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Coordinated-Transitional Care for Veterans with Heart Failure and Chronic Lung Disease

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Abstract

OBJECTIVES: Patients with congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) account for most 30-day hospital readmissions nationwide. The Coordinated-Transitional Care (C-TraC) program is a telephone-based, nurse-driven intervention shown to

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decrease readmissions in Veterans Affairs (VA) and non-VA hospitals. The goal of this project was to assess the feasibility and efficacy of adapting C-TraC to meet the needs of complex patients with CHF and COPD in a large urban tertiary care VA medical center.

DESIGN: We used the Replicating Effective Programs model to guide the implementation. The C-TraC nurse received intensive training in cardiology and pulmonology and worked closely with both inpatient and outpatient providers to coordinate care. Eligible patients were admitted with CHF or COPD and had at least one additional risk for readmission.

SETTING: The nurse met patients in the hospital, participated in their discharge planning, and then provided intensive case management for up to 4 weeks.

PARTICIPANTS: Over its initial 14 months, the program successfully enrolled 299 veterans with good fidelity to the protocol.

MEASUREMENTS: A total of 43 (15.8%) C-TraC participants were rehospitalized within 30 days compared with 172 (21.0%) of historical controls matched 3:1 on age, risk of 90-day hospital admission, and discharge diagnosis.

RESULTS: Participants were 54% less likely to be rehospitalized (odds ratio = .46; 95% CI = .24-.89).

CONCLUSION: The program was financially sustainable. The total cost of care in the 30-day postdischarge period was \$1842.52 less per C-TraC patient than per controls, leading the medical center to sustain and expand the program.

Keywords

transitional care; congestive heart failure; chronic obstructive pulmonary disease; readmission; cost

Nearly one in five Medicare beneficiaries are rehospitalized within 30 days of discharge, leading healthcare systems to focus on improving quality of care transitions.¹ The Department of Veterans Affairs (VA) faces unique challenges in providing transitional care at hospital discharge due to the extremely wide catchment areas of its acute care hospitals. This may help explain the fact that although the VA performs as well or better than non-VA hospitals on most quality measures, its readmission rates are modestly higher.² Veterans who use VA have more medical complexity than nonveteran populations, further contributing to risk.³ In 2011 alone, the VA spent \$1.2 billion on 30-day readmissions.⁴

The principles of effective care transitions were defined by Coleman et al, and the efficacy of clinical programs based on these principles was demonstrated by randomized controlled trials.⁵⁻⁷ Because they include home visits by an advanced practice nurse, these models can be challenging to implement in nonacademic, resource-poor environments. The Coordinated Transitions of Care (C-TraC) program is a nurse-driven, telephone-based intervention developed to meet the VA's need for low-cost transitional care.⁸ At the Madison, Wisconsin, VA, this simple intervention reduced readmissions and was associated with a cost savings of up to \$1225 per participant. C-TraC has achieved similar outcomes in non-VA settings⁹ and has been successfully adapted to a postsurgical population.¹⁰

VA Boston Medical Center has a 150-bed tertiary care hospital that provides subspecialty care to veterans from four New England states. Our population is enriched with veterans who have serious cardiopulmonary disease, a subset with the highest readmission rates. In prior work, we identified medication discrepancies and cognitive impairment as likely contributors to readmission.^{11,12} We therefore endeavored to adapt and implement C-TraC to serve a complex population with advanced heart and lung disease. We hypothesized that a registered nurse-case manager (RN-CM) with intensive training in the management of these conditions could have a substantial impact on posthospital outcomes.

METHODS

We developed the program in collaboration with VA's Office of Geriatrics and Extended Care (GEC) and the C-TraC Implementation Team at VA Madison (A.J.K. and L.J.). We used the Centers for Disease Control and Prevention's Replicating Effective Programs model to maintain fidelity to the original C-TraC protocol while customizing it to meet our local needs.¹³

Establishing Preconditions and Preimplementation

We created a program advisory group consisting of members of hospital leadership, subspecialty medicine, primary care, and case management. The group identified barriers to successful care transitions including a lack of a formal medication reconciliation during admission, inaccuracy of discharge summaries prepared by rotating house staff, lack of systematic postdischarge medication reconciliation, absence of a mechanism for contacting inpatient providers after discharge, inconsistent scheduling of follow-up visits, and prevalent patient factors contributing to ineffective selfmanagement.

In biweekly or monthly calls with the C-TraC Implementation Team, we adapted each core step of the original C-TraC protocol to our local context. Major adaptations are summarized in Table 1. Veterans were eligible if they were age 65 years or older, admitted to the medical service with a diagnosis of congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD), and had one or more of the following characteristics: living alone, discharge to a nonskilled facility, cognitive impairment, or one or more VA inpatient admission within the last year. We included younger veterans if they had cognitive impairment. We excluded patients who were enrolled in hospice, admitted with a primary diagnosis of substance abuse, not discharged directly home, or without telephone access.

We recruited a clinical nurse specialist with more than 10 years of experience and created an intensive 4-week training program. The RN-CM spent time embedded with inpatient case management, cardiology and palliative care, and outpatient primary care, geriatrics, and telehealth teams. She received specific training on the behavioral, nutritional, and pharmacologic management of COPD and CHF from subspecialists and clinic staff at VA Boston in both didactic and clinical settings. She traveled to Madison, Wisconsin, for a 1-week apprenticeship with the C-TraC Implementation Team, where her transitional care competencies were assessed by an experienced C-TraC nurse. For the first 2 years of the program, the RN-CM shared an office with nurse practitioners who provided COPD and CHF care and were available to her for advice and support.

Implementation

The C-TraC program launched on March 1, 2016. The RN-CM identified eligible participants by engaging in daily discharge rounds and electronic consults. We constructed a dashboard from VA's electronic medical record (EMR) that was updated daily and displayed all patients admitted with a diagnosis of CHF or COPD, their number of prior admissions, and most recent Care Assessment Needs (CAN) probability of hospital admission within 90 days. The CAN is a model developed for the VA to predict 90-day and 1-year risk of hospitalization and/or mortality.¹⁴

Patient Enrollment

The RN-CM met with eligible patients (and, when possible, their caregiver) to introduce the program. The visit usually occurred 1 to 2 days before discharge and did not replace or overlap with the normal discharge process. Participants received a simple card with key elements of the discharge plan, contact information for relevant providers, and three individualized red flags that should prompt a call to the RN-CM or healthcare provider, such as increased shortness of breath, weight gain, or leg swelling. The RN-CM could be reached directly by cell phone Monday to Friday from 8:30 to 5. After-hours care was provided by the nurse triage call center. The RN-CM scheduled an appointment for the first telephone follow-up with a target of 48 hours after discharge.

Postdischarge Phone Follow-Up

During the first postdischarge phone call, the RN-CM conducted medication reconciliation, assessed for red flags, ensured appropriate follow-up, and provided education. The patient lined up all pill bottles, and the nurse reconciled them to both the discharge summary and the EMR. Medication discrepancies were documented in a templated electronic progress note. The RN-CM attempted medication reconciliation even if it had been performed as part of routine postdischarge care. She made at least one phone call weekly for the next 3 weeks to check on the patient and perform a chart review; service was discontinued at completion of 30 days or sooner if both the veteran and RN-CM agreed it was no longer needed or the veteran refused further follow-up.

Data Collection and Analysis

We (R.L.R and J.A.D.) performed a detailed EMR review to confirm C-TraC eligibility and extract information on nurse interventions. We constructed a data set from VA's Corporate Data Warehouse that included baseline variables and postdischarge outcomes on C-TraC participants and comparison subjects. The primary outcome was an unplanned acute care admission to our hospital after 24 hours and within 30 days of discharge. Emergency department (ED) and urgent care (UC) visits within 30 days were identified by clinic codes. We calculated the mean total cost of care within VA in the 30-day postdischarge period using a cost calculator developed by VA's GEC Data Analysis Center. This did not include Medicare costs.

Identification of a Comparison Group

Most patients eligible for C-TraC were enrolled once the program began, leaving no comparable contemporaneous group. It was thus necessary to identify historical controls. Comparison subjects were admitted to the VA West Roxbury Medical Center from January 2012 to February 2016 and met C-TraC criteria. As a way of excluding seriously ill patients on hospice who are less likely to be readmitted, we excluded reference subjects with palliative care notes in the 3 months before discharge. Because an individual could have multiple C-TraC admissions over the 14-month period, the unit of analysis for the comparison was individual admissions rather than individual patients.

Matched Analysis

We matched three control admissions to each C-TraC admission on age (± 5 y), CAN probability of 90-day hospital admission just before admission ($\pm .05$) and discharge diagnosis (CHF, COPD, other cardiovascular disease, infection, other respiratory, and all other diagnoses). Patients enrolled in C-TraC more than once were matched to a different control each time. An individual control could be matched to an individual C-TraC participant only once, but individuals could serve as controls to more than one C-TraC participant. We used logistic regression to calculate the odds ratio (OR) and 95% confidence intervals (95% CIs) for readmission and visit to the ED or UC. We adjusted analyses for sex, race, service connection category (a complex variable including socioeconomic factors and disability), number of admissions in the prior year, year of admission, intensive care unit stay, and length of stay of the index admission. All analyses were performed using SAS software v.9.2, and all *P* values were two tailed; a value $< .05$ was considered statistically significant. The C-TraC program and its evaluation were determined to be quality improvement and not research by the VABHS Research and Development Committee.

RESULTS

Between March 1, 2016, and May 1, 2017, the nurse approached 300 patients and enrolled 299 veterans (one refusal); 26 patients (9%) did not meet the eligibility criteria, leaving 273 for analysis. The average age of the cohort was 75.3 years. Almost all participants were male (97.4%); 89.7% were white. Baseline characteristics of the C-TraC veterans and matched reference subjects were closely comparable, as seen in Table 2.

C-TraC process measures are displayed in Figure 1. The RN-CM completed the inpatient visit with 227 (83.2%) of the patients before discharge. The initial inpatient visit lasted an average of 23.6 minutes. In most cases (82.4%), the RN-CM engaged a caregiver. The average length of the first call was 45 minutes; most of the time was spent on medication reconciliation. The average number of additional follow-up calls per participant was two. Only 2.6% of veterans refused further contact after enrollment, but 8.1% could not be reached by phone after discharge. In 63% of cases, program goals were met before the 4 weeks had elapsed; only 74 veterans were followed for the full 30 days.

C-TraC Interventions

The most frequent C-TraC intervention in the postdischarge period was coordination of care, as shown in Table 3. This was most commonly to report medication discrepancies, alert providers to a change in patient status, or arrange a follow-up appointment. In more than half of the cases, the C-TraC RN-CM was the catalyst for referrals or equipment not planned for by the discharge team.

Between March 1, 2016, and May 1, 2017, the RN-CM performed a complete medication reconciliation in 181 veterans (66%) and identified and rectified 150 discrepancies in 66 (34.5%). Patients with discrepancies had an average of 16 medications at admission and discharge, prescribed by an average of 12 unique providers. The most common medication classes in which discrepancies occurred were cardiovascular drugs, pain medication, and inhalers.

A geriatric pharmacist (C.H.) reviewed the records of the 181 C-TraC patients who had complete medication reconciliation to assess the quality of the RN-CM's reconciliation, noting the number and type of discrepancy according to published methods¹⁵ and identifying potentially inappropriate or high-risk medications.¹⁶⁻¹⁸ The 150 discrepancies noted by the RN-CM were confirmed, and the pharmacist identified an additional 31. On root cause analysis, 82% were attributed to the discharge process (improper medication reconciliation, changes not discussed with patients, confusion about changes, and planned medications not received), 14% to patient factors (taking medications differently than described or refusing to take them), and 4% to other factors. One-third of medication discrepancies identified had substantial potential for an adverse event, and 38% of medications (n = 69) were potentially inappropriate.

C-TraC Outcomes

We matched each C-TraC admission to three comparison admissions to create a cohort of 819 historical reference admissions. There were 246 individuals represented across the 272 C-TraC admissions and 691 individuals across the 819 control admissions. As shown in Table 2, after matching, groups were balanced on age and discharge diagnosis, but C-TraC patients had higher CAN scores (.33 vs .27; $P < .001$). Other predictors of readmission were also higher in the C-TraC group.

The frequency of 30-day readmissions in C-TraC patients was lower than in the comparison group (15.8% vs 21.0%). The hazard ratio for the crude model was .70 (95% CI = .49-1.02). In the fully adjusted model, veterans in C-TraC were 54% less likely to be rehospitalized (OR = .46; 95% CI = .24-.89; Table 4). The hazard of 30-day ED or UC visits among C-TraC patients was lower, .66, but not statistically significant (95% CI = .35-1.24).

Mean cost of C-TraC patients in the 30-day postdischarge period was \$11 073.32, compared with \$12 915.84 for reference patients. C-TraC costs were on average \$1842.52 less per person, resulting in cost savings of \$503 008. The total cost of the program over the 14-month period was \$171 267, yielding net savings of \$331 741.

DISCUSSION

We were able to adapt the C-TraC protocol successfully to meet the transitional care needs of veterans with advanced CHF and COPD at our institution. C-TraC participants were 54% less likely to be rehospitalized than comparison subjects, despite their higher readmission risk. The magnitude of this decrease in readmissions was higher than in VA Madison, where admissions were decreased by one-third, and a non-VA population at the University of Wisconsin Hospitals and Clinics (35% decrease). C-TraC participants were 34% less likely to have a 30-day outpatient acute care visit, a result that did not reach statistical significance likely due to a lack of power. Our work suggests that C-TraC outcomes might be enhanced by having nurses focus on patients with specific diagnoses and empowering them to manage this population through a program of subspecialty training and integration with specialty providers.

C-TraC forms part of a spectrum of successful nurse-driven transitional care models for complex older adults. Where possible, incorporation of a home visit component has clear advantages, especially for the most complex.^{5,6,19} Some programs follow patients for longer than 30 days postdischarge that helps improve chronic disease management.^{6,19,20} C-TraC is a complement to these programs, making high-quality transitional care available to patients out of the range of home visits or who are in resource-poor healthcare systems. Of note, only 27% of patients in our program required the full follow-up, suggesting the major benefit of the intervention was in the first few weeks.

For patients and caregivers, the ability to contact the RN-CM directly was a major advantage of the program. The RN-CM was able to reach members of the inpatient team quickly when questions arose after discharge. She became adept at recognizing cognitive and functional impairment and poorly controlled symptoms. Her impact often began at discharge rounds, where she might advocate for additional home services or identify gaps in care.

Reconciliation by the RN-CM revealed discrepancies in 34% of patients; of these, at least 50 were serious and could have contributed to a readmission. The frequency of discrepancies in our cohort was lower than that seen at VA Madison (47%) and higher than at University of Wisconsin Hospital and Clinics (UWHC) (25%). Our RN-CM detected 89% of all discrepancies present, suggesting good quality reconciliation. Detailed reconciliation was time consuming and not possible in one-third of cases. Patients who had reconciliation completed by a visiting nurse often refused subsequent phone-based reconciliation; in other cases, patients were unable to cooperate. The RN-CM sometimes deferred reconciliation due to competing patient needs. These difficulties underline the importance of high-quality pre-discharge reconciliation. Our hospital leadership was concerned by the discrepancy rate found by our program. We are now instituting an inpatient medication reconciliation team of pharmacy technicians who will be trained and supervised by a pharmacist.

Our population is composed of veterans and almost entirely male, possibly limiting generalizability. The absence of formal medication reconciliation at our facility may have enhanced the effect of the C-TraC intervention relative to facilities such as VA Madison that use such resources. Due to the nonrandomized nature of our evaluation, there were likely

some systematic differences between groups. Multiple indicators of readmission were imbalanced, even after matching; however, these differences should have biased our results toward the null. We used historical controls, and care for COPD and CHF may have improved over time. However, our results remained significant after accounting for a year of admission. We chose a 3:1 matching scheme a priori due to the small size of our pilot; as a result, 16% of controls contributed more than one admission vs only 3% of C-TraC participants. Only a randomized controlled trial can determine the efficacy of a clinical program such as C-TraC with certainty. A trial funded by the National Institutes of Health to answer this question is ongoing.

In conclusion, this clinical demonstration project shows that adaptation of C-TraC to the needs of high-risk patients with CHF and COPD in a large tertiary care center is feasible, effective, and financially sustainable. Based on the results of this pilot, our institution has sustained and expanded the program that has now served more than 800 veterans. Our work adds to the evidence that veterans may benefit from dissemination of this program across VA's acute care hospitals.

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Figure 1.

Enrollment and program engagement process measures. C-TraC, Coordinated-Transitional Care.

Table 1.**Adaptations of C-TraC Protocol**

<ul style="list-style-type: none">• Limited program to high-risk patients with CHF or COPD• Provided RN-CM with 4-week intensive training in management of CHF/COPD as well as transitional care• Co-located RN-CM with clinicians who manage CHF/COPD• Used an automated dashboard based on the electronic medical record to identify potential patients and decrease time spent screening
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Abbreviations: CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; C-TraC, Coordinated-Transitional Care; RN-CM, registered nurse-case manager.

Table 2.**Baseline Characteristics of C-TraC Hospitalizations and Matched Reference Hospitalizations**

Characteristic	C-TraC hospitalizations (n = 273)	Reference hospitalizations (n = 819)	P value ^a
Age, y, mean (SD)	75.3 (9.25)	74.2 (9.55)	.10
CAN score, mean (SD)	.33 (.20)	.27 (.19)	<.001
Discharge diagnosis category, n (%)			1.0
Congestive heart failure	82 (30.0)	246 (30.0)	
Other cardiovascular	82 (30.0)	246 (30.0)	
Infection	35 (12.8)	105 (12.8)	
COPD	15 (5.5)	45 (5.5)	
Other respiratory	5 (1.8)	15 (1.8)	
All other diagnoses	54 (19.9)	162 (19.9)	
Sex, n (%)			.81
Male	266 (97.4)	800 (97.7)	
Race, n (%)			.59
White	245 (89.7)	744 (90.8)	
Service connection, n (%)			.63
Non-service connected	109 (39.9)	346 (42.3)	
<50% service connected	47 (17.2)	123 (17.2)	
50%-100% service connected	117 (42.8)	350 (42.7)	
Cognitive impairment, n (%)	58 (21.3)	134 (16.4)	.07
Admitting service, n (%)			.000
Medicine	235 (86.1)	623 (76.1)	
Other	38 (13.9)	196 (23.9)	
Admissions in the prior year, n (%)			.035
0	95 (34.8)	340 (41.5)	
1	56 (20.5)	168 (20.5)	
2	34 (12.5)	117 (14.3)	
3	88 (32.2)	194 (23.7)	
ICU stay during admission, n (%)	12 (4.4)	13 (1.6)	.007
Length of stay, d, n (%)			.000
1-2	87 (32.1)	362 (45.1)	
3-7	112 (41.3)	303 (37.7)	
8	72 (26.6)	138 (17.2)	
Diagnosis category			<.000
CHF	90 (33.0)	333 (40.7)	
COPD	41 (15.0)	205 (25.0)	
Both diagnoses	142 (52.0)	281 (34.3)	

Abbreviations: CAN, Care Assessment Needs; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; C-TraC, Coordinated-Transitional Care; ICU, intensive care unit; SD, standard deviation.

^aP values were calculated by χ^2 tests for categorical variables and *t* tests for continuous variables.

Table 3.

Interventions by the C-TraC Nurse-Case Manager

Service provided	C-TraC participants (n = 273)	%
Coordination with primary care	212	77.7
Detailed medication reconciliation	182	66.7
Coordination with specialty care	123	45.1
Put new resources in place	95	34.8
Education about medications	81	29.7
Care referrals (OT, PT, geriatrics, palliative care, etc)	53	19.4
Telehealth referral	49	17.9
Equipment (pill box, scale, etc)	43	16.9

Abbreviations: C-TraC, Coordinated-Transitional Care; OT, occupational therapy; PT, physical therapy.

Table 4.

Odds of 30-Day Readmission and Use of Outpatient Acute-Care Services Following C-TraC and Reference Hospitalizations

Outcome	C-TraC hospitalizations (n = 273)	Reference hospitalizations (n = 819)	Crude model	Adjusted model ^a
			Odds ratio (95%CI)	Odds ratio (95%CI)
30-d readmission	43 (15.8)	172 (21.0)	.70 (.49-1.02)	.46 (.24-.89)
30-d ED or UC visits	60 (22.0)	188 (23.0)	.95 (.68-1.31)	.66 (.35-1.24)

Abbreviations: CAN, Care Assessment Needs; CHD, congestive heart failure; CI, confidence interval; COPD, chronic obstructive pulmonary disease; C-TraC, Coordinated-Transitional Care; ED, emergency department; ICU, intensive care unit; UC, urgent care.

^a Adjusted for CAN score, number of admissions in the year before admission, admitting service, length of stay of the index admission, ICU stay, calendar year of admission, and whether the patient had a diagnosis of COPD, CHF, or both.