

Trauma Transitional Care Coordination: protecting the most vulnerable trauma patients from hospital readmission

Erin C Hall,¹ Rebecca Tyrrell,² Thomas M Scalea,² Deborah M Stein²

¹Department of Surgery, Division of Trauma, MedStar Washington Hospital Center, Washington, District of Columbia, USA

²R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine, Baltimore, Maryland, USA

Correspondence to

Dr Erin C Hall, Department of Surgery, Division of Trauma, MedStar Washington Hospital Center, Washington DC 20010, USA; erin.c.hall@medstar.net

This was presented at the 75th Annual Meeting of the American Association for the Surgery of Trauma, September 2016, Waikoloa, Hawaii.

Received 1 December 2017

Revised 12 January 2018

Accepted 16 January 2018

ABSTRACT

Background Unplanned hospital readmissions increase healthcare costs and patient morbidity. We hypothesized that a program designed to reduce trauma readmissions would be effective.

Methods A Trauma Transitional Care Coordination (TTCC) program was created to support patients at high risk for readmission. TTCC interventions included call to patient (or caregiver) within 72 hours of discharge to identify barriers to care, complete medication reconciliation, coordination of appointments, and individualized problem solving. Information on all 30-day readmissions was collected. 30-day readmission rates were compared with center-specific readmission rates and population-based, risk-adjusted rates of readmission using published benchmarks.

Results 260 patients were enrolled in the TTCC program from January 2014 to September 2015. 30.8% (n=80) of enrollees were uninsured, 41.9% (n=109) reported current substance abuse, and 26.9% (n=70) had a current psychiatric diagnosis. 74.2% (n=193) attended outpatient trauma appointments within 14 days of discharge. 96.3% were successfully followed. Only 6.6% (n=16) of patients were readmitted in the first 30 days after discharge. This was significantly lower than both center-specific readmission rates before start of the program (6.6% vs. 11.3%, $P=0.02$) and recently published population-based trauma readmission rates (6.6% vs. 27%, $P<0.001$).

Discussion A nursing-led TTCC program successfully followed patients and was associated with a significant decrease in 30-day readmission rates for patients with high-risk trauma. Targeted outpatient support for these most vulnerable patients can lead to better utilization of outpatient resources, increased patient satisfaction, and more consistent attainment of preinjury level of functioning or better.

Level of evidence Level IV.

BACKGROUND

Unplanned 30-day readmissions after trauma hospitalization are associated with a twofold increase in risk of death at 1 year and threefold higher per-patient expense.¹ One-fourth of annual Medicare expenditures in the USA are a result of 30-day hospital readmissions. As part of an effort to improve quality and reduce healthcare costs, the Hospital Readmission Reduction Program was instituted in 2012. This program reduces Medicare payments for hospitals with excessive readmissions for specific conditions and procedures,

including heart attack, heart failure, pneumonia, chronic obstructive pulmonary disease, hip/knee replacement, and coronary artery bypass graft surgery.²

Given the association with worse outcomes and the economic pressure from the Hospital Readmission Reduction Program, there has been much interest in reducing the 30-day readmission rate in medical patients.³⁻⁸ Transitional care coordination is a set of interventions that has been proven effective in reducing 30-day readmission rates in patients with complex chronic medical conditions.⁹⁻¹¹ The hallmarks of transitional care include focus on highly vulnerable, chronically ill patients throughout clinical transitions in health and health-care; the time-limited nature of the services; and the emphasis on education of patients and family caregivers to address root causes of poor outcomes and avoid preventable rehospitalizations.¹² The interventions that have been proven the most effective in successful transitional care programs for chronic medical diseases have included active care coordination by a nurse, active medication reconciliation, communication between primary caregivers and hospital, and home visitation.¹³

As trauma survival improves and trauma care becomes more complex, it is increasingly recognized that certain traumas create chronic disease. The form of this chronicity may be different for different patients. On discharge trauma patients may have separate appointments with a panoply of specialists, new medications for anticoagulation requiring monitoring, newly diagnosed chronic medical conditions, or even completely new anatomy. All of which may have profound long-term consequences for the patient. Although there is a movement in the trauma community to gather longer term outcomes,¹⁴ there are few, if any, interventions described to improve patient-centered outcomes for at-risk trauma patients after discharge.

It was our objective to design and implement a Trauma Transitional Care Coordination (TTCC) program based on traditional transitional care coordination models for chronic medical conditions. The aim of this program was to identify and support those trauma patients at highest risk for readmission and reduce overall readmission rates in this population. Additional outcome measures included trauma clinic appointment attendance, new primary care provider appointment attendance, and enrollee perception of the program.

To cite: Hall EC, Tyrrell R, Scalea TM, et al. *Trauma Surg Acute Care Open* 2018;**3**:1–4.

**Table 1** Identified risk factors for readmission

Social factors	Any previous readmission
	Lack of home assistance/care services
	Poor or absent insurance
Medical history	Psychiatric disease
	Drug abuse
	Multiple comorbidities without primary care
Trauma sequelae	Pulmonary embolism without primary care
	Vascular injury without primary care
	New tracheostomy
	New traumatic brain injury
	High-output fistula
	Large, open wounds before definitive closure

METHODS

Using a combination of literature review and expert clinical opinion from a panel of experienced trauma providers including nurses, case managers, intensivists, and surgeons, risk factors for readmission were defined (table 1).

Patients who had any of the risk factors were identified prior to discharge. A full-time Trauma Transitional Care coordinator supervised the following interventions: call to patient (or caregiver) within 72 hours of discharge to identify barriers to care, complete medication reconciliation, coordination of medical appointments or home visits, and individualized problem solving (table 2).

Information on all 30-day readmissions was collected using phone interviews and inperson meetings with TTCC coordinators. The 30-day readmission rates were compared with the center-specific readmission rate using the year prior to the initiation of the TTCC program. This comparison rate was the raw readmission rate for all trauma admissions to our center. The 30-day readmission rate of TTCC enrollees was also compared with population-based, risk-adjusted rates of readmissions using published benchmarks. Information was also collected on completion of follow-up outpatient trauma appointments and new primary care provider appointments.

After completion of the program, each enrollee was asked to complete a 10-item exit questionnaire over the phone. The instrument was designed to gauge enrollee perception of the program, helpfulness of services provided, and ability of enrollees to gain independence in identifying complications and taking care of their new normal.

Table 2 Timeline for Trauma Transitional Care Coordination interventions TTCC

Before discharge	Identification of high-risk patient
	Initial meeting with TTCC coordinator
Within 72 hours of discharge	Call to patient or caregiver
	Identification of barriers to care
	Complete medication reconciliation
Ongoing	Coordination of medical care/appointments
	Personalized problem solving

TTCC, Trauma Transitional Care Coordination.

Table 3 Causes of 30-day readmissions among Trauma Transitional Care Coordination enrollees

Non-preventable	Worsening of known infections (8)
Preventable	Inadequate culture follow-up (1)
	Symptomatic pleural effusion (1)
	Incorrect discharge medications (1)
	Inappropriate discharge location (5)

RESULTS

Two hundred and sixty patients were enrolled in the TTCC program from January 2014 to September 2015. The average age of enrollees was 41 years old (SD=14), the mean injury severity score was 14.6 (SD=10.2), and the mean length of stay was 11 days (SD=10.5). The majority of enrollees were white (53%), with 38% African-American enrollees and 9% listed as other. Most enrollees had blunt trauma (73%).

Of our 260 enrollees, 30.8% (n=80) were uninsured, 41.9% (n=109) reported current substance abuse, 26.9% (n=70) had a current psychiatric diagnosis, and 55.4% (n=144) had multiple comorbidities without a primary care provider.

Only 9 out of 260 patients were lost to follow-up. Seventy-four percent (n=193) of enrollees attended trauma clinic appointments within 14 days of discharge. Forty-four percent (n=115) attended new primary care provider appointments within 30 days of discharge.

The 30-day readmission rate was 6.6% (n=16). This readmission rate was significantly lower than our center-specific readmission rate for the year prior to initiation of the TTCC program (6.6% vs. 11.3%, P=0.02). This 30-day readmission rate was also lower than the previously published figure of 27% readmission rate among 174318 injured patients treated at trauma centers in California (P<0.001).¹ Of the 16 readmissions, 8 were non-preventable and 8 were preventable (table 3).

Of those enrollees who completed the program, 59.6% (n=155) completed the exit questionnaire. All survey participants agreed with the statement 'I feel more prepared and in more control of my new healthcare needs. I am able to take care of myself and my new normal'. In addition, all survey participants agreed with the statements 'The TTCC helped me understand why my medications are important, and when and how to take them' and 'I had multiple appointments that were easy for me to attend because the TTCC was helpful in helping me sort them out'.

DISCUSSION

The TTCC program was able to significantly reduce 30-day readmission rates among patients with high-risk trauma compared with previous center-specific rates and population benchmarks. TTCC also demonstrated feasibility of long-term follow-up with 96.6% of enrollees completing the program. All of those TTCC enrollees who completed the exit questionnaire felt prepared to take care of themselves and their new normal.

Previously published 30-day readmission rates after trauma range from 7% to 30%.¹⁵⁻²¹ Some of this variability comes from collection method and from specific trauma population studied. Most of the readmission rates less than 10% come from single-center studies without complete follow-up.^{15 22 23} Most of the published 30-day readmission rates for trauma also include all trauma patients at each center, not just those patients at high risk for readmission.^{19 24 25} We used two different readmission rates as a basis of comparison. Our center-specific rate of 11.3%

includes readmissions from all trauma patients, even those with a very low risk of readmission. We were able to demonstrate a lower rate of 30-day readmissions in our high-risk TTCC cohort than this baseline. We also wanted to compare our TTCC readmission rate with previously published population-based 30-day readmission rates for trauma patients. The Staudenmayer article that we use for our benchmark is both population-based and stratifies 30-day readmission rates by injury severity. This allows comparison of the 30-day readmission rate between our TTCC enrollees and a trauma population that is more similar to them. TTCC enrollees have a significantly lower rate of 30-day readmissions than both groups.

We were also able to demonstrate improved utilization of outpatient resources. Almost 75% of enrollees had follow-up outpatient trauma appointments and 44% had new primary care provider appointments. There were no preventable visits to the emergency department. All enrollees who completed the exit questionnaire agreed that TTCC helped with knowing when to contact the trauma team, coordinating and keeping outpatient appointments, and ultimately feeling in control and able to take care of themselves.

Focusing on long-term outcomes in trauma patients has long been considered a pipe dream. Although our survival rates at level I trauma centers have hovered around 95% for almost a decade, there has been little work published defining and tracking longitudinal trauma outcomes. There is a pervasive feeling that trauma patients are inherently unreliable and that follow-up will always be lousy. We have demonstrated, however, that long-term follow-up is possible, particularly when the aim is active coordination and delivery of care. Our completion rate was 96.6% among trauma patients who were purposefully chosen to be at the highest risk for loss to care and follow-up. This is an important finding. It is evidence that it is possible to track and impact outpatient trauma outcomes even in the most vulnerable of populations.

Our own center's journey to the creation of the TTCC program began in 2009, when we first started examining our readmissions. One of our case managers at the time became interested in transitional care coordination and how it might apply to trauma patients. She worked with hospital transitional care coordinators who specialized in chronic medical conditions to help develop a trauma-specific transitional care coordination program. Critical specialized training for TTCC coordinators includes knowledge of community-specific resources, insurance, available outpatient services, a familiarity with common treatments, and how to do motivational interviewing. The most important qualities in a trauma transitional care coordinator are knowledge of the trauma population and ability to meet the patient where they are and make it work without judgment. Our TTCC program is supported through the nursing and operations budget, and that support is aimed at funding the TTCC coordinator positions. Other resources used by TTCC coordinators are those already available through case management, outpatient clinic, and the hospital itself through the usual means. The biggest barrier to implementation of the program has been lack of understanding to the unique role TTCC can play. One-on-one education and ongoing group lectures for doctors, advanced practitioners, case managers, and nurse managers have helped the most to decrease this barrier.

One limitation to our study is the comparison populations for our 30-day readmission rate. The first comparison population we used was our own center-specific readmission rate. This rate has the inherent problems of being only a single center (therefore 'missing' readmissions to other hospitals or

institutions) and having no risk adjustment for readmission built in. The center-specific rate we used included all admitted trauma patients. To try and compare our TTCC participants with a trauma population whose baseline readmission risk was more like their own, we also used a population-based rate for comparison.¹ However, this comparison rate does not take into account the added risk associated with previous hospital readmissions, increased comorbidities, lack of resources, psychiatric history, and specific injury patterns that our TTCC enrollees had. All of these factors have been shown individually to increase risk of 30-day readmission.^{18-20,26} It could be the specific decrease in risk of 30-day readmission attributable to TTCC is greater when these factors are taken into account.

Another limitation to this study is using 30-day readmissions as our outcome measure. Readmissions have been associated with worse patient outcomes and higher cost and therefore have become an easily measurable and accepted substitution for poor outcome. Our next steps include tracking and comparing the actual longitudinal outcomes of TTCC enrollees and non-TTCC enrollees. The trauma community as a whole is struggling to define what these long-term, patient-centered outcomes are.²⁷ Bobrovitz *et al*²⁸ have developed and validated the Quality of Trauma Care Patient-Reported Experience Measure. Other measures might include return to work or school; functional and social status; and initiation and participation in needed health or support services. There is general agreement that there is a dearth of validated longitudinal outcome measures for trauma patients, and part of the work ahead is the development of meaningful, actionable, and measurable quality indicators.²⁹

Consistent with previous studies of transitional care coordination for chronic medical conditions, we have demonstrated that targeted outpatient support for at-risk trauma patients can lead to decreased 30-day readmission rates, better utilization of outpatient resources, increased patient satisfaction, and more consistent attainment of preinjury level of functioning or better. Institution of similar programs at other trauma centers could improve long-term outcomes and help contain healthcare cost on a national level.

Contributors ECH contributed to the conception and design of this project, analysis and interpretation of the data, and writing of the manuscript. RT contributed to the conception and design of this project, the acquisition of data, and contributed substantially to the writing and revising of the manuscript. DMS contributed to the conception and design of this project and the writing and revising of the manuscript. TMS contributed to the conception and design of this project and the writing and revising of the manuscript.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

Open Access This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

© Article author(s) (or their employer(s) unless otherwise stated in the text of the article) 2018. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 Staudenmayer K, Weiser TG, Maggio PM, Spain DA, Hsia RY. Trauma center care is associated with reduced readmissions after injury. *J Trauma Acute Care Surg* 2016;80:412–8.
- 2 cms.gov. *Readmissions reduction program*. Baltimore, MD: Centers for Medicare & Medicaid Services, 2016.



- 3 Calvillo-King L, Arnold D, Eubank KJ, Lo M, Yunyongying P, Stieglitz H, Halm EA. Impact of social factors on risk of readmission or mortality in pneumonia and heart failure: systematic review. *J Gen Intern Med* 2013;28:269–82.
- 4 Chambers M, Clarke A. Measuring readmission rates. *BMJ* 1990;301:1134–6.
- 5 Coleman EA. Falling through the cracks: challenges and opportunities for improving transitional care for persons with continuous complex care needs. *J Am Geriatr Soc* 2003;51:549–55.
- 6 Hansen LO, Young RS, Hinami K, Leung A, Williams MV. Interventions to reduce 30-day rehospitalization: a systematic review. *Ann Intern Med* 2011;155:520–8.
- 7 Murtaugh CM, Deb P, Zhu C, Peng TR, Barrón Y, Shah S, Moore SM, Bowles KH, Kalman J, Feldman PH, Siu AL. Reducing readmissions among heart failure patients discharged to home health care: effectiveness of early and intensive nursing services and early physician follow-up. *Health Serv Res* 2017;52.
- 8 Stukel TA, Fisher ES, Alter DA, Guttman A, Ko DT, Fung K, Wodchis WP, Baxter NN, Earle CC, Lee DS. Association of hospital spending intensity with mortality and readmission rates in Ontario hospitals. *JAMA* 2012;307:1037–45.
- 9 Alvarez R, Ginsburg J, Grabowski J, Post S, Rosenberg W. The social work role in reducing 30-day readmissions: the effectiveness of the bridge model of transitional care. *J Gerontol Soc Work* 2016;59:222–7.
- 10 Brock J, Mitchell J, Irby K, Stevens B, Archibald T, Goroski A, Lynn J. Care Transitions Project Team. Association between quality improvement for care transitions in communities and rehospitalizations among Medicare beneficiaries. *JAMA* 2013;309:381–91.
- 11 Jackson CT, Trygstad TK, DeWalt DA, DuBard CA. Transitional care cut hospital readmissions for North Carolina Medicaid patients with complex chronic conditions. *Health Aff* 2013;32:1407–15.
- 12 Naylor MD, Aiken LH, Kurtzman ET, Olds DM, Hirschman KB. The care span: the importance of transitional care in achieving health reform. *Health Aff* 2011;30:746–54.
- 13 Verhaegh KJ, MacNeil-Vroomen JL, Eslami S, Geerlings SE, de Rooij SE, Buurman BM. Transitional care interventions prevent hospital readmissions for adults with chronic illnesses. *Health Aff* 2014;33:1531–9.
- 14 Rios-Diaz AJ, Herrera-Escobar JP, Lilley EJ, Appelson JR, Gabbe B, Brasel K, deRoos-Cassini T, Schneider EB, Kasotakis G, Kaafarani H, Velmahos G, Salim A, Haider AH. Routine inclusion of long-term functional and patient-reported outcomes into trauma registries: The FORTE project. *J Trauma Acute Care Surg* 2017;83:97–104.
- 15 Copertino LM, McCormack JE, Rutigliano DN, Huang EC, Shapiro MJ, Vosswinkel JA, Jawa RS. Early unplanned hospital readmission after acute traumatic injury: the experience at a state-designated level-I trauma center. *Am J Surg* 2015;209:268–73.
- 16 Marcin JP, Romano PS. Impact of between-hospital volume and within-hospital volume on mortality and readmission rates for trauma patients in California. *Crit Care Med* 2004;32:1477–83.
- 17 Moore L, Stelfox HT, Turgeon AF, Nathens AB, Lavoie A, Bourgeois G, Lapointe J. Derivation and validation of a quality indicator for 30-day unplanned hospital readmission to evaluate trauma care. *J Trauma Acute Care Surg* 2014;76:1310–6.
- 18 Moore L, Stelfox HT, Turgeon AF, Nathens AB, Le Sage N, Émond M, Bourgeois G, Lapointe J, Gagné M, Rates GM. Rates, patterns, and determinants of unplanned readmission after traumatic injury: a multicenter cohort study. *Ann Surg* 2014;259:374–80.
- 19 Olufajo OA, Cooper Z, Yorkgitis BK, Najjar PA, Metcalfe D, Havens JM, Askari R, Brat GA, Haider AH, Salim A. The truth about trauma readmissions. *Am J Surg* 2016;211:649–55.
- 20 Olufajo OA, Metcalfe D, Yorkgitis BK, Cooper Z, Askari R, Havens JM, Brat GA, Haider AH, Salim A. Whatever happens to trauma patients who leave against medical advice? *Am J Surg* 2016;211:677–83.
- 21 Vachon CM, Aaland M, Zhu TH. Readmission of trauma patients in a nonacademic Level II trauma center. *J Trauma Acute Care Surg* 2012;72:531–6.
- 22 Ladha KS, Young JH, Ng DK, Efron DT, Haider AH. Factors affecting the likelihood of presentation to the emergency department of trauma patients after discharge. *Ann Emerg Med* 2011;58:431–7.
- 23 Morris DS, Rohrbach J, Sundaram LM, Sonnad S, Sarani B, Pascual J, Reilly P, Schwab CW, Sims C. Early hospital readmission in the trauma population: are the risk factors different? *Injury* 2014;45:56–60.
- 24 Fawcett VJ, Flynn-O'Brien KT, Shorter Z, Davidson GH, Bulger E, Rivara FP, Arbabi S. Risk factors for unplanned readmissions in older adult trauma patients in Washington State: a competing risk analysis. *J Am Coll Surg* 2015;220:330–8.
- 25 Petrey LB, Weddle RJ, Richardson B, Gilder R, Reynolds M, Bennett M, Cook A, Foreman M, Warren AM. Trauma patient readmissions: Why do they come back for more? *J Trauma Acute Care Surg* 2015;79:717–24.
- 26 Rivara FP, Koepsell TD, Jurkovich GJ, Gurney JG, Soderberg R. The effects of alcohol abuse on readmission for trauma. *JAMA* 1993;270:1962–4.
- 27 Gruen RL, Gabbe BJ, Stelfox HT, Cameron PA. Indicators of the quality of trauma care and the performance of trauma systems. *Br J Surg* 2012;99(Suppl 1):97–104.
- 28 Bobrovitz N, Santana MJ, Boyd J, Kline T, Kortbeek J, Widder S, Martin K, Stelfox HT. Short form version of the Quality of Trauma Care Patient-Reported Experience Measure (SF QTAC-PREM). *BMC Res Notes* 2017;10:693.
- 29 Stelfox HT, Straus SE, Nathens A, Bobranska-Artiuch B. Evidence for quality indicators to evaluate adult trauma care: a systematic review. *Crit Care Med* 2011;39:846–59.