

ED-Based Care Coordination Reduces Costs for Frequent ED Users

Michelle P. Lin, MD, MPH; Bonnie B. Blanchfield, ScD, CPA; Rose M. Kakoza, MD, MPH; Vineeta Vaidya, MS; Christin Price, MD; Joshua S. Goldner, MD; Michelle Higgins, PA-C; Elisabeth Lessenich, MD, MPH; Karl Laskowski, MD, MBA; and Jeremiah D. Schuur, MD, MHS

Frequent emergency department (ED) users often have complex medical, social, and behavioral health needs. They are more likely to have chronic illness, report lower socioeconomic status, and utilize all healthcare services at higher rates, despite often having health insurance and identifying a usual source of care.¹⁻⁶ As ED visits continue to increase and payment models shift toward alternative payments, with an emphasis on population health, it is critical for ED providers to become engaged in care coordination, particularly because the ED is the primary source of care for many frequent users.^{7,8}

Programs to reduce ED utilization among frequent ED users have employed intensive case management, care coordination and navigation, information sharing, disease management, and education.⁹⁻¹⁸ Community health worker (CHW) programs differ from traditional case management programs by employing community members, instead of licensed case managers or social workers, to assist with patient navigation. CHWs employed in ambulatory care settings have been shown to reduce ED visits and healthcare utilization among patients with chronic illness and recent hospitalizations; however, there are no peer-reviewed randomized controlled studies of the effects of CHW programs on ED visits among frequent ED users.¹⁹⁻²³ Prior study results showing an association between ED-based CHW programs and decreased ED use among frequent ED users have been observational in design, and a recent systemic review of ED visit reduction programs concluded that high-quality, peer-reviewed evaluations of such programs are lacking.^{24,25} Furthermore, a minority of existing studies on ED visit reduction programs have included information on program costs and cost savings.²⁵ We conducted a randomized controlled trial of a pilot ED-based care coordination and CHW program in order to reduce ED visits, hospitalizations, and associated costs among frequent ED users at Brigham and Women's Hospital, a large urban academic medical center.

ABSTRACT

OBJECTIVES: We evaluated a pilot quality improvement intervention implemented in an urban academic medical center emergency department (ED) to improve care coordination and reduce ED visits and hospitalizations among frequent ED users.

STUDY DESIGN: Randomized controlled trial.

METHODS: We identified the most frequent ED users in both the 30 days prior to the intervention and the 12 months prior to the intervention. We randomized the top 72 patients to receive either our pilot intervention or usual care. The intervention consisted of a community health worker who assisted patients with navigating care and identifying unmet social needs and an ED-based clinical team that developed interdisciplinary acute care plans for eligible patients. After 7 months, we analyzed ED visits, hospitalizations, and costs for the intervention and control groups.

RESULTS: We randomized 72 patients to the intervention (n = 36) and control (n = 36) groups. Patients randomized to the intervention group had 35% fewer ED visits ($P = .10$) and 31% fewer admissions from the ED ($P = .20$) compared with the control group. Average ED direct costs per patient were 15% lower and average inpatient direct costs per patient were 8% lower for intervention patients compared with control patients.

CONCLUSIONS: ED-based care coordination is a promising approach to reduce ED use and hospitalizations among frequent ED users. Our program also demonstrated a decrease in costs per patient. Future efforts to promote population health and control costs may benefit from incorporating similar programs into acute care delivery systems.

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METHODS

Study Design and Population

A multidisciplinary team of providers led by ED physicians and nurse care coordinators developed, implemented, and evaluated a pilot program to reduce ED visits and subsequent hospitalizations and improve quality of care for frequent ED users. In order to identify chronic frequent users, rather than those with an isolated health event requiring multiple visits, we identified patients with the most ED visits during both the 30-day period and the 12-month period preceding the introduction of the program. We randomly assigned the top 72 patients (36 per group) to the intervention and usual care (control) groups. We analyzed utilization and costs during the first 7 months of the pilot program, from October 1, 2014, through April 30, 2015.

The intervention consisted of 2 key elements: 1) interdisciplinary development of acute care plans to guide ED care and 2) the assignment of an ED-based CHW who assisted with care coordination and addressed social issues contributing to unmet health needs of frequent users. First, trained ED physicians and physician assistants performed a detailed chart review for all patients randomized to the intervention to identify medical and social issues driving frequent ED visits. Then, an acute care plan was developed to improve the quality, efficiency, and coordination of ED care. The plan was developed in conjunction with the patient's longitudinal providers (including primary care providers, medical specialists, and social workers at our institution) to reduce variation in acute care services. The plan was then uploaded to the electronic health record (EHR) and electronically "flagged" in a location visible to clinicians during ED encounters.

The CHW's goals were to better engage patients with their longitudinal providers and to help address unmet social and behavioral needs that contributed to ED utilization. At the start of the intervention, the CHW reviewed each patient's chart and called patients to conduct a standardized intake assessment to determine unmet needs. The CHW then communicated with patients by phone or in person, including during scheduled home visits, to address the identified needs. During working hours (Monday through Friday, 9 AM to 5 PM), the CHW was automatically paged when intervention patients were registered on arrival to the ED to connect patients with follow-up care and community-based resources. During ED visits, the CHW enrolled patients into the intervention if it was their first contact or continued to work with the patient to advance the acute care plan if they had previously been enrolled. The CHW assisted with specific tasks tailored to each patient's needs, such as coordinating transportation to clinic visits, providing information on local food banks, and establishing linkage to a primary care provider for patients without one. An interdisciplinary team

TAKEAWAY POINTS

- ▶ Results from a pilot randomized controlled intervention involving emergency department (ED)-based care coordination and community health workers demonstrated a trend toward reduced ED visits, hospitalizations, and costs among intervention patients.
- ▶ Compared with control patients, patients enrolled in the program had 35% fewer ED visits and 31% fewer ED admissions, which were associated with a 15% reduction in ED costs and an 8% reduction in inpatient costs during the 7-month pilot period.
- ▶ Future efforts to reduce acute care utilization and costs in high-cost patient populations may benefit from engaging ED providers in identifying high-risk patients and coordinating care.

consisting of the CHW, a physician, and a nurse care coordinator met weekly to discuss the needs of enrolled patients, assess progress of enrolled patients, and assign tasks for future encounters.

The evaluation of this quality improvement intervention was approved by our institutional review board. Randomization was deemed ethical, as we had limited resources and more patients than could be engaged in the intervention.

Data Analysis

The primary aim of our analysis was to assess the program's impact on ED visits and subsequent hospitalizations. A secondary aim was to assess the financial impact of the program on the direct costs of care per patient.

We retrospectively analyzed all ED visits, hospitalizations, and average direct costs per patient for the intervention and control groups. Statistical comparisons of demographic characteristics, ED utilization, hospitalizations (inpatient or observation), and average direct costs were based on 2-tailed *t* tests (for continuous variables) and χ^2 tests (for categorical variables). All patients were included in the analysis based on randomization status, regardless of actual enrollment or services received.

Utilization, demographic, and patient-level financial data were obtained from the healthcare system's enterprise data warehouse, which includes EHR and cost accounting data. Program costs were identified through the hospital accounting system and cost center reports.

RESULTS

Baseline characteristics for the 72 randomized patients in the intervention (*n* = 36) and control (*n* = 36) groups are presented in the [Table](#). Of note, the majority of patients in both groups had primary care providers at our hospital (61% intervention, 53% control) and identified a public payer (Medicare or Medicaid) as their primary insurance (91% intervention, 83% control). All analyses were intention-to-treat.

During the 7-month pilot period, intervention patients had 35% fewer ED visits (*P* = .10) and 31% fewer hospitalizations after ED visits (*P* = .20) compared with patients in the control group ([Figure](#)). Average ED direct costs per patient were 15% lower and average

TRENDS FROM THE FIELD

TABLE. Demographic Characteristics and Eligibility Criteria of Frequent ED Users

	Intervention n = 36		Control n = 36		P
	n	%	n	%	
Gender					
Male	18	50%	21	58%	.47
Age (years)					.49
>65	4	11%	5	14%	
Age, mean (SD)	46.8 (16.0)		49.3 (14.7)		
Race/ethnicity					.36
Black or African American	15	42%	9	25%	
White	15	42%	16	44%	
Hispanic or Latino	5	14%	10	28%	
Unknown	1	3%	1	3%	
Primary payer					.52
Medicare	17	47%	14	39%	
Medicaid	16	44%	16	44%	
Commercial	3	8%	6	17%	
BWH PCP					.47
Established BWH PCP	22	61%	19	53%	
	Total (n)	Mean per patient	Total (n)	Mean per patient	
Eligibility criteria					
ED visits, prior 30 days (9/1/14 to 9/30/14)	58	1.6	45	1.3	.58
ED visits, prior year (10/1/13 to 9/30/14)	656	18.2	548	15.2	.24

BWH indicates Brigham and Women's Hospital; ED, emergency department; PCP, primary care provider.

inpatient direct costs per patient were 8% lower for intervention patients (Figure). A greater reduction in costs was attributable to reduced ED visits (\$2247 per patient) than hospitalizations (\$802 per patient).

DISCUSSION

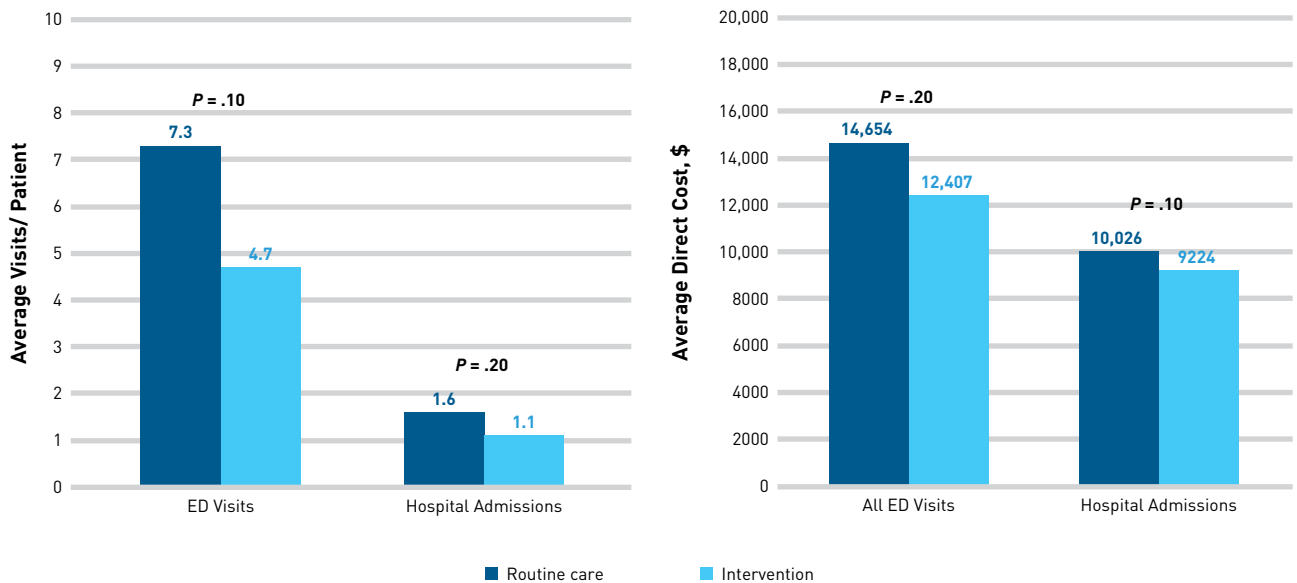
Our pilot program to improve care coordination and reduce costs associated with ED visits and hospitalizations among frequent ED users demonstrated promising results among enrolled patients in the intervention period. Although our findings are not statistically significant, our randomized controlled intervention trended toward decreased utilization and improved financial margins for the hospital.

Our program differs from prior ED-based case management programs by using a CHW, instead of a nurse case manager or other trained healthcare professional, and by utilizing a randomized controlled design.^{9-14,24-27} CHWs are public health workers, often trained laypersons, who are “trusted members of and/or have an unusually close understanding of the community served” and have the potential to provide higher quality, more culturally competent care.²⁸ Another feature of our program was the flexibility in the range and intensity of services we offered to patients. Some patients required infrequent contact to assist with scheduling and attending primary care appointments. Other patients benefited from more intensive contact, including multiple accompanied clinic visits or home visits.

The CHW was able to identify unmet social needs contributing to acute care utilization that may not be apparent to busy clinicians and are not readily addressed during a single ED or clinic visit. For example, one patient with chronic restrictive lung disease who was dependent on home oxygen experienced financial insecurity and anxiety related to his inability to make on-time utility payments. The CHW was able to enroll him in a financial assistance program to prevent utility shutoffs, provide a list of local food pantries, and accompany him to primary care appointments where he was connected with the pulmonology clinic social worker who assisted with ongoing needs.

As a result of decreased utilization, the average direct costs of the patients in the intervention group were lower than the costs of the patients in the control group. Our pilot program resulted in total annualized cost savings of \$117,997 to the hospital. Up-front implementation costs are often a barrier to adoption of quality improvement programs, particularly those that involve hiring and training new personnel. For example, our program had an annualized cost of \$55,115 to implement and demonstrated a positive return on investment (ROI) during the pilot period. Accounting for additional revenue from increased capacity as a result of fewer ED visits and hospitalizations would result in even higher ROI.

Our project demonstrates the feasibility of an ED-initiated care coordination and CHW program to promote population health and reduce healthcare costs. Care coordination and CHW programs have traditionally been based in primary care settings or patient-centered medical homes to address patients' chronic health needs. However, ED providers provide a unique perspective on the unmet social and behavioral needs contributing to acute care utilization, particularly among frequent ED users. This perspective can be leveraged to improve care coordination and quality while reducing healthcare expenditures. Prior to the initiative, primary care-based case management existed at our institution for patients with complex care needs and high overall healthcare expenditures enrolled in insurance plans with specific risk-sharing contracts; however, a majority of the patients targeted for our intervention had not previously been enrolled in the existing program due to their insurance status, suggesting an unmet need. As payment and care delivery

FIGURE. ED Visits, Hospitalizations, and Associated Direct Costs for Control (Routine Care) and Intervention Groups During Intervention Period

ED indicates emergency department.

models shift toward value-based payment models prioritizing population health, it is critical to engage acute care providers, in addition to longitudinal providers, in care coordination efforts. Our pilot program can serve as a model for other interdisciplinary collaborations to improve care coordination and reduce costs.

Limitations

Our findings are primarily limited by the sample size, which was due to inadequate resources and prevented us from detecting statistically significant effects. A cohort size of 98 (196 total participants) would have been needed to show statistically significant results ($P = .05$) with 80% power and a 36% reduction in ED visits. Our analysis did not include visits outside our institution; therefore, our patients' utilization at other hospitals during the intervention period was unknown. However, a majority of patients in both the control and intervention groups had a usual source of care at our hospital, suggesting that these patients would preferentially use our ED for acute care. It is also possible that the results at our urban academic tertiary care hospital may not be generalizable to all institutions. However, the characteristics of our study population (Table) closely mirror those of frequent ED users described in previous studies.^{10,11} We did not assess ED visit acuity or whether a hospitalization was ambulatory care-sensitive, as we were primarily interested in overall utilization and cost to the hospital.

The promising results of our pilot program were a function of the high productivity of our CHW, the low relative cost of a CHW

compared with traditional case managers or social workers, and the high rates of ED utilization by study patients, resulting in more frequent contact between the CHW and frequent ED users. ED visits and hospital utilization may have been impacted by seasonality, as the pilot took place during winter months; however, we still observed greater declines in utilization among the intervention group relative to controls after randomizing. Finally, we did not include data on health outcomes, and the pilot program period evaluated lasted 7 months; further research is needed to assess impact on long-term clinical outcomes, quality, utilization, and cost.

CONCLUSIONS

ED-based care coordination incorporating CHWs and acute care plans is a promising approach to reduce ED visits and hospitalizations and associated costs among frequent ED users. Future efforts to improve quality and efficiency of care for high-cost patients may benefit from collaboration with acute care providers. ■

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Author Affiliations: Icahn School of Medicine at Mount Sinai (MPL), New York, NY; Brigham and Women's Hospital (BBB, RMK, VV, CP, JSG, MH, EL, KL, JDS), Boston, MA; Harvard Medical School (BBB, RMK, VV, CP, JSG, MH, EL, KL, JDS), Boston, MA.

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Address Correspondence to: Michelle P. Lin, MD, MPH, SM, Icahn School of Medicine at Mount Sinai, 1 Gustave L. Levy Place, Box 1620, New York, NY 10029. E-mail: michelle.lin@mountsinai.org.

REFERENCES

- Hunt KA, Weber EJ, Showstack JA, Colby DC, Callahan ML. Characteristics of frequent users of emergency departments. *Ann Emerg Med.* 2006;48(1):1-8. doi: 10.1016/j.annemergmed.2005.12.030.
- LaCalle E, Rabin E. Frequent users of emergency departments: the myths, the data, and the policy implications. *Ann Emerg Med.* 2010;56(1):42-48. doi: 10.1016/j.annemergmed.2010.01.032.
- Sun BC, Bursstin HR, Brennan TA. Predictors and outcomes of frequent emergency department users. *Acad Emerg Med.* 2003;10(4):320-328. doi: 10.1111/j.1553-2712.2003.tb01344.x.
- Hansagi H, Olsson M, Sjöberg S, Tomson Y, Göransson S. Frequent use of the hospital emergency department is indicative of high use of other health care services. *Ann Emerg Med.* 2001;37(6):561-567. doi: 10.1067/mem.2001.111762.
- Colligan EM, Pines JM, Colantuoni E, Wolff JL. Factors associated with frequent emergency department use in the Medicare population. *Med Care Res Rev.* 2017;74(3):311-327. doi: 10.1177/1077558716641826.
- Colligan EM, Pines JM, Colantuoni E, Howell B, Wolff JL. Risk factors for persistent frequent emergency department use in Medicare beneficiaries. *Ann Emerg Med.* 2016;67(6):721-729. doi: 10.1016/j.annemergmed.2016.01.033.
- Moore BJ, Stocks C, Owens, PL. Statistical brief #227: trends in emergency department visits, 2006-2014. Healthcare Cost and Utilization Project website. hcup-us.ahrq.gov/reports/statbriefs/sb227-Emergency-Department-Visit-Trends.pdf. Published September 2017. Accessed October 25, 2017.
- Baker DW, Stevens CD, Brook RH. Regular source of ambulatory care and medical care utilization by patients presenting to a public hospital emergency department. *JAMA.* 1994;271(24):1909-1912. doi: 10.1001/jama.1994.03510480033030.
- Soril LJ, Leggett LE, Lorenzetti DL, Noseworthy TW, Clement FM. Reducing frequent visits to the emergency department: a systematic review of interventions. *PLoS One.* 2015;10(4):e0123660. doi: 10.1371/journal.pone.0123660.
- Kumar GS, Klein R. Effectiveness of case management strategies in reducing emergency department visits in frequent user patient populations: a systematic review. *J Emerg Med.* 2012;44(3):717-729. doi: 10.1016/j.jemermed.2012.08.035.
- Althaus F, Paroz S, Hugli O, et al. Effectiveness of interventions targeting frequent users of emergency departments: a systematic review. *Ann Emerg Med.* 2011;58(1):41-52.e42. doi: 10.1016/j.annemergmed.2011.03.007.
- Okin RL, Boccellari A, Azocar F, et al. The effects of clinical case management on hospital service use among ED frequent users. *Am J Emerg Med.* 2000;18(5):603-608. doi: 10.1053/ajem.2000.9292.
- Stergiopoulos V, Gozdzik A, Tan de Bibiana J, et al. Brief case management versus usual care for frequent users of emergency departments: the Coordinated Access to Care from Hospital Emergency Departments (CATCH-ED) randomized controlled trial. *BMC Health Serv Res.* 2016;16(1):432. doi: 10.1186/s12913-016-1666-1.
- Shumway M, Boccellari A, O'Brien K, Okin RL. Cost-effectiveness of clinical case management for ED frequent users: results of a randomized trial. *Am J Emerg Med.* 2008;26(2):155-164. doi: 10.1016/j.ajem.2007.04.021.
- Horwitz SM, Busch SH, Balestracci KM, Ellingson KD, Rawlings J. Intensive intervention improves primary care follow-up for uninsured emergency department patients. *Acad Emerg Med.* 2005;12(7):647-652. doi: 10.1197/j.aem.2005.02.015.
- Baren JM, Boudreaux ED, Brenner BE, et al. Randomized controlled trial of emergency department interventions to improve primary care follow-up for patients with acute asthma. *Chest.* 2006;129(2):257-265. doi: 10.1378/chest.129.2.257.
- Doran KM, Colucci AC, Hessler RA, et al. An intervention connecting low-acuity emergency department patients with primary care: effect on future primary care linkage. *Ann Emerg Med.* 2013;61(3):312-321.e7. doi: 10.1016/j.annemergmed.2012.10.021.
- Gary TL, Batts-Turner M, Yeh HC, et al. The effects of a nurse case manager and a community health worker team on diabetic control, emergency department visits, and hospitalizations among urban African Americans with type 2 diabetes mellitus: a randomized controlled trial. *Arch Intern Med.* 2009;169(19):1788-1794. doi: 10.1001/archinternmed.2009.338.
- Spencer MS, Rosland AM, Kieffer EC, et al. Effectiveness of a community health worker intervention among African American and Latino adults with type 2 diabetes: a randomized controlled trial. *Am J Public Health.* 2011;101(12):2253-2260. doi: 10.2105/AJPH.2010.300106.
- Gibbons MC, Tyus NC. Systematic review of U.S.-based randomized controlled trials using community health workers. *Prog Community Health Partnersh.* 2007;1(4):371-381. doi: 10.1353/cpr.2007.0035.
- Islam N, Nadkarni SK, Zahn D, Skillman M, Kwon SC, Trinh-Shevrin C. Integrating community health workers within Patient Protection and Affordable Care Act implementation. *J Public Health Manag Pract.* 2015;21(1):42-50. doi: 10.1097/PHH.0000000000000084.
- Kangovi S, Mitra N, Grande D, et al. Patient-centered community health worker intervention to improve posthospital outcomes: a randomized clinical trial. *JAMA Intern Med.* 2014;174(4):535-543. doi: 10.1001/jamainternmed.2013.14327.
- Burns ME, Galbraith AA, Ross-Degnan D, Balaban RB. Feasibility and evaluation of a pilot community health worker intervention to reduce hospital readmissions. *Int J Qual Health Care.* 2014;26(4):358-365. doi: 10.1093/intqhc/mzu046.
- Enard KR, Ganetin DM. Reducing preventable emergency department utilization and costs by using community health workers as patient navigators. *J Healthc Manag.* 2013;58(6):412-428.
- Raven MC, Kushel M, Ko MJ, Penko J, Bindman AB. The effectiveness of emergency department visit reduction programs: a systematic review. *Ann Emerg Med.* 2016;68(4):467-483.e15. doi: 10.1016/j.annemergmed.2016.04.015.
- Lee KH, Davenport L. Can case management interventions reduce the number of emergency department visits by frequent users? *Health Care Manag (Frederick).* 2006;25(2):155-159.
- Spillane LL, Lumb EW, Coughlin DJ, Wilcox SR, Clark JS, Schneider SM. Frequent users of the emergency department: can we intervene? *Acad Emerg Med.* 1997;4(6):574-580. doi: 10.1111/j.1553-2712.1997.tb03581.x.
- Community health workers. American Public Health Association website. apha.org/apha-communities/member-sections/community-health-workers. Accessed September 22, 2016.

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