TECHNICAL APPENDIX

EXPANDED METHODS SECTION

The Madison VA Coordinated-Transitional Care (C-TraC) Program

The C-TraC Program was launched April 1, 2010 as a Geriatrics Research, Education and Clinical Center clinical quality improvement project at Madison VA Hospital in Madison, Wisconsin. Madison VA Hospital is an 87-bed general VA hospital, with approximately 4,400 admissions annually. It provides a wide variety of inpatient medical and surgical services to eligible veterans throughout Wisconsin, northern Michigan and northern Illinois. Of veterans who receive care at the hospital, 75 percent reside beyond the reach of a home visit.

C-TraC targeted community-dwelling veterans at high-risk of poor post-hospital outcomes. To be eligible for C-TraC, veterans had to be hospitalized on non-psychiatric acute-care medical and surgical wards at Madison VA Hospital and discharged to a non-institutional community setting, including home, home with home health, home hospice or assisted living facility. Eligible veterans had to have a working telephone, and either have medical record documentation of dementia, delirium or other cognitive impairment or be 65 years or older and live alone or have at least one previous hospitalization in the preceding 12 months. Veterans were excluded if they were discharged as 24-hour observation patients or if their primary diagnosis was

alcohol withdrawal. Additionally, veterans who had a VA internal medicine resident as their primary care provider were excluded, because these veterans received a different resident-led transitional care intervention. The data offered in this paper were obtained during the first 24 months of the program. The C-TraC program and its evaluation were deemed not to be research by the University of Wisconsin Institutional Review Board and by the Madison VA Research and Development Committee. Therefore, no research-level written consent was obtained from the veterans in the intervention. Veterans were verbally asked if they wanted to participate in the program, and as with any clinical program, they had the right to refuse services.

For eligible veterans, a C-TraC nurse case manager used standardized protocols to achieve four basic goals which were adapted from Coleman's Four Pillars® of transitional care.(1) First, educate and empower the veteran and the veteran's caregiver in medication management through use of a patient-led medication reconciliation facilitated by the C-TraC nurse case manager. Medication reconciliation is a process by which medication inconsistencies or discrepancies between different sites of care are identified through review of a patient's current medication regimen and previous regimens as a way to improve patient safety.(2) Second, ensure the veteran has medical follow-up in place and is ready and able to actively

participate in that follow-up. Third, educate the veteran and the veteran's caregiver regarding the signs of a worsening medical condition and how to respond to such signs. Fourth, ensure the veteran and the veteran's caregiver know whom to contact if questions or concerns arise during the period after hospital discharge but before the first outpatient follow-up. C-TraC veterans were supplied with standard VA discharge educational materials, but, unlike Coleman's Four Pillars® approach, they did not create a personal health record with the C-TraC nurse case manager. This step was omitted because the day of discharge was already full of hours of education which could overwhelm a vulnerable patient; because performing this step over the phone would have been problematic; and because having a patient hand-write their own health record would be difficult, frustrating and possibly ineffective for those with cognitive impairments or other vulnerabilities.

Planning the Intervention

The C-TraC program was developed and assessed at Madison VA Hospital, a small Midwestern VA hospital with a culture of collaboration, innovation and excellence. Although a need for transitional care was identified, Madison VA Hospital had no formal transitional care program in place. The large geographic region over which the Madison VA Hospital's patients resided

made an in-home visit-based transitional care program impractical, and no alternative evidence-based options for transitional care were identified. Nursing and medical hospital leadership provided initial support for the development and testing of the C-TraC program. Frequent meetings of geriatric and nursing staff were held to develop the initial programmatic concept and protocols, and these were then modified through additional discussions with leadership. C-TraC was initially piloted on a very small scale over the course of 4 months during the year prior to its launch in April 1, 2010. Data from this small pilot were utilized to successfully compete for VA grant funding, which supported the formal program launch and an observational program evaluation with a pre-post assessment. Although involvement of a contemporaneous control group within this assessment would have been ideal, very few similar, non-C-TraC patients were available for ready comparison because of the small size of the hospital. The VA grant money supported a 1.0 full-time C-TraC nurse case manager for clinical activities and a 0.5 full-time program assistant for data collection. A VA staff geriatrician served as Director of the C-TraC program, overseeing and approving all protocols, implementation and assessment activities.

Prior to the formal launch on April 1, 2010, meetings were held with nursing, medical, therapy and social work leadership

to inform them of the program, to plan evaluations and to garner buy-in and input. Brief meetings were also held with potentially affected VA inpatient and outpatient direct care staff to introduce them to the program. Care was taken to ensure that C-TraC was seen as a bridging program, belonging equally to both the inpatient and outpatient realms. The C-TraC nurse case manager was hired and trained during this period, and was involved in the majority of these meetings.

After C-TraC's formal launch, the C-TraC Director and C-TraC nurse case manager held weekly meetings to discuss any programmatic issues and to ensure program fidelity. During the first 6 months (the baseline period), the program was implemented for a small number of participants. The program assistant was hired and trained in data collection. Full data collection commenced while phone scripts, templates and protocols evolved through a series of frequent team meetings and feed-back with leadership, patients and non-C-TraC staff participants. The brief informational meetings to introduce C-TraC to direct patient care staff continued. During the subsequent 18 months (the intervention period), the C-TraC program used finalized protocols, fully trained staff and established processes which were tightly integrated into existing hospital work-flows. Enrollment was maximized to capacity for the 1.0 full-time C-TraC nurse case manager.

Interim programmatic process measures and outcomes were reviewed at least bi-monthly to evaluate progress. Hospital leadership and inpatient and outpatient staff were updated on the program's outcomes bi-annually.

The C-TraC Nurse Case Manager

The C-TraC nurse case manager was a 1.0 full-time senior registered nurse with prior experience in VA inpatient, outpatient and geriatrics case management. Although her office was physically located in the hospital, she was incorporated into the routine operations and viewed as an important member of both the inpatient and the outpatient primary teams. This system-bridging role was achieved through extensive pre-launch planning sessions with all major inpatient and outpatient stakeholder groups, including inpatient administration, nursing, medicine, surgery, social work and therapy, and outpatient administration, primary care, social work and nurse case management. Additionally, any direct care staff who would interact clinically with the C-TraC nurse case manager were introduced to the program and to the C-TraC nurse case manager through 15 minute information sessions.

An Overview of the C-TraC Protocol

The C-TraC nurse case manager identified eligible veterans via review of daily electronic hospital admission lists and by participation in daily multi-disciplinary discharge rounds on each targeted inpatient ward. During these rounds, the C-TraC nurse case manager would use her prior clinical experience and training to offer a transitional care and outpatient viewpoint to the inpatient providers, making recommendations for home health, physical therapy and hospice referrals, and geriatrics and palliative care consults as she deemed appropriate. Also, from her prior contacts, the C-TraC nurse case manager would often have in-depth knowledge about frequently hospitalized veterans and could provide important patient-specific details to the inpatient care teams who knew the veteran less well.

The C-TraC nurse case manager met with each eligible hospitalized veteran and their caregiver, if present, prior to hospital discharge to offer enrollment into the C-TraC program and to introduce themselves, the four basic transitional care goals and to set up a time for a 48-72 hour post-discharge follow-up phone call. The C-TraC nurse case manager ensured that all enrolled veterans had an active plan for outpatient follow-up, often needing to facilitate outpatient appointment scheduling to ensure that a follow-up plan was in place. She gave the veteran a one-half sheet brightly colored page documenting the veteran’s three red flags, the date and time for

the follow-up phone call, date of the next follow-up outpatient medical appointment, and contact information for herself and triage with instructions to call if the red flags or other problems or questions arose. Red flags were identified by the C-TraC nurse case manager and were limited to three in number to optimally conform with principles of adult learning.(3) Additionally, as the standard of care, all veterans discharged from Madison VA Hospital during this timeframe received complete medication reconciliation and medication discharge counseling by an inpatient pharmacist, and routine educational materials and day-of-discharge teaching by VA medical, nursing and pharmacy personnel. This standard discharge education did not routinely include teaching on red flags, but did include instructions for medical follow-up appointments and utilized teach-back methods for new care procedures, like insulin injections.

The veteran and the veteran’s caregiver, if present, were phoned during the pre-arranged time 48-72 hours post-discharge to reinforce the four transitional care goals. At this initial phone call the veteran was asked to have all of their pill bottles on the table in front of them. They were then asked, “Tell me how you take your medications,” to facilitate a patient-led medication reconciliation. The hospital discharge medication list was used as the ‘gold standard’ for this medication reconciliation process. Red flags, plans for medical

follow-up and contact information for the C-TraC nurse case manager and triage were again reviewed. The C-TraC nurse case manager conducted 1.5 post-discharge phone calls per veteran (range 1-4 calls), which lasted an average of 36 minutes each (range 10-75 minutes). The majority of phone time was spent in medication reconciliation. These phone calls continued on a weekly basis until the primary care provider or appropriate specialty provider saw the veteran in follow-up, or the veteran and C-TraC nurse case manager agreed that no further telephone follow-up was necessary because the veteran was doing so well, or four weeks passed. If red flags or medication discrepancies were identified during any of these calls, the C-TraC nurse case manager would contact the primary care provider. If the red flags merited more immediate attention, the C-TraC nurse case manager would arrange an urgent care appointment for the veteran or recommend that the veteran be seen in the emergency room, depending upon established VA triage criteria and the C-TraC nurse case manager's clinical judgment. If a home visit for in-person assessment or clinical care was deemed necessary by the C-TraC nurse case manager, she would arrange a home health services visit through an available home health agency in the veteran's area. For cognitively impaired veterans without a caregiver, the C-TraC nurse case manager worked to activate potential caregivers and community supports for the veteran. All

veteran contacts were documented using specially-designed electronic medical record system templates to ensure program fidelity, standardize documentation and promote efficiency. These notes were sent for electronic co-signature to the veteran's primary care provider and outpatient nurse case manager. The veteran's specialty provider was added as an additional signer if appropriate. For example, surgeons were added as additional signers to post-surgery patients. The C-TraC nurse case manager was available to veterans Monday through Friday, 8am – 5pm. Veteran issues or questions outside of these hours were forwarded to the VA triage service.

The full role of the C-TraC nurse case manager can be seen in Exhibit 1. The C-TraC protocols, patient hand-outs, telephone and inpatient-visit scripts and electronic documentation templates are available for download through the University of Wisconsin Health Innovation Program at www.hipxchange.org

Program Evaluation: Data Collection and Analysis

Seven hundred and thirteen veterans were identified as eligible and approached for enrollment in C-TraC from the April 1, 2010 program launch through March 31, 2012 using the criteria and procedures listed above. Five veterans refused C-TraC enrollment and were excluded. Final sample size was 708. All

veterans enrolled in the program were analyzed, regardless of whether they completed the full protocol.

Sociodemographics, comorbidities, functional measures, C-TraC process measures and outcomes were abstracted from each veteran's medical record by a team of three trained medical abstractors using a standardized manual and abstraction form which was formally tested prior to use.(4) Sociodemographic variables, obtained by abstracting VA enrollment data and standardized hospital nursing assessment forms, included veteran age, race, gender, education level, service connectivity, Medicare and Medicaid status and whether the veteran lived alone. Abstracted comorbidities and disease severity indicators were obtained from review of the veteran's past medical history, relevant discharge summary and problem list. These included presence of a previous Madison VA hospitalization during the 12 months prior to the index admission; medical documentation of active dementia, delirium or other cognitive impairment; or a history of coronary artery disease, congestive heart failure, peripheral vascular disease, cerebrovascular disease, chronic pulmonary disease, connective tissue disease, gastrointestinal ulcer disease, liver disease, diabetes, diabetic end-organ damage, hemipalegia or parapalegia, renal disease or a cancer. These latter 12 items were abstracted and used to calculate a Charlson comorbidity score using methods proposed by Charlson et

al.(5, 6) Functional measures, obtained from standardized nursing assessment forms, included veteran report of needing more help with bathing, dressing, transferring or toileting during the 2 weeks prior to hospitalization; of experiencing a decline in ability to stand or walk during the 2 weeks prior to hospitalization; and of whether a veteran manages his own medications. Outcomes data included medication discrepancies discovered and rectified during the 48-72 hour post-discharge phone call, and the presence of a 30-day rehospitalization back to the VA.

Data were analyzed over 24 months to monitor for changes in program effectiveness, program maturation and sustainability of effect. The first 6 months of the program, which occurred April – September, 2010, constituted a baseline or establishment period, during which full data collection commenced but intervention protocols were only implemented in a partial, trial fashion on a limited number of participants. During this baseline period the C-TraC program staff were hired and trained, leadership approved work-processes, the program was introduced to inpatient and outpatient VA staff and program documentation templates were created. The large majority of individuals in the baseline period did not receive the bulk of the intervention. Therefore, eligible veterans enrolled during this initial 6-month timeframe for whom full data was collected were

used as the baseline group. The subsequent 18-months of the program, which occurred October 2010 – March 2012, constituted the intervention period. During the intervention period the C-TraC program used finalized protocols, fully trained staff and established processes which were tightly integrated into existing hospital work-flows, and enrollment was maximized to capacity for the 1.0 full-time C-TraC nurse case manager. The intervention period was extended to a full 18 months to allow for better assessment of program sustainability of both operation and impact.

Analyses were conducted using STATA 11 (StataCorp LP, College Station, TX). Basic frequencies were calculated for C-TraC process measures, outcomes and veteran characteristics. Multivariate logistic regression with robust estimates of the variance to account for clustering were used to produce adjusted odds ratios and 95 percent confidence intervals examining the relationship between 30-day rehospitalization and enrollment within the C-TraC intervention period versus the baseline period, adjusting for all sociodemographics, Charlson comorbidity score and functional measures listed above. All confidence intervals and p-values were tested for significance at less than 0.05. At a two-tailed alpha = 0.05, at the baseline rehospitalization rate of 34 percent and at the sample size of 708, this analysis had 80 percent power to detect a 14 percent

absolute decrease in rehospitalizations, which corresponds to an odds ratio of 0.51 on multivariate logistic regression analysis.

Program Fidelity Measures

Process measures demonstrated high fidelity during the intervention period suggesting a successful implementation of the C-TraC protocols. Seventy-four percent of enrollees received an in-hospital visit and 90 percent received a post-discharge phone call with full medication reconciliation and care plan education. The C-TraC nurse case manager worked with caregivers for 30 percent of enrolled veterans. Hospital and primary care staff frequently notified the C-TraC nurse case manager when they felt that their patients could benefit from the C-TraC intervention. A small number of off-site outpatient providers, who were not able to attend the brief pre-launch introductory sessions and who did not see the e-mailed program introductions, occasionally expressed surprise at the C-TraC nurse case manager's involvement in their patient's care. However, upon explanation of her role, the informal feedback from these providers was universally positive. No obvious patient or system-level harms from C-TraC were identified.

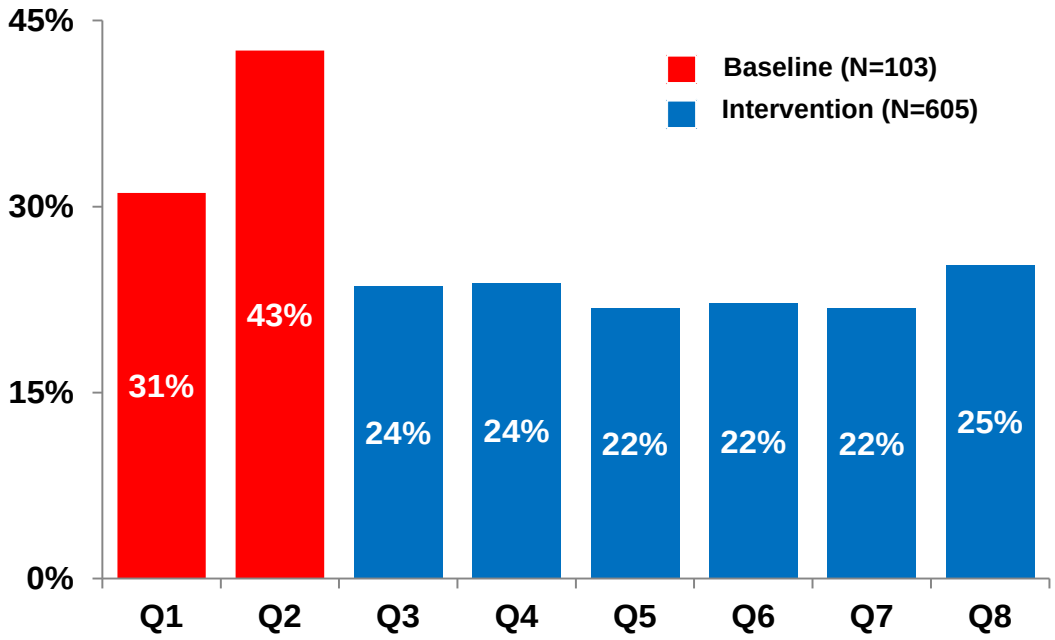
Appendix Table 1. Characteristics of Veterans Within the VA C-TraC Program (N=708)*

Characteristic	Overall % (N = 708)	Baseline Period, Months 1-6 % (N = 103)	Intervention Period, Months 7-24 % (N = 605)	P-Value
Sociodemographics				
Age: (Average [SD])	75 [8.4]	74 [7.3]	75 [8.6]	
<60y	1	2	1	0.13
60-69y	26	31	25	
70-79y	39	43	38	
80-89y	27	21	28	
>89y	7	3	7	
Race, White	97	99	97	0.41
Male	97	98	97	0.61
Lives Alone	39	41	39	0.87
Medicaid	2	2	2	0.81
Medicare	90	93	89	0.20
Education Level:				
Less Than 8 Years	10	10	11	0.80
Some High School	16	19	15	
High School Graduate/GED	39	39	40	
Some College	24	25	24	
College Graduate	10	8	11	
VA Service Connected Status:				
. 100%	13	8	14	0.16
50-99%	13	11	13	
1-49%	12	17	11	
Not Service Connected	62	65	61	
Co-Morbidities and Disease Severity				
Previous Hospitalization During Prior 12 Months	69	79	68	0.03
Dementia, Other Cognitive Impairment or Delirium	22	15	23	0.05
Coronary Artery Disease	47	42	48	0.27
Congestive Heart Failure	33	32	33	0.79
Peripheral Vascular Disease	31	41	30	0.02
Cerebrovascular Disease	21	25	21	0.31
Chronic Pulmonary Disease	42	44	41	0.63
Connective Tissue Disease	21	21	21	0.99
Gastrointestinal Ulcer Disease	21	19	22	0.58
Liver Disease	6	10	5	0.06
Diabetes	36	40	35	0.32
Diabetes End-Organ Damage Present	20	27	19	0.07
Hemipalegia/Parapalegia	2	4	1	0.09
Renal Disease	34	28	35	0.18
Cancer	39	41	39	0.71
Charlson Comorbidity Index Score (Average [SD])	6.2 [3.9]	6.5 [3.9]	6.1 [3.9]	0.07
Functional Measures				
In 2 Weeks Prior to Hospitalization Needed More Help with Bathing, Dressing, Transferring and/or Toileting	27	22	28	0.21
In 2 Weeks Prior to Hospitalization Experienced a Decline in Ability to Stand or Walk	44	46	43	0.58
Manages Own Medications	67	64	67	0.74

Source: Author's analysis

*Values represent percent unless otherwise specified

Appendix Figure 1. 30-Day Rehospitalization Rates for Veterans in the VA C-TraC Program During Baseline and Intervention Periods



Q = 3-month period (ie. quartile)
Average rehospitalization rates for baseline (34%) and intervention (23%), P-value = 0.013

Appendix Table 2: Adjusted Odds of 30-Day Rehospitalization for Veterans in C-TraC Intervention Period as Compared to Those Within the Baseline Period (N=708)*

Characteristics	30 Day Rehospitalization		
	Adjusted Odds Ratio	95% CI	P-Value
C-TraC Group			
Baseline period (Months 1-6), N = 103	1.00		Ref
Intervention period (Months 7-18), N= 605	0.55	(0.33, 0.90)	0.018
Sociodemographics			
Age:			
<60y	1.00		Ref
60-69y	1.41	(0.14, 13.92)	0.768
70-79y	1.53	(0.16, 14.97)	0.716
80-89y	1.01	(0.10, 10.09)	0.995
>89y	1.32	(0.12, 14.46)	0.821
Race, Non-White	0.58	(0.10, 3.27)	0.536
Male	5.35	(0.53, 54.50)	0.157
Lives Alone	1.25	(0.81, 1.93)	0.310
Medicaid	0.57	(0.10, 3.20)	0.523
Education Level:			
Less Than 8 Years	1.00		Ref
Some High School	1.64	(0.73, 3.66)	0.231
High School Graduate/GED	1.05	(0.50, 2.20)	0.906
Some College	1.79	(0.83, 3.88)	0.138
College Graduate	0.81	(0.31, 2.06)	0.652
VA Service Connected Status:			
100%	2.16	(1.23, 3.79)	0.007
50-99%	0.83	(0.44, 1.57)	0.566
1-49%	1.28	(0.69, 2.39)	0.433
Not Service Connected	1.00		Ref
Co-Morbidities and Disease Severity			
Charlson Comorbidity Index Score	1.05	(1.00, 1.10)	0.077
Functional Measures			
In 2 Weeks Prior to Hospitalization Needed More Help with Bathing, Dressing, Transferring and/or Toileting	1.42	(0.85, 2.37)	0.183
In 2 Weeks Prior to Hospitalization Experienced a Decline in Ability to Stand or Walk	0.75	(0.47, 1.20)	0.226
Manages Own Medications	0.73	(0.47, 1.14)	0.168

* Multivariate logistic regression adjusting for all characteristics included within the tables using robust estimates of variance; R2 0.0611

References

1. Coleman EA, Parry C, Chalmers S, Min SJ. The care transitions intervention: Results of a randomized controlled trial. Arch Intern Med. 2006 Sep 25;166(17):1822-8.

2. Agency for Healthcare Research and Quality. Medication Reconciliation. Rockville, MD: AHRQ; 2012 [cited 2012 September 17th]; Available from: http://www.psnet.ahrq.gov/primer.aspx?primerID=1.

3. Cowan N, Morey CC, Chen Z, Gilchrist AL, Saults JS. Theory and measurement of working memory capacity limits. Psychol Learn Motiv. 2008;49:49-104.

4. Reisch LM, Fosse JS, Beverly K, Yu O, Barlow WE, Harris EL, et al. Training, quality assurance, and assessment of medical record abstraction in a multisite study. Am J Epidemiol. 2003 Mar 15;157(6):546-51.

5. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. J Clin Epidemiol. 1994 Nov;47(11):1245-51.

6. Kieszak SM, Flanders WD, Kosinski AS, Shipp CC, Karp H. A comparison of the Charlson comorbidity index derived from medical record data and administrative billing data. J Clin Epidemiol. 1999 Feb;52(2):137-42.