 15.0% in Kangovi *et al.*). Even still, these researchers did find that intervention patients were less likely to have multiple 30-day readmissions. A randomized quality improvement intervention by Burns *et al.* [32] that targeted high-risk patients found a decrease in 30-day hospital readmission, although their results were not significant. Limitations to that study may be secondary to employing a part-time health worker for only a 6-month period. When considering implementing LHWs in care transition programs, it is important to consider population health principles, such as the patient population to target (i.e. risk stratification) and the effort level at which a LHW should be employed. Health systems have the most to benefit by taking a risk-stratification approach as high-risk populations contribute to the highest proportion of adverse events and costs. Our study indicates that an in-hospital LHW model may serve as a cost-effective model in reducing 30-day hospital readmission rates in high-risk

hospitalized patients, especially for rural hospitals that have limited resources in implementing costly care transition programs with skilled health professionals.

There are many elements in our LHW model which may have contributed to the improved readmission rates observed in our study. Coordination of care among the LHW and the SCRM case managers was based on the patient's self-identified needs and may ensure a comprehensive view of the patient's social circumstances outside the hospital. Intervening upon the social needs of hospitalized patients makes it possible for healthcare staff to address underlying factors that may be contributing to readmissions. As our results demonstrate, social factors, such as transportation costs, were independently associated with 30-day readmission risk. Communicating with the hospitalized patient about their social needs and ways to address these needs not only gives patients the tools to improve their situation, it may also instill a sense of empowerment. Paradoxically, those who screened positive for anxiety were less likely to be readmitted in the adjusted model. We speculate that avoidance of hospital admission may be a behavioral factor that is attributable to underlying anxiety tendencies [33]. That is, those with anxiety disorders may avoid going back to the hospital due to the traumatic nature that is associated with being hospitalized.

The patient-centered nature of this intervention may translate well into other care transition programs and could be utilized in medical home

models. Results from this study are similar to other studied care transitions programs, such as better outcomes for older adults through safe transitions (BOOST) [34] and Coleman [1] models, which are more costly, as their patient navigator models use trained health professionals. Our LHW model may be an alternative for resource-limited rural and community hospitals, especially as health systems seek more affordable measures to improve the value of healthcare and as payment models shift from volume- to value-based programs with risk-sharing partnerships.

Limitations

This study was conducted in Appalachia Kentucky with known health disparities, and the results may not be applicable to other regions of the state or country. Also, the convenience sample we obtained may not generalize well to other patient populations and settings: all but one of our patients was white, and we excluded individuals from nursing homes or hospice. The quasi-experimental design of the study cannot exclude the possibility of temporal trends impacting the study outcomes. The study was performed among hospital clients on one floor of the hospital and did not address sicker populations, such as patients in intensive care rooms.

Future direction

Other studies on the effectiveness of using non-traditional healthcare teams as part of transitional care plans are warranted; especially models that complement the usual focus on clinical factors by addressing social factors in an individual's life. Functioning as 'coach' and 'partner', the LHW model shows special promise in such settings, helping to engage the nation's indigent patients in health behaviors that can result in positive health and healthcare outcomes.

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Conflict of interest statement

None declared.

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