Evaluating the effects of a multidisciplinary transition care management program on hospital readmissions

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DOI 10.1093/ajhp/zxaa091

Purpose. To measure the effect of a pharmacist-initiated transitions of care (TOC) program on rates of 30-day all-cause readmissions and primary care follow-up.

Methods. A retrospective cohort study was conducted to evaluate a pharmacist-initiated TOC program for patients discharged from hospitals of a large health system from September 2015 through July 2016. Discharged patients of 13 primary care physicians (the intervention cohort) received TOC program services, and discharged patients seen by 12 other primary care physicians (the control cohort) received usual care. Patients in both cohorts were followed for 90 days. The primary outcome was 30-day all-cause readmissions, and secondary outcomes were 14-day primary care visits, TOC pharmacist identification and resolution of medication therapy problems (MTPs), and transition care management (TCM) billing. Multivariable modeling was performed to test the associations of patient receipt of TOC services with 30-day readmissions and 14-day primary care visits, with controlling for patient demographics and baseline healthcare utilization.

Results. A total of 492 patients received the TOC intervention, and 379 were followed in the usual care cohort. Among intervention patients, 960 MTPs were identified, and 85.7% of identified MTPs were resolved. Moreover, 9% of intervention cohort patients were readmitted within 30 days, compared to 15% of control cohort patients, and this effect was significant in the multivariable model (odds ratio, 1.82; 95% confidence interval, 1.15-2.89; P = 0.0108). Rates of primary care visits did not differ significantly between the groups; 65% of intervention group visits were billed using TCM codes.

Conclusion. A pharmacist-initiated TOC program was effective in reducing 30-day all-cause readmissions.

Keywords: care transitions, medication therapy management, medication reconciliation, pharmacists

Am J Health-Syst Pharm. 2020;77:931-937

It is well documented that the hospital discharge process introduces care coordination challenges, frequently resulting in inadequate patient monitoring following discharge.[1] Consequently, hospital discharges are commonly associated with adverse events, including unplanned readmission.[1] In an effort to reduce preventable hospital readmissions among Medicare beneficiaries, the Hospital Readmissions Reduction Program (HRRP) was launched by the Centers for Medicare and Medicaid Services (CMS) in 2012.[2] This program reduces hospital payments associated with 6 specific conditions by up to 3% for institutions with excess readmissions.[2] In response, hospitals nationwide have implemented various strategies aimed at improving the discharge process and reducing readmissions. However, recent evidence suggests that the effect of the HRRP on readmissions has been overestimated, partly due to changes in how patient diagnoses are documented during billing.[3] Further research

is needed to better understand what role, if any, HRRP has had in reducing readmissions.[3]

To promote further focused management of care transitions by health systems, CMS introduced 2 new transitional care management (TCM) Current Procedural Terminology (CPT) codes in 2013.[4] To bill for TCM, eligible providers must provide 3 service components: (1) interactive contact with a patient and/or caregiver within 2 business days of hospital discharge, (2) non–face-to-face services (eg, education, referrals to community-based resources) as needed, and (3) a face-to-face provider visit within 7 or 14 calendar days of discharge according to patient complexity.[4] One study found that although TCM services were associated with reduced healthcare costs and mortality, billing for TCM services occurred in only about 7% of eligible hospital discharges in 2015.[5] Furthermore, TCM services were not widespread, with 10% of practices accounting for almost 70% of TCM billing.[5] Physician office workflow challenges, including the need to identify a team member to make the initial contact, may be factors contributing to low TCM use.[5] Pharmacists are well positioned to assist with TCM components, and roles for pharmacists in TCM services have been described.[6,7]

In fact, several transition of care (TOC) programs have included pharmacist interventions. However, many evaluations have been limited by short study periods and/or small sample sizes.[8-12] Evaluations have also produced inconsistent conclusions regarding effectiveness.[13-15] Some have reported descriptive statistics regarding pharmacist interventions only.[16] Moreover, to our knowledge there have been no controlled evaluations of pharmacist-led TOC evaluations that describe effects on both readmissions and opportunities for TCM billing. Therefore, the objective of the study described here was to measure the effect of a pharmacist-initiated, multidisciplinary TOC program on (1) 30-day all-cause readmissions and (2) 14-day postdischarge primary care provider visits and to characterize MTP identification and resolution and TCM billing.

KEY POINTS

- A retrospective cohort study was conducted to evaluate a pharmacist-led transition of care program's effect on 30-day hospital readmissions and primary care follow-up visits and to characterize medication therapy problems identified and the extent of transition care management (TCM) billing among intervention group patients.
- A significant reduction in 30-day readmissions was found when controlling for demographic and other variables.
- There was no significant between-group difference in rates of follow-up visits; 65% of intervention group follow-up visits were billed using TCM codes.

Methods

Setting and overview of TOC program. Indiana University Health–Arnett (IUHA) is comprised of a 175–adult bed hospital located in Lafayette, IN, and 4 outpatient facilities. IUHA is part of the statewide Indiana University Health (IU Health) system. As of 2015, approximately 853 discharges per month occurred at IUHA hospital. To promote care coordination and prevent avoidable readmissions, a pilot pharmacist-initiated TOC program was launched in February 2015 to serve patients of 4 IUHA primary care physicians. The program was well received by primary care providers and patients, and pilot program data (unpublished) suggested the program was successful in reducing readmissions. Therefore, IUHA decided to scale the program to patients served by additional primary care physicians.

The scaled program consisted of several steps. After generating a daily report of all patient discharges, a dedicated TOC pharmacist (1 full-time equivalent) would (1) review each patient's discharge instructions, (2) determine whether a postdischarge primary care provider follow-up visit had been scheduled, (3) make contact with the patient and/or caregiver by telephone within 2 business days of discharge to review discharge instructions and confirm receipt of discharge medications, (4) conduct a comprehensive medication reconciliation in the outpatient electronic medical record, and (5) provide, during a telephone call, education on discharge instructions, also identifying and resolving MTPs and, when needed, scheduling the primary care follow-up visit. Follow-up visits could occur with physicians or nonphysician midlevel providers (physician assistants and nurse practitioners). Resolution of MTPs occurred by telephone (eg, through provision of adherence education to the patient), through notes to the physician entered in the electronic medical record, or through other interventions (eg, telephone calls to a patient's community pharmacy.) Some of the pharmacist's responsibilities (eg, phone contact within 2 business days) were designed to promote practice alignment with TCM CPT billing requirements, and intervention group physicians were individually trained on TCM CPT billing requirements and encouraged to use TCM CPT codes for billing when appropriate.

Study design. We evaluated the TOC program by applying a retrospective cohort study design. During program implementation, 25 primary care physicians from the 4 outpatient facilities were identified. In an effort to create a reasonable comparison group for program evaluation, the IUHA team matched the physicians by patient panel size and type of primary care clinic (eg, internal medicine, family medicine) within each facility, and

divided them into 2 groups of physicians (one group of 13 and another group of 12) balanced for panel size. The group of 13 primary care physicians was assigned to initially participate in the TOC program. The IUHA team then approached these physicians to confirm their willingness to have their patients receive TOC pharmacist services. Only 1 physician declined, and this physician was replaced by another physician from the same clinic. Therefore, discharged patients of these 13 primary care physicians represented the intervention cohort and received the TOC program during the study observation period (September 2015 through July 2016), with the last evaluated discharges occurring on July 31, 2016. Discharged patients of the remaining 12 primary care physicians during the same time period served as the control cohort. Patients in both cohorts were followed for 90 days after discharge. This follow-up period was chosen to provide adequate time for ascertainment of both primary and secondary outcomes data.

For both cohorts, patients were included if they were Medicare insurance beneficiaries, were discharged to their home or an assisted living facility following an inpatient or observation stay in a general medical/surgical or intensive care unit, required primary care follow-up, and had an IUHA primary care physician who participated in the study. Exclusion criteria included the following: discharge from a specialty unit (eg, labor/delivery unit), discharge with no identified need for primary care follow-up (eg, as indicated by a notation in the discharge summary), discharge or transfer to another acute care or a long-term care facility, and insurance other than Medicare or no insurance.

The primary outcome was 30-day all-cause hospital readmission. Secondary outcomes included primary care physician visits (ie, visits to primary care, family medicine, or internal medicine physicians) within 14 days of discharge and, within the intervention group, a description of the TOC pharmacist's activities, including MTPs identified and/or resolved and the numbers and types of interventions made. We also measured 14-day visits to a primary care provider (including nurse practitioners and physician assistants) and summarized the number and proportion of intervention cohort primary care visits that were billed using TCM CPT codes 99495 or 99496 (these codes were not used by control group providers).

Data collection. The data source for hospital readmissions and 14-day follow-up visits was the IU Health data warehouse, which is a secure, central repository of clinical data (ie, electronic medical record documentation) and financial data (ie, insurance claims) associated with patient encounters from across the IU Health system. Additional variables (ie, covariates in our models) were also collected from the data warehouse and included patient demographics (age, sex, and race), healthcare utilization in the 12 months prior to discharge (numbers of outpatient, inpatient, and emergency department visits), number and type of comorbidities, and baseline risk for readmission within 30 days. Comorbidities and discharge diagnoses were determined using *International Classification of Diseases, Ninth Revision* (ICD-9) codes (for discharges from September 2014 through August 2015) or *ICD Tenth Revision* (ICD-10) codes (for discharges from September 2015 through July 2016) through review of all encounter data for 1 year prior to the discharge date and used to estimate medical comorbidities using the Elixhauser method.[17-19] Baseline risk of 30-day readmission was estimated using the LACE index score, a validated score which is derived from length of stay of index admission, acuity of the admission, comorbidities, and number of emergency department visits in the prior 6 months.[20] The LACE score ranges from 0 to 19, with a score of 0 to 4 indicating low readmission risk, a score of 5 to 9 indicating moderate risk, and a score of ≥10 indicating high risk.[21,22] TOC pharmacist interventions, including MTPs identified and resolved (as determined through communication with physicians or electronic medical record review by the pharmacist), were documented by the pharmacist in a Microsoft Excel (Microsoft Corporation, Redmond, WA) database. The Cipolle framework[23] was applied to guide the characterization of MTPs.

Data analysis. Baseline patient characteristics and outcome measures were summarized as frequencies and percentages for categorical variables, as mean (SD) values for normal continuous variables, and medians and interquartile ranges for non-normal continuous variables. Univariate differences in patient characteristics between the intervention and control cohorts were compared using Student's *t* test or a Wilcoxon test for continuous variables and a χ^2 test for categorical variables.

For the primary analysis, univariate and multivariable generalized linear mixed models were used to test for differences in readmission and primary care visit outcomes between the intervention and control cohorts. Random effects for facility and for physician nested within facility were used to account for the correlation of patients being nested by physician and facility. Covariates included patient age, sex, race, LACE score (both numeric and categorical versions were considered), and other variables with a *P* value of <0.10 based on univariate tests comparing intervention vs control group outcomes and assessing whether a covariate was related to a given outcome. Variables significant at the 0.10 level were not included in the multivariable model if they were already used in LACE score calculation. Patients were regrouped by race as white or nonwhite due to small samples in some of the categories. Similarly, obesity was dichotomized as present (including overweight and obesity classes 1 through 3) or not present. A 5% significance level was used for tests of the intervention effect and covariates in the final multivariable models. Post hoc power analyses were

conducted to examine whether sufficient power was present to detect differences in primary care visit outcomes. These analyses were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC). Descriptive statistics summarizing MTP identification and/or resolution and TCM CPT billing were computed using SPSS version 23.0 (IBM, Inc., Armonk, NY). The evaluation was approved by the Indiana University institutional review board in May 2016 in anticipation of readiness by IUHA to conduct the evaluation and expand the program to more physicians shortly thereafter.

Results

Cohort characteristics. Patient characteristics are summarized in Table 1. A total of 492 patients received the TOC intervention, and 379 were followed in the usual care cohort. Overall, patients in both cohorts were mostly white females, with an average age of approximately 74 years. The groups were similar overall. However, the intervention group had a greater proportion of females (58% vs 51%, $P = 0.038$), and the distributions of LACE scores were different between groups ($P < 0.0001$), with the intervention group appearing to have a greater proportion of patients at the highest baseline risk for readmission.

30-day all-cause hospital readmissions. A smaller proportion of intervention cohort patients (44 of 492, or 9%) were readmitted within 30 days, as compared to the control cohort (55 or 379 patients, or 15%), but this difference was not significant in the univariate analysis (odds ratio [OR], 1.77; 95% confidence interval [CI], 0.93-3.35; $P = 0.08$). In univariate models (data not shown; results available by request), the following covariates were significantly different between the intervention and control groups and/or associated with 30-day all-cause hospital readmission and entered into the multivariable model: patient age, LACE score (both numeric and categorical, with the numerical measure chosen for parsimony), sex, race, number of previous inpatient visits, and selected comorbidities (paralysis, hypothyroidism, alcoholism, obesity, hypertension, drug abuse, and valvular disease). In addition to study group (intervention or control), the following variables were significant in the multivariable model (Table 2): LACE score, number of previous inpatient visits, drug abuse, and valvular disease. In the final model, the odds of 30-day readmission were 1.82 times higher (95% CI, 1.15-2.86; $P = 0.0108$) in the control group than in the intervention group.

14-day postdischarge primary care visits. There was no significant difference between the cohorts in the proportions of patients with a primary care physician visit within 14 days in the univariate model: 59% of intervention patients ($n = 288$) vs 62% of control patients ($n = 235$)(OR, 1.92; 95% CI, 0.75-1.91; $P = 0.46$). Results for this outcome also were not significant when controlling for covariates in the multivariable model (OR, 1.27; 95% CI, 0.82-1.96; $P = 0.28$). There was also no significant difference between the cohorts in the proportion of patients with any primary care provider visit within 14 days in the univariate model: 71% ($n = 348$) in the intervention group vs 64% ($n = 243$) in the control group (OR, 0.78; 95% CI, 0.51-1.19; $P = 0.25$). Results for this outcome remained nonsignificant when controlling for covariates in the multivariable model (OR, 0.85; 95% CI, 0.55-1.31; $P = 0.45$).

Post hoc power calculations for the number of visits based on the F statistics for the group effect and corresponding numerator and denominator degrees of freedom in the respective

Table 1. Baseline Characteristics of Study Population, Overall and by Group

Characteristic or Variable	Overall ($n = 871$)	Control ($n = 379$)	Intervention ($n = 492$)	*P* Value
White race, No. (%)	860 (99)	371 (98)	489 (99)	0.049
Female, No. (%)	476 (55)	192 (51)	284 (58)	0.038
Age, mean (SD), y	73.9 (12.1)	73.4 (12.0)	74.3 (12.2)	0.252
Total number of comorbidities (per Elixhauser method), median (IQR)	3 (1-4)	3 (1-4)	3 (1.5-5)	0.230
No. of previous ED visits, median (IQR)	0 (0-1)	0 (0-1)	0 (0-1)	0.395
No. of previous inpatient visits, median (IQR)	0 (0-1)	0 (0-1)	0 (0-1)	0.773
No. of previous outpatient visits, median (IQR)	5 (3-8)	4 (3-8)	5 (3-8)	0.741
Readmission risk (per LACE score), No. (%)				<0.0001
High	321 (37)	129 (34)	192 (39)	
Moderate	508 (58)	217 (57)	291 (59)	
Low	42 (5)	33 (9)	9 (2)	

Abbreviations: ED, emergency department; IQR, interquartile range. LACE denotes LACE index, a measure of readmission based on length of stay for index admission, acuity of admission, comorbidities, and number of emergency department visits.

Table 2. Results of Multivariable Modeling of 30-Day Readmission Risk in Study Population (n = 871)

Variable	Odds Ratio (95% CI)	*P* Value
Group (control vs intervention)	1.82 (1.15-2.89)	0.0108
Age	0.99 (0.97-1.01)	0.2653
LACE score	1.21 (1.12-1.32)	<.0001
No. of previous inpatient visits	1.21 (1.03-1.42)	0.0194
Female vs male	1.14 (0.71-1.82)	0.5878
Nonwhite vs white	1.43 (0.26-7.92)	0.6821
Comorbidities[a]		
Paralysis	0.28 (0.04-1.97)	0.1982
Hypothyroidism	0.92 (0.57-1.48)	0.7256
Alcoholism	0.41 (0.12-1.35)	0.1416
Obesity	0.49 (0.22-1.08)	0.0772
Valvular disease	0.46 (0.27-0.78)	0.0044
Hypertension	0.72 (0.41-1.27)	0.2526
Drug abuse	0.26 (0.08-0.87)	0.0293

Abbreviations: CI, confidence interval. LACE denotes LACE index, a measure of readmission based on length of stay for index admission, acuity of admission, comorbidities, and number of emergency department visits.
[a]Results represent comborbidity variables as absent vs present.

multivariable models indicated that the observed power was 19% for primary care physician visit within 14 days and 12% for visit with any primary care provider within 14 days given an α level of 0.05.[24] Among 14-day follow-up visits received by the intervention cohort, 216 (75%) of the primary care physician visits and 226 (65%) of visits to any primary care provider were billed using one of the specified TCM CPT codes.

Pharmacist interventions. Among the 492 patients in the intervention group, the TOC pharmacist identified 960 MTPs and resolved 823 (85.7%) (Table 3). Medication nonadherence was the most common MTP identified.

Discussion

In 2013, the American Society of Health-System Pharmacists (ASHP) and the American Pharmacists Association jointly published best practices for pharmacists' involvement in care transitions. They identified elements of success relating to multidisciplinary support and collaboration, effective integration of the pharmacy team, availability of data to justify resources, electronic patient information and data transfer between inpatient and outpatient partners, and a strong partnership network.[25] At launch, the IUHA TOC program benefited from some of these elements (eg, multidisciplinary support and collaboration, effective integration of the pharmacy team) but was challenged by a lack of available data pertaining to program effectiveness.

The evaluation demonstrated that the TOC program reduced 30-day all-cause hospital readmissions but did not significantly increase the likelihood of patients following up with a primary care provider within 14 days of discharge. The findings suggest that a pharmacist-initiated TOC program, regardless of subsequent primary care follow-up, is an effective strategy that hospitals and health systems could use to reduce readmissions and improve reimbursement under the HRRP.[2] Our results are somewhat congruent with those of a meta-analysis of pharmacist roles in TOC programs.[26] In that analysis, programs with "patient-centered follow-up," defined as a pharmacist being "engaged in follow-up after the patient was discharged from the hospital," lowered 30-day readmissions by 30% (OR, 0.70; CI, 0.63-0.78) compared to usual care. Pharmacist follow-up care, which included either a clinic visit or a combination of more than 1 type of follow-up (whether it be face-to-face, clinic, home, or telephone follow-up), was shown to result in significant readmission reductions relative to readmission rates in programs without patient-centered follow-up. Our program involved use of a pharmacist for telephonic "patient-centered care" follow-up within 2 days post discharge, whereby the pharmacist not only ensured that patients had primary care follow-up appointments but, more importantly, identified and resolved MTPs.

Furthermore, it is notable that medication nonadherence and adverse drug reactions represented the majority of MTPs identified. Therefore, the TOC pharmacist was well positioned to intervene with the patient and achieve resolution, regardless of whether follow-up with a primary care provider occurred. In fact, the majority (85.7%) of MTPs identified were resolved, and approximately half were resolved directly with patients. Interestingly, medication nonadherence was the most common MTP identified in other evaluations of pharmacist TOC intervention models.[8,27] Considering pharmacists' unique training in the identification of MTPs and interventions to improve medication adherence, further research into the prevalence of medication nonadherence and roles for pharmacists to address nonadherence during care transitions is warranted.

Our findings also suggest that pharmacists might play an important role in assisting providers with TCM billing, which could result in additional revenue generation. In this evaluation, 65% of all follow-up primary care visits received by the intervention cohort patients were billed using one of the TCM CPT codes. This is a much higher

Table 3. Summary of MTP Identification and Resolution Outcomes in Intervention Group (n = 492)

Variable	Value
Time to pharmacist call, mean (SD), days	1.9 (1.2)
MTPs per patient, No. (%) patients	
0	42 (8.5)
1	110 (22.4)
2	181 (36.8)
≥3	159 (32.3)
Types of MTPs identified, No. (%) MTPs	
Nonadherence	373 (38.9)
Adverse drug reaction	270 (28.1)
Other	174 (18.1)
Ineffective drug	51 (5.3)
Unnecessary drug therapy	40 (4.2)
Additional drug therapy needed	27 (2.8)
Dose too high	13 (1.4)
Dose too low	12 (1.3)
Interventions made, No. (%) MTPs	
With patient	475 (49.5)
With prescriber	457 (47.6)
Other	28 (2.9)
MTP resolution status, No. (%) MTPs	
Resolved	823 (85.7)
Not resolved	105 (10.9)
Other	32 (3.4)

Abbreviation: MTP, medication therapy problem.

proportion than that reported in recent literature. Although Bindman et al[5] found that TCM was associated with reduced total healthcare costs and mortality, only 7% of eligible discharges in 2015 resulted in TCM billing. Future evaluations should determine the cost-effectiveness of pharmacist care transition models, to include both revenue generation through provision of TCM and cost avoidance resulting from averted rehospitalization.

There were strengths and limitations of the evaluation. A primary strength was the sample size, which was larger than those reported in several other evaluations of TOC pharmacist interventions[8-12] and sufficient for detecting a difference between groups in hospital readmissions. Other strengths included the use of a separate control group (as opposed to a pre-post design) and characterization of TCM billing among intervention patients. However, the evaluation was conducted in a single healthcare system, and neither primary care physician or patient assignment was randomized; rather, group assignments were based on physician interest in the program, panel size, and facility location. We also did not have sufficient power to detect a difference in secondary outcomes, as evidenced by our post hoc power calculations. Finally, our study population included only Medicare-eligible patients; therefore, the intervention and results may not be generalizable to broader groups of hospitalized patients.

Conclusion

A pharmacist-initiated TOC program was effective at reducing 30-day all-cause hospital readmissions, regardless of primary care follow-up after discharge. Among intervention patients who received a primary care follow-up visit, 65% received TCM services billed using a TCM CPT code. A pharmacist-initiated TOC model could be considered by hospitals to reduce preventable readmissions and increase revenue through TCM billing.

Acknowledgments

We thank Mary Ann Kozak, DrPH, for her contributions to the grant application.

Disclosures

The evaluation was funded by the ASHP Research and Education Foundation. A portion of Dr. Snyder's salary was supported by grant number K08HS022119 from the Agency for Healthcare Research and Quality (AHRQ). Dr. Davis and Dr. Krekeler are employees of IUHA. The other authors have declared no potential conflicts of interest.

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Additional information

This work was presented as a poster at the 2018 ASHP Midyear Clinical Meeting in Anaheim, CA. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of AHRQ.

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