

## HEALTH CARE REFORM

## The Care Transitions Intervention

*Translating From Efficacy to Effectiveness*

Rachel Voss, MPH; Rebekah Gardner, MD; Rosa Baier, MPH; Kristen Butterfield, MPH; Susan Lehrman, MPH, PhD; Stefan Gravenstein, MD, MPH

**Background:** Well-executed communication among hospital providers, patients, and receiving providers at the time of hospital discharge contributes to better health outcomes and lower overall health care costs. The Care Transitions Intervention has reduced 30-day hospital readmissions by 30% in a randomized controlled trial in an integrated health system but requires real-world testing to establish effectiveness in other settings. We hypothesized that coaching would reduce 30-day readmission rates for fee-for-service Medicare beneficiaries, even in open, urban health care delivery systems.

**Methods:** This was a quasi-experimental prospective cohort study. From January 1, 2009, through June 30, 2010, coaches recruited a convenience sample of fee-for-service Medicare patients in 6 Rhode Island hospitals to receive the Care Transitions Intervention. We paired coaching data with Medicare claims and enrollment data and used logistic regression to compare the odds of 30-day readmission for the intervention group vs internal and external control groups.

**Results:** Compared with individuals who did not receive any part of the intervention (20.0% readmission rate), 30-day readmissions were fewer for participants who received coaching (12.8%; odds ratio, 0.61; 95% confidence interval, 0.42-0.88). Individuals in the internal control group (declined to participate or were lost to follow-up before completing a home visit) had readmission rates similar to those of the external control group (18.6%; odds ratio, 0.94, 95% confidence interval, 0.77-1.14).

**Conclusions:** The Care Transitions Intervention appears to be effective in this real-world implementation. This finding underscores the opportunity to improve health outcomes beginning at the time of discharge in open health care settings.

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**W**HEN HOSPITAL DISCHARGES are well executed, hospital staff members provide timely and accurate health information to downstream providers at patient discharge<sup>1-3</sup> and activate<sup>4</sup> patients and their caregivers to manage their care.<sup>3,5,6</sup> Focusing on good cross-setting communication at the time of hospital discharge

*See also pages 1230  
and 1238*

**Author Affiliations:** Quality Partners of Rhode Island (Mss Voss, Baier, and Butterfield and Drs Gardner and Gravenstein), Departments of Medicine (Drs Gardner and Gravenstein and Ms Baier) and Community Health (Dr Gravenstein), Alpert Medical School of Brown University, and School of Business, Providence College (Dr Lehrman), Providence, Rhode Island.

can improve health outcomes, decrease health care costs, and support patients in understanding how, when, and where to seek help, should they need it.<sup>5,7,8</sup> In the United States, 30-day all-cause readmission rates for patients 65 years or older generally range from 20% to 25%, depending on clinical condition and geographic region,<sup>9</sup> indicating much room for improvement.

Interventions addressing patient- and systems-level factors show promise for reducing hospital readmissions. For ex-

ample, Coleman and colleagues' Care Transitions Intervention (CTI)<sup>8</sup> demonstrated a 30% hospital readmission reduction in a health care environment already performing substantially better than the national average. The CTI focuses on empowering high-risk patients to better manage their illnesses through a home visit and telephone calls by trained transitions coaches.<sup>8,10</sup> Although the CTI has been shown in randomized controlled trials to reduce hospital readmissions,<sup>8</sup> patients who agree to participate in randomized controlled trials are a select subset of that population, limiting the generalizability of these observations. The Centers for Medicare & Medicaid Services funded a pilot project in 14 states<sup>11</sup> to demonstrate the CTI's effectiveness in a real-world setting, without a signed consent requirement for participants to receive the intervention, and targeting a broader population in a variety of health care systems. Such an implementation can help to establish the CTI's effectiveness and understand how to fit the CTI into the cultures, characteristics, and policies of an open

**Table 1. ICD-9 Codes Used to Identify Pertinent Conditions**

Condition	ICD-9 Codes
Acute myocardial infarction	410.00, 410.01, 410.10, 410.11, 410.20, 410.21, 410.30, 410.31, 410.40, 410.41, 410.50, 410.51, 410.60, 410.61, 410.70, 410.71, 410.80, 410.81, 410.90, 410.91
Congestive heart failure	402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9
Pulmonary conditions	480.0, 480.1, 480.2, 480.3, 480.8, 480.9, 481, 482.0, 482.1, 482.2, 482.30, 482.31, 482.32, 482.39, 482.40, 482.41, 482.49, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483.0, 483.1, 483.8, 485, 486, 487.0, 491.0, 491.1, 491.20, 491.21, 491.22, 491.8, 491.9, 492.0, 492.8, 494.0, 494.1, 496

Abbreviation: ICD-9, *International Classification of Diseases, Ninth Revision*.

system in which health care is not integrated across settings. Compared with the integrated system in which Coleman et al<sup>8</sup> tested the CTI, open, nonintegrated health care systems are likely to have a wider array of communication mechanisms (and related barriers to accessing patient care information) and to pose a greater risk of avoidable readmission. Rhode Island's Medicare Quality Improvement Organization (Quality Partners of Rhode Island) contracted with the Centers for Medicare & Medicaid Services to address readmissions and chose the CTI model as one component of our approach.

We hypothesized that coaching would reduce 30-day readmission rates for Medicare fee-for-service (FFS) beneficiaries, even in open, urban health care delivery systems.

## METHODS

### SETTING

We recruited patients at 6 Rhode Island acute care hospitals from January 1, 2009, to June 30, 2010, including 2 community hospitals, 3 teaching hospitals, and a tertiary care center and teaching hospital, ranging from 129 beds to 719 beds. The average preintervention (January 1 through December 31, 2008) readmission rate for these hospitals was 21.1% (range, 18.1-23.1%). All 6 hospitals function within an open, nonintegrated health care system, despite common corporate ownership of 3 of the facilities. Recruitment began in one hospital at a time during 11 months; coaches were recruiting participants in all hospitals by November 2009. The Miriam Hospital and Kent Hospital institutional review boards approved this study protocol; all 6 participating hospitals accepted the determinations from one of these institutional review boards.

### STUDY POPULATION

The study recruited hospitalized FFS Medicare beneficiaries. From January 1 through December 31, 2009, coaches approached consecutive individuals, initially identified on the basis of admission diagnoses of specific cardiac or respiratory conditions (based on *International Classification of Diseases, Ninth*

**Table 2. Description of Rhode Island Coaching Discussion Topics**

Coaching Discussion Topic	Description
The Four Pillars <sup>8</sup>	<ol style="list-style-type: none"> <li>1. Ensure that medications taken match the medications prescribed and that the participant knows which medication to take when and how often</li> <li>2. Identify health conditions and record important notes in the personal health record</li> <li>3. Discuss/practice how to schedule a follow-up visit and encourage the participant to do so; the coach does not schedule the visit</li> <li>4. Help the participant recognize "red flags" (warning signs) that should prompt a telephone call or a more urgent visit with the care provider</li> </ol>
Communicating with providers	<ol style="list-style-type: none"> <li>1. Enroll participant in current care, the state-wide health information exchange</li> <li>2. Define some of the terms associated with advance directives and emphasize the importance of having an advance directive</li> </ol>

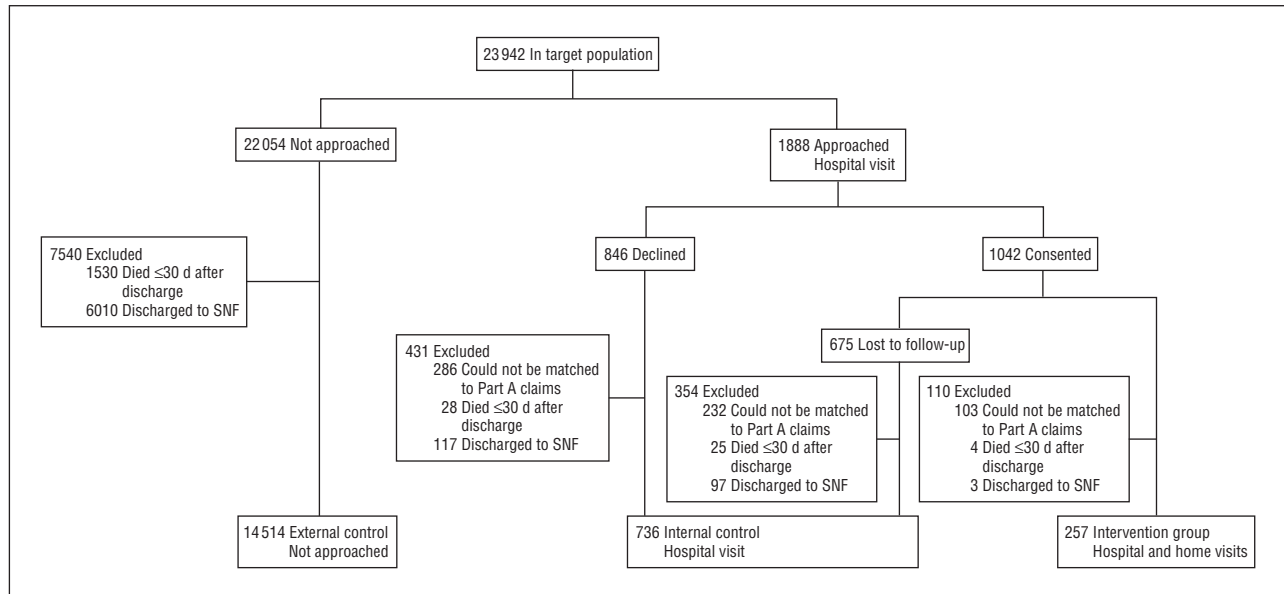
Revision codes; **Table 1**) or related symptoms, including shortness of breath, sudden weight gain, fever, cough, and chest pain. In January 2010, because of increased coaching capacity, we expanded eligibility to include all general medicine FFS Medicare beneficiaries, regardless of diagnosis. Participants were not randomized to the intervention; coaches used inpatient census lists to identify patients meeting the eligibility criteria and approached a convenience sample of consecutively identified individuals. Logistical constraints of the CTI team, including the time and day of patient discharge and the coaches' ability to speak to patients directly without interfering with clinical care or the hospital discharge process, drove convenience. The coaches' caseload and scheduling also affected sampling; coaches worked part time (18-24 hours per week), with an average caseload of 12 to 15 patients per coach, comparable to the caseload reported by Coleman et al.<sup>8</sup> Coaches staggered their schedules to broaden coverage during daytime hours and weekdays cumulatively across all hospitals, resulting in coach availability generally from 9 AM to 2 PM, Monday through Friday.

Coaches excluded patients to be discharged to a long-term care or skilled nursing facility, current long-term care facility residents, and those with a documented hospice referral. Coaches approached eligible hospitalized patients (and caregivers, if present) to explain the intervention and obtain permission for a home visit to complete the CTI. Coaches encouraged but did not require caregiver participation; however, coaches excluded patients noted to have limited English proficiency or inadequate cognitive function unless a caregiver agreed to receive the intervention as a proxy.

The same criteria applied to the comparison populations, although we could not exclude individuals with limited English proficiency or those with undiagnosed cognitive impairment. The external control group included patients never approached but eligible according to the study criteria. The internal control group included patients we approached but who declined the intervention or did not complete the home visit.

### COACHING INTERVENTION

The CTI is a patient-centered intervention to empower individuals to manage their health and communicate effectively with



**Figure.** Study population. SNF indicates skilled nursing facility.

their providers; details are published elsewhere.<sup>8</sup> The complete intervention occurs across 30 days and includes a coach completing a hospital visit, a home visit, and 2 follow-up telephone calls. After obtaining verbal consent in the hospital, coaches give participants booklets in which to record their personal health record, including their main health problems, their medications, and questions for their health care providers. Coaches also discuss topics related to participants' communication with their outpatient providers (**Table 2**). Upon patient discharge, coaches aim to complete a home visit within 3 days, the first telephone call within 7 to 10 days, and the final telephone call by day 30. During each of these interactions, coaches reinforce the topics broached during the hospital visit, including the completion and use of the participants' personal health record, and further activate patients to understand the signs and symptoms of worsening of their condition before emergency issues occur. The coaching prepares participants to self-manage and communicate more effectively with their providers. The second telephone call emphasizes the importance of the follow-up visit with a physician if not already completed and helps the patient locate other sources of continued support. Coaches try to contact patients at least 3 times by telephone before categorizing them as "unable to contact."

In our study, coaches had a background in nursing or social work and received training in the CTI with materials and guidance from Coleman's team.

## DATA SOURCES AND COVARIATES

This analysis relied on Medicare claims data, enrollment data, and a coaching database developed by the investigators to track the intervention. Claims data provided information on all Rhode Island FFS Medicare beneficiaries. The analysis used Medicare Part A claims from January 2009 through July 2010 (allowing 1 month for 30-day readmissions to occur) matched with coach tracking data from January 2009 through June 2010. Claims data also provided the primary and secondary outcomes, as well as the following covariates: (1) diagnoses based on *International Classification of Diseases, Ninth Revision* codes, (2) admission date and discharge date to calculate the length of stay, (3) number of hospitalizations in the year before coaching, (4) number of comorbidities adjusted using the Elixhauser model,<sup>12</sup> and (5) race. Medicare enrollment data identified individuals eligible for both

Medicare and Medicaid (dual eligibility status). These variables allowed us to assess and then control for potential confounders, as detailed under "Statistical Analysis."

The coach tracking database included information on patients offered the CTI between January 2009 and June 2010: (1) whether patients accepted or refused the intervention, (2) the extent of the intervention received by each patient, and (3) the date of recruitment. All data sources included patient name, sex, and date of birth; we matched information across databases based on these demographics.

The outcome was 30-day all-cause readmission to any hospital. We defined the index hospitalization as any FFS Medicare claim for any diagnosis or cause from an acute care hospital. We calculated readmission as hospitalization at any facility occurring at any time before 31 days after the index hospitalization. The calculation excluded individuals who died in the hospital or were transferred to another acute care hospital on the same day, as well as hospitalization (index or readmission) for individuals who died within 30 days of the index hospitalization discharge date.

## STATISTICAL ANALYSIS

We categorized hospitalized individuals into 3 groups (**Figure**): the intervention group (those who were approached and consented to the CTI during the hospitalization and completed a home visit), the internal control group (those who were approached during the hospitalization and were offered the CTI but did not complete the intervention, including those who initially declined the intervention and those who accepted the CTI but were lost to follow-up before completing a home visit), and the external control group (those who were hospitalized and eligible for the CTI but were not approached). The internal and external control groups allowed us to assess internal and external validity. Individuals initially agreeing to the intervention were labeled as lost to follow-up after 3 or more coach telephone calls failed to reach the individual or caregiver. To match the intervention group, control groups excluded individuals who were discharged to skilled nursing facilities or long-term care facilities, as well as those who received hospice care within 30 days of discharge. All groups excluded patients who died within 30 days after discharge.

We based our initial sample size estimates on assumptions that our intervention groups resembled those with *International Clas-*

sification of Diseases, Ninth Revision, codes shown in Table 1. If the baseline readmission rate is 30%, with the  $\alpha$  value set at .05, for 80% power to detect a 30% reduction in our intervention group, and it represented only about 20% of the population we approached, we would need 192 patients to complete the intervention. We used a conditional logistic regression model, matching on the hospital of index admission to control for clustering. We calculated odds ratios for 30-day hospital readmissions, using intervention status as the main independent variable and adjusting for covariates that were significantly different between the groups at  $P < .20$  in bivariate analyses as well as covariates supported by the literature (Table 3). We used a significance level of  $P < .05$  and 2-sided tests for all hypotheses.

We used commercial software (SAS version 9.1; SAS Institute, Inc, Cary, North Carolina) for all analyses.

## RESULTS

Of the 1888 individuals we approached, 1042 (55.2%) consented to the intervention. Of the 1042 who consented, 257 individuals (24.7%) completed the home visit. This final intervention group represents 13.6% of the eligible approached population (Figure). Within the intervention group, 191 of 257 participants (74.3%) received all components of the intervention (home visit and both coach telephone calls); 238 of these participants (92.6%) completed the visit and 1 telephone call.

Compared with the intervention group, patient characteristics differed for hospitalizations in the internal control group; the declined and lost to follow-up subsets of the internal control group were more often male (48.7% and 41.7%) vs the intervention group (31.5%). The declined subset also had longer hospital stays (mean, 6.4 vs 5.7 days) and more hospital admissions in the previous year (mean, 2.8 vs 1.9) than the intervention group. Additional differences existed between the external control and intervention groups. Patients in the external control group were more often male (48.7% vs 31.5%), were more often dually eligible (26.6% vs 21.8%), were younger (18.7% vs 28.4% 85 years or older), and had fewer hospital admissions in the previous year (mean, 1.4 vs 1.9; Table 4).

The odds of a hospital readmission within 30 days of discharge were significantly lower following hospitalizations after which individuals received the intervention compared with those who were never approached (odds ratio [OR], 0.61; 95% confidence interval [CI], 0.42-0.88); the absolute readmission rate was 12.8% vs 20.0%. We adjusted these odds for (1) clustering by hospital, (2) characteristics that differed significantly between individuals readmitted and those not readmitted at  $P < .20$ , and (3) characteristics supported by the literature (age, race, sex, dual eligibility status, length of stay, having  $\geq 3$  comorbidities, and diagnoses of heart failure, chronic obstructive pulmonary disease, and dementia) (Table 3). The internal control group's readmission rate (18.6%) was similar to that of the external control group (OR, 0.94; 95% CI, 0.77-1.14), as were rates for both subpopulations of the internal control group—individuals who declined the intervention (18.6%; OR, 0.94; 95% CI, 0.73-1.21) or who were lost to follow-up (18.7%; OR, 0.91; 95% CI, 0.68-1.22) were similar to the rate of the external control group.

**Table 3. Adjusted Odds Ratios for 30-Day Readmission (January 2009–June 2010)**

Covariate	Adjusted Odds Ratio (95% CI)	Unadjusted Readmission Rate, %
Initial hospitalization diagnosis		
CHF	1.63 (1.48-1.79) <sup>a</sup>	25.3
COPD	1.26 (1.15-1.38) <sup>a</sup>	22.7
Dementia	0.83 (0.64-1.07)	15.4
Sex		
Male	1 [Reference]	21.3
Female	0.85 (0.78-0.93) <sup>a</sup>	18.4
Race		
White	1 [Reference]	19.6
Black	0.98 (0.81-1.18)	21.3
Other	1.03 (0.85-1.29)	21.6
Age, y		
<65	1.28 (1.13-1.46) <sup>a</sup>	23.1
65-74	0.94 (0.82-1.06)	18.2
75-84	0.99 (0.88-1.13)	18.6
$\geq 85$	1 [Reference]	18.7
Length of stay, d	1.03 (1.02-1.04) <sup>a</sup>	
Comorbidities		
<3	1 [Reference]	17.8
$\geq 3$	1.15 (1.05-1.26) <sup>a</sup>	22.0
Dual eligibility status <sup>b</sup>	1.27 (1.15-1.41) <sup>a</sup>	23.5
Intervention status		
External control	1 [Reference]	20.0
Internal control	0.94 (0.77-1.14)	18.6
Declined	0.94 (0.73-1.21)	18.6
Lost to follow-up	0.91 (0.68-1.22)	18.7
Intervention	0.61 (0.42-0.88) <sup>a</sup>	12.8

Abbreviations: CHF, congestive heart failure; CI, confidence interval; COPD, chronic obstructive pulmonary disease.

<sup>a</sup>Significant at  $P < .05$ . Regression model adjusted for age, race, sex, dual eligibility status, length of stay, 3 or more comorbidities, and diagnoses of CHF, COPD, and dementia.

<sup>b</sup>Eligible to receive Medicare and Medicaid.

## COMMENT

The intervention group's significantly reduced readmission rate (36.0% reduction compared with the external control group) mirrors Coleman and colleagues' 30% reduction.<sup>8,10</sup> This study adds to the evidence supporting the use of the CTI upon hospital discharge of medical patients in an open health care system.

It is noteworthy that coaching demonstrates effectiveness despite challenges not present in the randomized controlled trials. Specifically, Coleman and his team tested the CTI in a closed health care system, which removes some barriers to inpatient-outpatient communication. However, the Rhode Island Medicare pilot program included other interventions targeting improved communication between providers, which may have affected interprovider communication for all 3 comparison groups. During the course of this project, 21 other Rhode Island initiatives focused on transitions of care, several of which adapted the CTI for telephonic coaching. However, these interventions should not have differentially benefited any specific subset of our study populations. In addition to possibly affecting transitions in our patient populations, these initiatives likely augmented the effect of our intervention,



**Table 4. Patient Characteristics of the Index Hospitalization (January 2009 to June 2010)**

Patient Characteristic	External Control Group (n = 14 514)	P Value	Internal Control Group (n = 736)				Intervention Group (n = 257)
			Declined (n = 415)	P Value	Lost to Follow-up (n = 321)	P Value	
Male sex, No. (%)	7071 (48.7)	<.001 <sup>a</sup>	191 (46.0)	<.001 <sup>a</sup>	134 (41.7)	.01	81 (31.5)
Race, No. (%)							
White	13 093 (90.2)	.81	375 (90.4)	.90	294 (91.6)	.70	233 (90.7)
Black	708 (4.9)	.32	26 (6.3)	.98	17 (5.3)	.63	16 (6.2)
Other	679 (4.7)	.24	13 (3.1)	.99	9 (2.8)	.83	8 (3.1)
Age, No. (%), y							
<65	4265 (29.4)	<.001 <sup>a</sup>	64 (15.4)	.35	59 (18.4)	.07	33 (12.8)
65-74	3791 (26.1)	.49	103 (24.8)	.36	88 (27.4)	.87	72 (28.0)
75-84	3743 (25.8)	.07	124 (29.9)	.81	99 (30.8)	.98	79 (30.7)
≥85	2715 (18.7)	<.001 <sup>a</sup>	124 (29.9)	.68	75 (23.4)	.17	73 (28.4)
Length of stay, mean (SD), d	5.7 (4.8)	.91	6.4 (4.1)	.01 <sup>a</sup>	6.0 (3.3)	.19	5.7 (3.0)
Prior-year admissions, mean (SD)	1.4 (1.0)	<.001 <sup>a</sup>	2.8 (2.3)	.03 <sup>a</sup>	2.2 (1.7)	.12	1.9 (1.7)
≥3 Comorbidities, No. (%)	6725 (46.3)	.03	241 (58.1)	.66	120 (37.4)	.22	137 (53.3)
Dual eligibility status, No. (%)	3860 (26.6)	.08 <sup>a</sup>	76 (18.3)	.21	76 (23.7)	.59	56 (21.8)
Diagnosis of dementia, No. (%)	478 (3.3)	.87	9 (2.2)	.45	6 (1.9)	.33	8 (3.1)

<sup>a</sup>P values determined on comparison with the intervention group; significant at  $P < .05$ .

suggesting that effective real-world implementation of the CTI can provide additional benefit beyond systems-level changes already occurring. Other efforts to reduce readmissions and improve patient safety have noted the synergy between patient- and systems-level changes,<sup>4</sup> although the current study was unable to quantify any added effect on this implementation of the CTI.

Translating the CTI model into an effective, generalizable intervention reveals challenges in recruitment and retention, evident in our roughly 55% acceptance and 75% attrition rate among participants who agreed to a home visit. Even as we took steps to increase consent from and retain reluctant participants, we still demonstrated a significant effect on readmission, unlike programs that cannot replicate findings from randomized controlled trials.

An analysis of the 2 populations included within the internal control group (declined and lost to follow-up) indicated that these 2 groups had similar readmission rates and mean days to readmission from discharge, but this does not preclude differences in patient activation, health literacy, perceived stress, trust of the coach, resistance to allowing strangers in for a home visit, or other psychosocial factors that may affect people's willingness or ability to accept and complete the intervention. Because the CTI depends on activating individuals to advocate for their own health, it is less likely to benefit those who are not or cannot currently be activated to a certain level of readiness to act, and identifying such individuals is an important consideration for resource allocation in effective CTI implementation. Likewise, we do not yet know whether adapting recruitment for the internal control group would result in greater acceptance of the CTI or whether completing the CTI would be effective for them.

Members of the internal control group did not differ significantly from and, more importantly, were no more likely to be readmitted than were members of the exter-

nal control group, suggesting that the participants who completed the CTI were not at uniquely lower risk (or more able to be activated to self-manage) before the intervention than the overall target population (OR, 0.94; 95% CI, 0.77-1.14).

We attempted to control for sampling biases in our analysis. For example, excluding individuals who had died could overestimate the effect, as those individuals might have been at greater risk for readmission because of advanced or end-stage disease conditions. However, because the mortality rate was significantly higher in the external control group, excluding these individuals would have decreased the readmission rate in the external control group more than in the intervention group. Thus, excluding individuals who died helps to ensure that our estimate of the intervention effect is a conservative estimate of the CTI effect. A sensitivity analysis that included those individuals and examined a combined end point of death or readmission did not significantly alter the results (data not shown).

Despite expectations to the contrary, the external control group had a higher proportion of younger patients and a higher readmission rate. The fact that the control group also had a greater proportion of individuals with disabilities compared with the intervention group might explain this phenomenon. By definition, all participants younger than 65 years receiving Medicare are disabled or have an end-stage chronic disease. We controlled for age in our regression model to mitigate this effect.

The study design is limited. As a quality improvement intervention, we offered CTI to as many people as possible within the constraints of project resources and subsequently analyzed the data. Individuals who declined or failed to complete the intervention represent the population not likely to enroll in a randomized controlled trial, but they do represent an important reference group that helps inform us how patients in a more typical clinical care setting might receive the interven-

tion. A true intent-to-treat analysis would provide additional information (particularly given the large volume of resources used when approaching people who do not consent), and we are continuing to collect data to be able to conduct such an analysis.

There are 3 additional limitations of our study. First, we compared hospital readmissions based on unique index hospitalizations rather than patients, which may overestimate our effect. However, Coleman et al's study<sup>8</sup> analyzed hospitalizations, allowing us to better compare. In addition, we calculated power for the present analysis based on events rather than people, and the sample is not appropriately sized for the alternative analysis. A second limitation is that we did not exclude surgical patients from our external control group, although they are not represented in the group offered the intervention. Because surgical patients typically have lower readmission rates, this may result in an underestimate. Finally, we used a consecutive convenience sampling method for hospitalizations. This sampling method and the resource constraints of the intervention limit generalizability because we were able to approach only 8% of the total population. For example, individuals who are "convenient" to approach for participation may be less ill, be hospitalized longer, or have more time between tests, all factors that could produce a sampling bias. Conversely, some individuals who were not approached might have limited English proficiency or undiagnosed cognitive impairments that could put them at greater risk of readmission. Although we controlled for length of stay and comorbidities, we cannot address all other factors.

Nonetheless, the same challenges that limit generalizability in the present study are likely applicable to others that might implement the CTI as a quality improvement intervention. Thus, the current study's large comparison group and ability to capture readmission at any hospital (including out-of-state hospitals and those differing from the site of the index admission) strengthen the case for the intervention's potential benefits and present a more thorough picture of the effect of readmissions on the health care system.

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Correspondence: Stefan Gravenstein, MD, MPH, Quality Partners of Rhode Island, 235 Promenade St, Ste 500, Providence, RI 02908 (stefan\_gravenstein@brown.edu).

Author Contributions: Study concept and design: Voss, Gardner, Baier, Lehrman, Butterfield, and Gravenstein. Acquisition of data: Voss, Gardner, Butterfield, and Gravenstein. Analysis and interpretation of data: Voss, Gardner, Baier, Butterfield, and Gravenstein. Drafting of the manuscript: Voss, Gardner, Baier, Butterfield, and Gravenstein. Critical revision of the manuscript for important intellectual content: Voss, Gardner, Baier, Butterfield, and Gravenstein. Statistical analysis: Baier, Butterfield, and Gravenstein. Obtained funding: Baier and Gravenstein. Administrative, technical, and material support: Voss, Gardner, Baier, Butterfield, and Gravenstein. Study supervision: Gardner, Baier, Lehrman, and Gravenstein.

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