

Original Investigation

Patient-Centered Community Health Worker Intervention to Improve Posthospital Outcomes

A Randomized Clinical Trial

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← Invited Commentary

IMPORTANCE Socioeconomic and behavioral factors can negatively influence posthospital outcomes among patients of low socioeconomic status (SES). Traditional hospital personnel often lack the time, skills, and community linkages required to address these factors.

OBJECTIVE To determine whether a tailored community health worker (CHW) intervention would improve posthospital outcomes among low-SES patients.

DESIGN, SETTING, AND PARTICIPANTS A 2-armed, single-blind, randomized clinical trial was conducted between April 10, 2011, and October 30, 2012, at 2 urban, academically affiliated hospitals. Of 683 eligible general medical inpatients (ie, low-income, uninsured, or Medicaid) that we screened, 237 individuals (34.7%) declined to participate. The remaining 446 patients (65.3%) were enrolled and randomly assigned to study arms. Nearly equal percentages of control and intervention group patients completed the follow-up interview (86.6% vs 86.9%).

INTERVENTIONS During hospital admission, CHWs worked with patients to create individualized action plans for achieving patients' stated goals for recovery. The CHWs provided support tailored to patient goals for a minimum of 2 weeks.

MAIN OUTCOMES AND MEASURES The prespecified primary outcome was completion of primary care follow-up within 14 days of discharge. Prespecified secondary outcomes were quality of discharge communication, self-rated health, satisfaction, patient activation, medication adherence, and 30-day readmission rates.

RESULTS Using intention-to-treat analysis, we found that intervention patients were more likely to obtain timely posthospital primary care (60.0% vs 47.9%; $P = .02$; adjusted odds ratio [OR], 1.52; 95% CI, 1.03-2.23), to report high-quality discharge communication (91.3% vs 78.7%; $P = .002$; adjusted OR, 2.94; 95% CI, 1.5-5.8), and to show greater improvements in mental health (6.7 vs 4.5; $P = .02$) and patient activation (3.4 vs 1.6; $P = .05$). There were no significant differences between groups in physical health, satisfaction with medical care, or medication adherence. Similar proportions of patients in both arms experienced at least one 30-day readmission; however, intervention patients were less likely to have multiple 30-day readmissions (2.3% vs 5.5%; $P = .08$; adjusted OR, 0.40; 95% CI, 0.14-1.06). Among the subgroup of 63 readmitted patients, recurrent readmission was reduced from 40.0% vs 15.2% ($P = .03$; adjusted OR, 0.27; 95% CI, 0.08-0.89).

CONCLUSIONS AND RELEVANCE Patient-centered CHW intervention improves access to primary care and quality of discharge while controlling recurrent readmissions in a high-risk population. Health systems may leverage the CHW workforce to improve posthospital outcomes by addressing behavioral and socioeconomic drivers of disease.

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The Affordable Care Act holds health systems accountable for patient outcomes, such as primary care access,¹ patient-reported quality of care,² and hospital readmission.³ Patients with low socioeconomic status (SES) are at highest risk by these measures, particularly in the posthospital period: they have lower access to posthospital primary care,^{4,5} poorer quality of hospital care,⁶ and elevated risks of all-cause readmission and death after hospital discharge.⁷⁻¹¹ To improve these outcomes, hospitals will need to address socioeconomic and behavioral risk factors that occur in low-SES patients' homes and communities. The American Hospital Association^{12(p1)} has urged hospitals to "evolve into health systems partnering with community organizations" and to consider acute illness as a signal that triggers patient-centered care extending beyond hospitalization. However, the current health care workforce may not be equipped to operationalize this shift. Traditional personnel often lack the time, skills, and community linkages required to address underlying socioeconomic drivers of disease. In addition, several studies have shown that low-SES patients may harbor mistrust of these personnel^{13,14} and prefer "empathic support"^{15,16} from someone with whom they can relate.

Community health workers (CHWs) are trained laypeople who share socioeconomic backgrounds with their patients, which facilitates the workers' ability to provide support consistent with patients' values and needs.¹⁷ There is evidence that CHWs can improve outcomes for patients with chronic conditions,¹⁸⁻²³ increase linkages to primary care after emergency visits for hypertension,²⁴ and reduce hospital use for children with asthma.²⁵ This evidence has prompted increased use of CHWs in new models of care, such as the Oregon Coordinated Care Organization.²⁶ However, integration of CHWs into the health care workforce has been hampered by 3 factors. First, CHW interventions—including hiring, supervision, and work practices—are often poorly standardized and difficult for health systems to reproduce. Second, most published CHW interventions are disease specific, limiting generalizability to a growing patient population with multiple chronic diseases. Third, according to the Agency for Healthcare Research and Quality,²⁷ many studies of CHW interventions within the United States are of low methodologic quality.

Our objective was to create a standardized, exportable CHW model—Individualized Management for Patient-Centered Targets (IMPACT)—and conduct a randomized clinical trial to test its effect on posthospital outcomes among low-income, uninsured, or Medicaid patients hospitalized with varied conditions. These patients are at high risk for poor outcomes^{7,11} but, unlike Medicare patients, are often ineligible for care transition services. We hypothesized that, compared with patients receiving usual care, those receiving the intervention would have higher rates of posthospital primary care access and better posthospital outcomes, including higher quality of discharge communication, self-rated health, satisfaction, patient activation, and medication adherence and lower 30-day readmission rates.

Methods

This study was a 2-armed, single-blind, randomized clinical trial. The study was approved by the institutional review board

of the University of Pennsylvania. Participants provided written informed consent and received a total of \$30 in prepaid gift cards as study honoraria.

Study Setting and Participants

The study was conducted at 2 academically affiliated Philadelphia hospitals. Eligible patients were (1) aged 18 to 64 years; (2) observation patients or inpatients on the general medicine service between April 10, 2011, and October 30, 2012; (3) uninsured or insured by Medicaid; (4) English speaking; (5) on the day of admission, expected to be discharged to home as opposed to a postacute care facility; and (6) residents of 5 Philadelphia zip codes in which more than 30% of the residents lived below the federal poverty level and which accounted for 35% of all readmissions to study hospitals. One of the original inclusion criteria, the recommendation to follow up with a primary care provider (PCP) after hospital discharge, was removed on May 23, 2011, because this determination would have occurred after randomization.

Patient Enrollment

Each day, trained research assistants (RAs) used the electronic medical record to create a list of newly admitted eligible patients, ordered the list using a random number generator, and then approached patients in their hospital rooms until they enrolled 3 patients per day. After confirming eligibility and obtaining written informed consent, RAs conducted a verbal survey to obtain sociodemographic and health information. The RAs then notified a member of the study team (S.K.) not involved with outcomes assessment who assigned each patient to 1 of 2 study arms using a previously obtained computer-generated randomization algorithm using permuted variable block sizes with a concealed sequence.²⁸ This study team member contacted CHWs when a participant was randomized to the intervention. A researcher external to the study team held a copy of the randomization algorithm for monitoring purposes. Patients were recruited between April 10, 2011, and October 30, 2012, at which time the trial was stopped because we had reached our prespecified sample size target. Follow-up surveys were completed on December 18, 2012.

Procedures

Control arm patients received routine hospital care, including daily multidisciplinary rounds to discuss patients' discharge needs. Nurses reconciled medication changes and handed patients written discharge instructions and prescriptions. Primary care physicians within the health system received an electronic discharge summary within 30 days of discharge.

The intervention arm also received IMPACT, a CHW model developed by the study team based on qualitative participatory action research with high-risk, low-SES patients.^{15,29} The IMPACT model consisted of 3 elements that are described in detailed protocols and available online³⁰: (1) recruitment and hiring guidelines, (2) training, and (3) standardized work practices. For recruitment and hiring, the IMPACT protocol specified minimum educational requirements (high school diploma) and guidelines for selecting CHWs with personality traits that low-SES patients identified as important (eg, active listening). For

training, the IMPaCT protocol included a college-accredited month-long training course designed to give CHWs the skills necessary to address barriers reported by patients. Other topics included motivational interviewing, professional boundaries, and core competencies of community health work.³¹

Finally, the IMPaCT protocol defined standardized work practices that CHWs use to provide tailored care in 3 stages: goal setting, goal support, and connection with primary care. On the day of hospital admission, CHWs used an in-depth semi-structured interview guide to help patients set goals for recovery. This interview began with the open-ended question: "What do you think you will need to do to stay healthy after discharge?" The CHWs then worked with patients to create an individualized action plan for achieving each of these patient-centered goals. Each plan comprises 4 elements: a measurable goal, patient confidence in achieving the goal,³² resources, and a step-by-step plan for goal achievement. This approach builds on the technique developed by the Community Health Access Project³³ but allows patients and CHWs to develop individualized action plans rather than selecting from prespecified standard templates.

During hospitalization, CHWs served as liaisons between patients and the inpatient care team, explaining patients' goals to the team and ensuring that patients could execute the team's discharge instructions. During and after hospitalization, CHWs provided tailored support based on patients' goals using telephone calls, text messages, and visits. For example, if a patient's stated goal was to quit smoking, the CHW might have accompanied the patient to a smoking cessation class. Finally, CHWs connected patients to primary care. If patients lacked a PCP or were dissatisfied with their current PCP, CHWs helped patients select suitable providers based on referrals from other patients and features, such as cost or proximity to public transportation. The CHWs coached patients to schedule and attend appointments and offered to accompany patients to the first posthospital appointment. During this appointment, CHWs provided PCPs with the medical discharge summary and an overview of patients' action plans. The intervention lasted until the posthospital primary care appointment and a minimum of 14 days.

For this study, 2 CHWs (M.L.W. and S.M.) were hired as full-time employees earning \$14 per hour. These CHWs were initially supervised by the principal investigator (S.K.) and subsequently supervised by a master's-level social worker with experience in case management and community organizing. The manager followed standardized supervision manuals to provide oversight through real-time consultation and biweekly individual meetings, telephone contact, and documentation review. During biweekly meetings, the manager reviewed the action plans for each patient in the CHWs' active caseload, providing suggestions to facilitate goal achievement. The manager also facilitated a weekly team meeting with all CHWs to discuss patient cases and provide ongoing training on topics that CHWs deemed important to their work.

Baseline Measures

Upon enrollment, RAs collected the following baseline data: age, race,³⁴ ethnicity,³⁴ employment,³⁴ household income and

size,³⁴ unmet or delayed need for medical care,³⁵ number of emergency department visits and hospital admissions in the prior 12 months,³⁵ and usual source of care.³⁵ In addition, the baseline questionnaire included the 12-Item Short Form Health Survey,³⁶ the Patient Activation Measure,³⁷ the Enhancing Recovery In Coronary Heart Disease Social Support Inventory,³⁸ the Single Item Literacy Screener,³⁹ single-item drug⁴⁰ and alcohol⁴¹ screening questions, and questions assessing homelessness and food insecurity.⁴² Additional clinical information collected from the electronic medical record included patient *International Classification of Diseases, Ninth Revision* codes and the Emergency Severity Index.^{43,44}

Outcome Measures

The prespecified primary outcome was patient-reported completion of a follow-up appointment with a PCP within 14 days of discharge. We chose this as our primary outcome based on prior qualitative work^{15,29} suggesting that low-SES patients viewed lack of access to posthospital primary care as a key barrier to recovery.

Prespecified secondary outcomes were defined and measured according to the licensing instructions of validated instruments. We were interested in measuring the effectiveness of the intervention in improving outcomes that were of interest to low-SES patients¹⁵ and reflected domains of enhanced patient experience, improved health, and controlled acute care use.⁴⁵ We measured high-quality discharge communication, defined as a positive answer to the Hospital Consumer Assessment of Healthcare Providers and Systems survey² question, "During this hospital stay, did doctors, nurses, or other hospital staff talk with you about whether you would have the help you needed when you left the hospital?" We measured the mean change in patient activation³⁷ between the baseline and follow-up surveys according to licensing instructions for the Patient Activation Measure.³⁷ We calculated mean satisfaction on a 5-point scale using the general satisfaction domain of the Patient Satisfaction Questionnaire Short Form.⁴⁶ We defined *perfect medication adherence* as a score of zero on the Morisky Medication Adherence scale.⁴⁷ We measured health outcomes using mean change in self-rated mental and physical health⁴⁸ between baseline and follow-up using the licensing instructions for the complete 12-Item Short Form Health Survey instrument. Finally, we summarized rates of all-cause 30-day readmission to any hospital in Pennsylvania in 2 prespecified ways: the proportion of patients readmitted within 30 days after the index discharge and the proportion of readmitted patients who experienced multiple 30-day readmissions. After determining that our data source could not consistently collect information on emergency department visits, this secondary outcome was removed on June 3, 2011.

Research assistants blinded to study arms and hypotheses used standardized interview guides to collect patient-reported outcomes 14 days after discharge. The RAs made 4 telephone calls and 1 home visit attempt before considering patients lost to follow-up. Readmission data were collected by linking patient identifiers with the Pennsylvania Health Care Cost Containment Council⁴⁹ statewide database for all hospital discharges across Pennsylvania.

Process Measures

For intervention patients, CHWs documented process measures, including initiation of intervention, CHW presence during discharge instructions and PCP appointment, and notes on progress toward achieving patients' goals. The RAs who were not blinded conducted brief exit interviews with intervention patients asking their "thoughts on the IMPaCT Project" and the intervention component they found most helpful.

Statistical Analysis

We based our sample size estimate on a 15% increase in completed follow-up with a PCP within 14 days following hospital discharge in the intervention arm compared with a previously reported^{4,50} follow-up estimate of 49% in the control arm. We estimated requiring 192 patients per arm to allow detection of this difference with 80% power and a type I error rate of 5%.

Descriptive comparisons between group baseline characteristics and outcomes used χ^2 tests for categorical variables and 2-tailed, unpaired *t* tests, as well as the Wilcoxon rank-sum test for continuous variables. Confidence intervals for absolute risk differences were calculated using the Agresti-Caffo method.⁵¹ Multivariable regression models, logistic for binary outcomes and linear for continuous outcomes, included study arm and all baseline covariates differing between arms, with the threshold set at $P < .10$ (number of usual care providers and insurance status). We also included baseline health and activation scores in the linear regression models for change in health and activation, respectively.

We performed an intention-to-treat analysis based on random assignment and used multiple imputation for missing data,⁵² simulating a multivariate normal distribution for all variables in the primary analysis model as well as those associated with missing outcome information. Each of 5 imputed data sets was analyzed and the results were combined for inference. To assess the robustness of our results, we performed 3 additional analyses: using multiple imputation with chained equations,⁵³ including only patients with complete data, and assuming loss to follow-up as failure. The results of these sensitivity analyses were similar to those of the original model, and we report only the results of the original model.

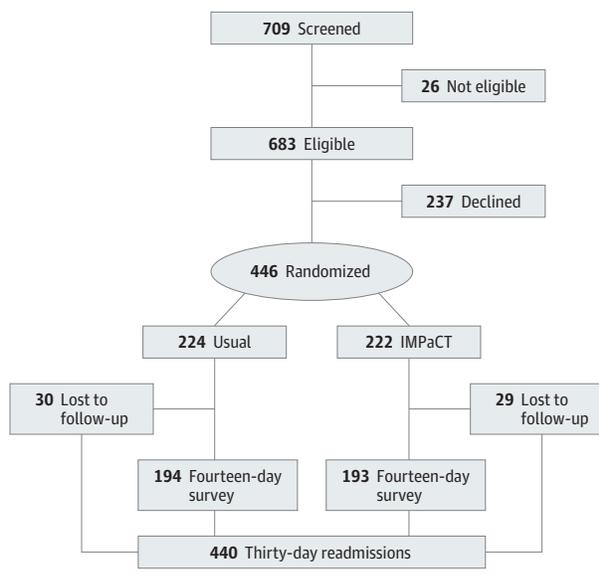
We analyzed open-ended feedback from intervention arm patients using a grounded theory approach.⁵⁴ First, transcribed data were imported into NVivo 10.0 (QSR International Pty Ltd), a qualitative analysis software program.⁵⁵ We then developed a coding structure that included major ideas that emerged from a close reading of the data. Two independent members of the study team (S.K. and J.S.) coded transcribed data and resolved discrepancies by consensus.

Results

Study Patients

Of the 709 patients we screened, 26 were found to be ineligible because they were non-English speaking, did not reside in study zip codes, or were expected to be discharged to a post-acute care facility. Of the remaining 683 eligible patients, 237

Figure. Participant Flow



This figure outlines the Consolidated Standards for Reporting of Trials Diagram for this randomized clinical trial. IMPaCT indicates Individualized Management for Patient-Centered Targets.

(34.7%) declined to participate and 446 (65.3%) were enrolled (Figure). Participants and nonparticipants were similar in age ($P = .49$) and sex ($P = .51$). The mean age of the cohort was 44.5 years, 40.6% were male, 93.5% were black, 81.0% had an annual household income below \$15 000, and 39.4% had unmet health needs. The 2 study arms were similar in all baseline characteristics with the exception of insurance status ($P = .09$) and percentage with a usual care provider ($P = .04$) (Table 1).

Nearly equal percentages of control and intervention patients completed the follow-up interview (86.6% vs 86.9%; $P = .92$). The 59 noncompleters were more likely than the 387 completers to be homeless (15.3% vs 2.3%; $P < .001$), to not be black (13.6% vs 5.4%; $P = .02$), to use illicit drugs (35.1% vs 19.6%; $P = .01$), and to have a longer index length of stay (mean [SD], 3.7 [5.7] vs 2.3 [2.6]; $P = .003$). Readmissions data were available for 98.7% of the enrolled patients.

Outcome Measures

A greater percentage of patients in the intervention arm completed posthospital primary care follow-up within 14 days of discharge compared with the control arm (60.0% vs 47.9%; $P = .02$). After adjustment for covariates imbalanced between groups, intervention patients had a 52% higher odds of completing posthospital primary care follow-up within 14 days (odds ratio [OR], 1.52; 95% CI, 1.03-2.23) (Table 2). Among unadjusted secondary outcomes, patients in the intervention arm were more likely to report high-quality verbal discharge communication (91.3% vs 78.7%; $P = .002$) and greater improvements in mental health (mean, 6.7 vs 4.5; $P = .02$) and activation (3.4 vs 1.6; $P = .05$). There was no significant difference between the arms in satisfaction with medical care (3.4 vs 3.4;

$P = .85$), improvement in physical health (5.5 vs 4.8; $P = .62$), or perfect medication adherence (63.7% vs 59.3%; $P = .37$). There were 45 total readmissions in the control arm com-

pared with 38 readmissions in the intervention arm. A similar proportion of patients in both arms experienced at least one 30-day readmission (15.0% vs 13.6%; $P = .68$). However, patients in the intervention arm were less likely to have multiple readmissions (2.3% vs 5.5%; $P = .08$). Among the subgroup of patients who were readmitted, the intervention decreased recurrent readmissions from 40.0% to 15.2% ($P = .03$).

Table 1. Baseline Sociodemographic and Health Characteristics for 446 Participants^a

Characteristic	No. (%)	
	Control (n = 224)	Intervention (n = 222)
Age, mean (SD), y	44.0 (12.1)	45.1 (12.5)
Female sex	126 (56.3)	139 (62.6)
Black	209 (93.3)	208 (93.7)
Unemployed	192 (85.7)	183 (82.8)
Household annual income <\$15 000	166 (81.0)	168 (81.6)
Low social support	32 (14.3)	26 (11.7)
Homeless	8 (3.6)	8 (3.6)
Excessive alcohol use	63 (29.4)	51 (23.3)
Drug use	46 (20.8)	50 (22.7)
Health literacy, mean (SD) ^b	1.9 (1.3)	1.9 (1.2)
Patient Activation Measure, mean (SD)	59.2 (14.8)	59.6 (15.6)
Self-rated health (SF-12), mean (SD)		
Mental health	42.1 (12.5)	42.5 (12.7)
Physical health	33.6 (11.0)	33.0 (10.4)
Uninsured ^c	77 (34.4)	60 (27.0)
Access to care		
Delayed health need	111 (49.8)	116 (52.7)
Unmet health need	88 (39.5)	86 (39.3)
Usual care setting		
Hospital clinic	64 (28.8)	65 (29.4)
Emergency department	53 (23.9)	55 (24.9)
Community clinic	61 (27.5)	62 (28.1)
Private physician	37 (16.7)	36 (16.3)
None	7 (3.2)	3 (1.4)
Usual care provider ^d		
1	135 (60.3)	154 (70.6)
>1	23 (10.4)	23 (10.6)
None	64 (28.8)	41 (18.8)
No. of admissions in 12 mo, mean (SD)	3.4 (7.3)	2.6 (2.9)
Index LOS, mean (SD), d	2.6 (3.1)	2.5 (3.3)
Most common index admitting diagnosis, ICD-9		
Chest pain (786.5)	39 (17.4)	34 (15.3)
Asthma with exacerbation (493.92)	11 (4.9)	12 (5.4)
Abdominal pain (789.09)	10 (4.5)	7 (3.2)
Heart failure (428)	5 (2.2)	8 (3.6)
Syncope and collapse (780.2)	8 (3.6)	5 (2.3)
Emergency Severity Index		
2	68 (31.3)	64 (29.1)
3	144 (66.4)	149 (67.7)
4	5 (2.3)	7 (3.2)

Abbreviations: ICD-9, International Classification of Diseases, Ninth Revision; LOS, length of stay; SF-12, 12-Item Short Form Health Survey.

^a Scales range from 0 to 100 unless otherwise indicated; denominators vary because there were less than 5% missing data within each measure.

^b Health literacy measured on a scale of 1 (high) to 5 (low).

^c $P = .09$.

^d $P = .04$.

Process Measures

The CHWs met with 99.0% of patients during hospitalization within 24 hours of admission. Action plans commonly related to psychosocial issues (47.3%), insurance (23.9%), and medication costs (23.5%) (Table 3). Patients had a mean of 2.6 action plans. The CHWs helped patients to achieve a mean of 50.0% of their action plan goals. The CHWs were present at the time of discharge for 40.0% of intervention patients and communicated by telephone with an additional 49.5% within 48 hours of discharge. The CHWs were present at the initial visit with a PCP for 36.1% of the patients in the intervention arm. We compared all process and outcome measures between CHWs and found no significant differences.

Most (79.7%) intervention patients provided positive open-ended feedback (Table 4). Patients appreciated that the intervention was tailored to their preferences. They described CHWs as advocates who were highly accessible, especially compared with other members of the health care team. Numerous patients said that CHWs were effective in “getting things done” that might have otherwise “slipped through the cracks.” Patients explained that CHWs worked “outside the box” in addressing psychosocioeconomic determinants of health. Patients thought that the most helpful component of the intervention was social support (54.2%) followed by establishing primary care (23.8%). Patients provided examples of instrumental (67.1%), emotional (19.3%), and informational (5.8%) social support provided by CHWs. Patients reflected on skills or traits that enabled CHWs to be effective: 18.5% described personal traits, 5.4% described organizational skills, and 3.2% described CHWs’ knowledge. Negative feedback was reported by 12.1% of the patients. Patients who already had support systems in place considered CHW support to be redundant. Others stated that their CHW was too busy with other patients to provide necessary support. Several patients thought that the intervention duration was too short.

Discussion

Our results demonstrate that a brief CHW intervention improved posthospital primary care access, discharge communication, patient activation, mental health, and recurrent readmissions for a population of high-risk hospitalized patients with varied conditions. This study has 3 main findings that may help health systems improve the value of health care.

First, many interventions improve one dimension of health care—patient experience, health outcomes, or cost—at the expense of others. For example, prior interventions that in-

Table 2. Outcomes in 446 Participants^a

Outcome	Unadjusted		Absolute Difference (95% CI)	NNT	P Value	Adjusted ^b Odds Ratio (95% CI) or β Coefficient (SE)
	No. (%)					
	Control Group	Intervention Group				
Posthospital primary care	92 (47.9)	115 (60.0)	12.0 (2.0 to 21.7)	8	.02	1.52 (1.03-2.23)
High-quality verbal discharge communication	118 (78.7)	137 (91.3)	12.7 (4.5 to 20.5)	8	.002	2.94 (1.50-5.80)
Perfect medication adherence	115 (59.3)	123 (63.7)	4.5 (-5.2 to 14.0)	NA	.37	1.24 (0.82-1.87)
Any readmission	30 (13.6)	33 (15.0)	1.4 (-5.2 to 7.9)	NA	.68	1.13 (0.66-1.95)
Multiple readmissions	12 (5.5)	5 (2.3)	-3.2 (-6.9 to 0)	31	.08	0.40 (0.14-1.06)
Multiple readmissions among readmitted patients ^c	12 (40.0)	5 (15.2)	-24.8 (-44.5 to -2.8)	4	.03	0.27 (0.08- 0.89)
Change in Patient Activation Score, mean (SD)	1.6 (17.2)	3.4 (17.5)	1.8 (0.8 to 4.0)	NA	.05	3.80 (1.50)
Change in Mental Health Score, mean (SD)	4.5 (12.2)	6.7 (14.0)	2.2 (0.4 to 4.8)	NA	.02	2.84 (1.20)
Change in Physical Health Score, mean (SD)	4.8 (10.4)	5.5 (10.4)	0.7 (-1.3 to 2.8)	NA	.62	0.64 (0.98)
Satisfaction with medical care, mean (SD)	3.4 (1.2)	3.4 (1.2)	0 (-0.2 to 0.3)	NA	.85	0.04 (0.12)

Abbreviations: NA, not available; NNT, number needed to treat.

^a Denominators of unadjusted outcomes do not include missing data. Adjusted outcomes include imputed missing data.

^b Outcomes adjusted for baseline number of usual care providers and insurance

status. Change in health and activation also adjusted for baseline health and activation scores.

^c Among those readmitted, n = 63.

Table 3. Process Measures for 222 Participants^a

Category	No. (%)	Example Action Plan		
		Barrier	Goal	Outcome
Psychosocial	105 (47.3)	62-y-old socially isolated woman with repeated admissions for panic attacks and chest pain	Find a fun social activity	CHW went with patient to local recreation center; patient felt "at home" and plans to return
Insurance	53 (23.9)	24-y-old uninsured man readmitted after missing follow-up for lupus erythematosus flare; he is eligible for medical assistance but lost his birth certificate in house fire	Get medical assistance	CHW helped patient to apply for birth certificate; patient received insurance card
Medication cost	52 (23.4)	46-y-old patient with hypertensive urgency who could not afford \$65 co-pay for discharge medications	Get low-cost prescriptions	CHW and patient explained problem to hospitalist, who revised prescriptions to generic formulations; there was no co-pay
Transportation	48 (21.6)	42-y-old man with heart failure who cannot afford transportation to his PCP; he waits until he is not well and calls an ambulance	Arrange transportation	CHW helped patient apply for van services through his insurance company; patient took the van to his PCP appointment
Housing	39 (17.6)	53-y-old with schizophrenia and diabetes mellitus who lives in a boarding home that will close 2 wk after discharge	Create a plan for alternative housing	CHW worked with patient, family, and insurance company to move into another community boarding home
Food	36 (16.2)	50-y-old former hospital housekeeper with diabetes mellitus who is unemployed and has insufficient food	Visit a public food pantry	CHW went with patient to nearby public food pantry; patient picked up food and was satisfied
Motivation	31 (14.0)	41-y-old woman with diabetes mellitus and hypertension who states she has a weakness for eating junk food and gained 3.6 kg last month	Develop a nutrition plan	Patient spoke with her cousin (a personal trainer), developed a nutrition plan, and showed this to her CHW
Other	22 (10.0)	55-y-old patient with diabetes mellitus who is legally blind and has difficulty taking medications	Get services for the blind	CHW arranged intake appointment with Associated Services for the Blind and Visually Impaired
Substance abuse	22 (9.9)	53-y-old man with duodenal ulcer who misses multiple outpatient appointments; patient confided to CHW that he is depressed and wants to stop smoking marijuana	Get drug and alcohol treatment	CHW went with patient to addiction services program; he attended regularly and began recovery
Debt	18 (8.1)	58-y-old man with COPD who smokes when he worries about how to pay his past-due rent	Create a budget spreadsheet so he can understand his finances	CHW worked with patient and his wife to create a monthly budget spreadsheet for their fixed income

Abbreviations: CHW, community health worker; COPD, chronic obstructive pulmonary disease; PCP, primary care physician.

^a Patients were permitted to have more than 1 action plan; therefore, percentages do not total 100.

creased primary care access for underserved patients led to significantly increased rates of readmission,⁵⁰ possibly by increasing surveillance⁵⁶ without addressing underlying driv-

ers of poor health. This intervention simultaneously improved patient experience and health outcomes while controlling costly hospital use.

Table 4. Open-Ended Feedback From 222 Intervention Patients

Theme	Quote	%
Positive feedback		79.7
Tailored care	She took the time and patience to listen so she could better understand how to help.	
Accessibility	She was always there and I knew I could call her any time. I'm glad she was there for me because nobody else was.	
Contrast to traditional personnel	No [physician] in the world spends adequate time with their patients, they spend 2-5 min and then move on to the next person. That's why we need people like the [CHW].	
Addressing social determinants	She helped me get childcare and helped me with programs for going back to school.	
Advocacy	A lot of people can't read the documents the doctors give them, so it's really helpful to have someone there to help.	
Effectiveness	She helped me get connected in ways I would have never done on my own.	
Negative feedback		12.1
Redundancy	I already got the right meds and everything and I had most things figured out by then, so there wasn't much she could do for me.	
Inaccessibility	My CHW couldn't attend my follow-up appointment with me [because] she was busy with another patient.	
Duration	It would be better if they were around for longer than 2 weeks. It's tough to have that assistance given and then taken away.	
Type of support		
Instrumental	She showed me how to budget my money and actually went with me to a quit-smoking class. I was nervous at first, but having her there the first time made it easier.	67.1
Emotional	She rode home with me and made me feel like someone cared about me. This was the first time anyone showed concern about me after I got out of the hospital. A lot of people are depressed, so the extra support is needed.	19.3
Informational	She gave me info about programs I didn't know about, like maintaining diet and transportation to doctor appointments.	5.8
Characteristics of CHWs		
Personal traits	She was so helpful and caring, she became like a friend.	18.5
Organizational skills	She really was a good helper getting things organized. She was very consistent and helpful with keeping me on top of my paperwork.	5.4
Knowledge	She was great at networking and got me hooked up to a lot of things. She could have sent me to a health facility near my home, but she knew that I didn't have insurance at the time and so she found a better place for me to go—a community health center. It saved me a lot of money.	3.2

Abbreviation: CHW, community health worker.

^a Patients were permitted to have more than 1 category; therefore, denominators vary.

Second, we observed a modest reduction in recurrent hospital readmission in the overall cohort but a substantial reduction among the subgroup of readmitted patients. These findings raise questions about population management: should health systems strive to improve a variety of outcomes in a broader population of vulnerable patients or target a narrow population at high risk for a particular outcome (ie, hospital readmission)? A targeted strategy has 2 prerequisites. First, health systems require accurate real-time readmission risk prediction models, which are currently lacking.⁵⁷ Second, health systems must forego benefit to patients who are not at high risk for readmission but may be at risk for other outcomes, such as lack of primary care access or poor health status. Further cost-effectiveness analysis will help inform the optimal targeting strategy for this intervention.

Third, the intervention offers health systems a scalable strategy for implementing the principle of patient-centered care. The CHWs used a standardized approach to create tailored action plans for achieving patients' individualized goals. The fact that the intervention was patient rather than disease centered will enable health systems to use the same CHW recruitment, training, and work practice protocols for a range of patients across diseases and settings. In this study, patients often described psychosocial issues as barriers to recovery and appreciated the element of social support the most among components of the intervention. The CHWs provided creative types of social support, such as going with patients to local recreation centers or helping families budget their limited fi-

nances. This type of support is often absent from health care and hospital care in particular, suggesting that CHWs offer value because they deliver a kind of service that conventional health professionals do not.

This study has limitations. First, the intervention was brief, perhaps explaining why the effect sizes for improvement in mental health and activation were slightly lower than the 3-point minimal important difference thresholds for these scales. Also, persistence of benefit from this intervention depends on longitudinal care provided by PCPs. However, we believed that bridging care gaps during the high-risk posthospital period was an important first step. Second, because CHWs worked with inpatient care teams, there may have been some spillover of benefit from the intervention to control patients. This effect would bias our results toward the null. Third, we did not have access to data on emergency department visits, which would have been useful because low-SES patients are at high risk for requiring emergency department care.⁵⁸ Fourth, this was a single-center study in a highly vulnerable population, which limits the generalizability of our findings. However, a strength of the study compared with many other CHW interventions is that we did not limit inclusion to patients with specific diseases. Finally, the primary outcome in this study was based on patient self-reported completion of the follow-up visit. Other studies^{59,60} have demonstrated high correlation between self-reports and documented health care use, particularly within a short recall period.

Conclusions

A patient-centered CHW intervention improved key outcomes among a population of low-SES adults with varied con-

ditions. Hospitals have been challenged to transform into comprehensive health systems capable of responding to acute illness with proactive, patient-centered, and community-based care. This study may help inform health systems as they redesign their workforces and care practices to achieve this goal.

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