

Reducing costs and improving care after hospitalization: Economic evaluation of a novel transitional care clinic

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Abstract

Transitional care management (TCM) is a novel strategy for reducing costs and improving clinical outcomes after hospitalization but remains under-utilized. An economic analysis was performed on a hospital-based transition of care clinic (TCC) open to all patients regardless of payor status. TCC reduced re-hospitalization and emergency department (ED) utilization at six-month follow up. A cost-consequence analysis based on real world data found the TCC intervention to be cost effective relative to usual care. Hospital managers should consider adoption of TCC to improve patient care and reduce costs.

Keywords

access to health services, cost effectiveness, patient readmission

Background

Healthcare expenditures in the U.S. healthcare system are increasing, in part driven by escalating costs related to hospitalizations for chronic, relapsing conditions. Compounding this problem is a fragmented health care delivery system where coordination of clinical care is not financially incentivized in large parts of the health care landscape, especially among the 27 million Americans who lack health insurance.¹ To address concerns around coordinated care and increasing costs, Medicare has developed a number of financial models for incentivizing hospital utilization for chronic conditions, including the Readmission Reduction Program (2010), bundled payments (2012), and more recently payment for Transitional Care Management (TCM) services (2014). CMS has defined TCM care by providing payment to physicians for coordinating and conducting post-discharge care among beneficiaries within a 30-day TCM post-discharge period. TCM services must involve an “interactive contact” defined as a phone call, email, or face-to-face visit within two business days after discharge, followed by an in-person visit within 7–14 days.²

This financial scheme reflects a growing interest in managing clinical outcomes and costs by extending

coordinated care efforts into the ambulatory realm after discharge. These **transitional care clinics** (TCC) have been evaluated and largely found to be effective and cost-saving for individual conditions. For heart failure, multi-disciplinary clinic interventions reduced all-cause readmissions, and telephone support interventions reduced heart failure readmissions.³ Clinical benefit for TCM after stroke suggests reduced length of stay, and some low-strength evidence shows possible reduced mortality after MI.⁴ TCM care has been associated with reduced mortality (1.0% versus 1.6%) over the first two months after discharge.⁵

CMS incentivizes a face-to-face physician encounter early after discharge, but no single clinical intervention has proven to be singularly dominant in effectiveness.

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A systematic review of 43 studies evaluating readmission reduction strategies failed to identify a single intervention to reduce 30-day rehospitalization risk. Analyzed interventions were highly heterogeneous.⁶ A multifaceted approach appears to improve efficacy. A randomized trial of a post-discharge bundle of care coordination (follow up, medicine reconciliation, and pharmacy support) reduced hospital and emergency department (ED) utilization by 31% in an urban safety-net hospital.⁷ Coleman et al. performed a trial of 750 community dwelling older adults (mean age 76) randomized to active care transition centered around medication self-management, patient communication, coordinated follow up, and identification of red flag complications. Hospitalization was reduced at 30 and 90 days (8.3 vs. 11.9 and 16.7 vs 22.5, respectively).⁸ Likewise, a systematic review and meta-analysis of 32 pharmacy-supported transition of care interventions observed a 32% reduction in admissions at 30 days.⁹

While varied in structure and format, Medicare expenditures from 2013 to 2015 showed reduction in costs among beneficiaries receiving TCM services. TCM services were associated with lower adjusted total Medicare costs per beneficiary (\$3033 versus \$3358).⁵ A quasi-experimental study of patient engagement, home visits, and telephone follow up among 2235 Medicare and Medicaid patients observed a 31% reduction in 30-day readmissions in a difference-in-difference analysis; expenditures per beneficiary were reduced over 6 months in this cohort by \$8690.¹⁰

Despite the evidence for improved outcomes and reduced costs, the penetrance of transitional care management programs in routine practice by health systems and individual health care providers remains limited. Claims reviews after implementing the CMS TCM program found that utilization was low (only 7% of eligible discharges by 2015).⁵ Adoption of CMS-funded TCM was observed in only 21.5% of 48,231 eligible primary care practices in the US by 2016, affecting only 9.3% of eligible discharges; this equated to an additional \$4520 of revenue per adopting practice.¹¹

The prevalence of hospital managed TCM clinics serving a broader population (including uninsured patients), is unknown but suspected to be low. While health systems aspire to better coordinate care and reduce costs, the economic impact of establishing new TCM programs remains relatively unexamined. A robust analysis must necessarily examine the clinical and economic impact to a hospital for establishing TCM services among all of its patients, including those without formal insurance coverage. *This study thus examines the cost-effectiveness of a novel open-access hospital-based TCM clinic.*

Methods

Analytical methods

Elements from the cost-consequence analysis were presented according to Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement.¹²

Study objective

An economic evaluation of a novel transition of care clinic (TCC) was thus performed based on the model of Drummond et al. and according to the Recommendations From the Second Panel on Cost-Effectiveness in Health and Medicine.^{13,14} Formal evaluation was performed from the health care sector perspective, with an informal analysis performed from the a societal perspective.

Target population

Adult patients (>18 years old) discharged from Piedmont Athens Regional Medical Center in Athens, Georgia, USA were eligible for referral to the TCC. Patients were not included if discharges were part of scheduled, expected hospitalizations (*i.e.* elective surgeries, obstetrical deliveries). Patients were provided appointments irrespective of payor status.

Setting and location

A TCC (the Piedmont Athens Regional Community Care Clinic) was established at a medium-sized 350-bed community hospital in Athens, Georgia in 2016 as part of a new graduate medical education program. This was located adjacent to the main hospital campus and near the emergency department. The clinic is staffed by medical assistants, registered nurses, attending physicians, residents, and a nurse practitioner. Available resources include an embedded pharmacist, social worker, and financial counselor. Referral sources for the TCC include hospitalists and specialists caring for patients hospitalized at Piedmont Athens Regional Medical Center. Patients were enrolled on a registry of discharged patients in the EPIC electronic health record. Per protocol, patients were contacted by a registered nurse within two business days after discharge from the hospital with standard follow up questions. Patients were scheduled for follow up within 14 days of discharge. Subsequent care was then determined, either under the continued direction of the TCC or by the patient's primary care physician (PCP).

The intervention took place within the context of the U.S. healthcare system, and within the state of Georgia. Access to care is reflected by public health data for the

county: there were 8605 discharges per 100,000 population per year. In 2018 there were 904 discharges (8% of patients) without insurance for Clarke County, Georgia.¹⁵ Meanwhile, the ED utilization rate was 39,424 visits per 100,000 population. Uninsured patients accounted for 26.8% of ED visits. Among these, 2293 visits were for ambulatory care sensitive conditions (conditions that respond to timely and effective care in the outpatient setting) rather than clinical emergencies.

Study perspective

This analysis was performed from the perspective of a single hospital within a regional health system. The audience for this analysis is health system decision makers seeking to assess the costs and benefits of an innovative transitional care program.

Comparators

For comparison, patients in the discharge registry eligible for referral to the TCC program during the same period who *did not follow up* or establish care with the TCC providers were included as a comparator sample. This comparator group was not randomized to the TCC intervention, exposing findings to some risk of bias in the clinical impact of the clinic. This cohort represents a synchronous, clinically similar group of subjects with available data for review who had a counterfactual follow up experience in terms of outcomes and costs.

Time horizon

Patient data was evaluated from 1 January 2019 over a subsequent 90-day period, with a follow up of 6 months.

Choice of health outcomes

Primary key effectiveness *E* outcomes included assessing changes in health state by hospital or ED admission status at 6 months. Secondary effectiveness outcomes included primary care provider access at baseline and 6 months. Resources consumed were tabulated as they related to the health sector (*C1*). Subgroups of *C1* included Inpatient Costs (*C1-IP*) and Outpatient Costs (*C1-OP*).

Clinical data was obtained by manual audit of a patient registry maintained in the EPIC (Epic Systems Corp., Verona, WI) electronic health records (EHR) for patients discharged from 1 January 2019 through 31 March 2019.

Extracted fields included:

- admission diagnosis
- discharge diagnosis
- chief complaint

- admission date
- discharge date
- length of stay for index hospitalization
- age
- sex
- comorbid mental health diagnosis
- primary care physician before admission
- primary care physician after admission
- payor status
- completed transition of care telephone call
- completed transition of care clinic visit with 14 days of index hospitalization
- 30-day emergency department visit
- 30-day inpatient readmission status, and
- ED visit or readmissions over 6 months.

Patient records were de-identified and managed in accordance with federally mandated privacy standards. In addition, baseline risk of readmission was imputed using an algorithm available through the EPIC software and reported in Table 1.

Measurement of effectiveness

The impact of the TCC intervention on the primary effective endpoint (E-6admit) was determined by comparing the E-6admit value for those patients in the registry seen in the TCC versus those who were not seen in the TCC over the subsequent 6 months. This was likewise calculated for PCP access. Data was expressed in proportions with 95% confidence intervals.

Estimating resources and costs

Outpatient clinic costs were calculated using real operational expenses for the Piedmont Athens Community Care Clinic for January through June 2019. Monthly expenditures were compared with monthly visit volumes to generate a cost per clinic visit. TCC costs were assumed to equal costs for other clinic visits. Provider costs (for MDs or NPs) were estimated to be \$50 per visit, based on provider payments for this region per RVU.¹⁶ Each TCC visit was estimated to be 1 RVU.

Inpatient direct costs were imputed from hospital financial records and measured to average \$4,830 (SD 166) for all 11,006 discharges over a 6-month period (average LOS 4.5 ± 0.2 days, case-mix index 1.54 ± 0.03). Mean direct costs for ED visits were measured to be $\$702 \pm 42$ for the study period. Since ED visits were twice as frequent as admissions in the study cohort, the estimated inpatient costs (ED + admission) were weighted, averaging \$2,070.

Currency, price date, and conversion

Costs were reported in USD for 2019.

Table 1. Patient characteristics.

Characteristic	Mean \pm SD	p-value
Age (y)	48.4 \pm 14.1	
TCC	48.9 \pm 12.5	NS
No TCC	47.8 \pm 14.8	
Female (%)	44	
TCC	29	0.006
No TCC	50	
Uninsured (%)	55	
TCC	48	NS
No TCC	61	
Index admission length of stay (d)	3.8 \pm 4.8	
TCC	3.3 \pm 3.3	NS
No TCC	4.3 \pm 6.4	
Estimated risk of hospital re-admission or ED visit per year (%)	24.5 \pm 22.0	
TCC	21.0 \pm 24.7	0.03
No TCC	28.8 \pm 22.5	
PCP prior to index admission (%)	22	
TCC	21	NS
No TCC	22	

TCC: transition of care clinic.

Assumptions

Patient data was only extracted from the TCC electronic health record; no records were sought from other neighboring health systems or clinics. Since the main analysis is from the health system perspective of the Piedmont Athens Regional Medical Center, costs and care incurred outside of this system were not factored into the cost analysis of direct costs.

Data analysis

The economic consequences of the TCC were estimated. First, identification of how health states may have changed were identified. This was categorized by anticipated effects *E* in a logic model with data available over a six-month period from their index hospitalization and follow up in the TCC (Figure 1). Measured effects included clinic participation (TCC visit) and 6-month ED visit or hospital readmission (E-6admit).

Second, resources saved were estimated. This was achieved by determining the cost *S1* for each health effect *E* on the health system, including an emergency department visit or hospitalization over a 6-month period. Measurement of saved resources from other sectors *S2* was not estimated. In addition, indirect resource savings from patients and their families *S3*, or attendant productivity gains *S4* were not estimated (or thus estimated in the analysis to equal zero).

Cost savings for the health system perspective was determined by calculating the cost per hospitalization or ED visit avoided. In addition, an assessment of other value *V* was assigned to the outcome of

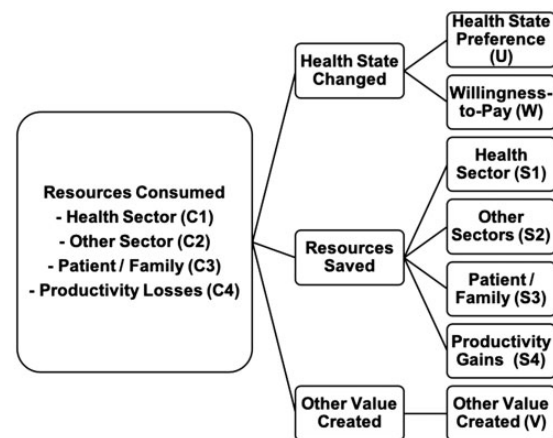


Figure 1. Logic model for cost-consequence analysis.

establishing a primary care provider as a result of the TCC. There were no missing data points for effectiveness endpoints.

Results

Study parameters

Patient characteristics were similar in each cohort, other than a slightly higher readmission risk in the No TCC group (Table 1). A distribution of diagnoses was represented in the cohort, with the most common diagnostic categories being infections, gastrointestinal disorders, and chest pain (Figure 2).

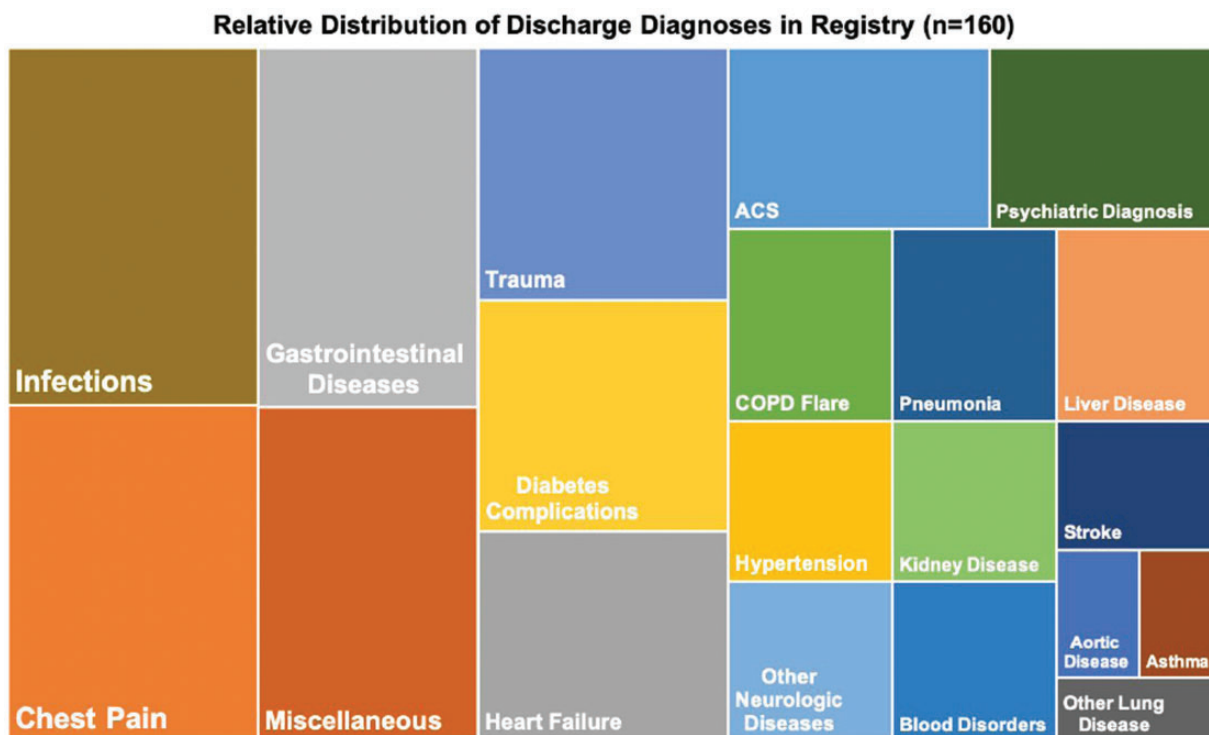


Figure 2. Diagnosis categories evaluated and managed by TCC.

Table 2. Results of trial-based analysis.

Item	TCC (N = 86)		No TCC (n = 74)		Mean difference	95% CI
	Number	Unit Cost	Number	Unit Cost		
IP & ED	7	\$2,070	23	\$2,070	-0.23	
OP	79	\$145*	51	\$145*	+0.23	
Total		\$25,973		\$55,023		
Total per Patient		\$302		\$774	\$442	\$438–445

IP: inpatient; ED: emergency department; OP: outpatient; TCC: transition of care clinic. Compared to the No TCC group, the TCC cohort exhibited a 23% absolute reduction in Inpatient and ED utilization and a 23% absolute increase in outpatient utilization during the study period. This resulted in a savings of \$442 per patient.

*Mean clinic visit cost (\$95) + estimated provider cost (\$50).

Incremental outcomes and costs

For the primary *effectiveness* endpoint, the TCC cohort had a rate of 0.08 for ED visits or inpatient admission compared to 0.31 in the reference group – an absolute risk reduction of 0.23 and risk ratio of 0.26 (95% CI 0.12 to 0.57, $p = 0.0008$) for the desired health state change *U* (Table 2). For the secondary *effectiveness* endpoint, access to PCP was increased to 100% for the TCC cohort (relative risk reduction 0.008, 95% CI 0.0005 to 0.13; $p = 0.0007$).

Based on calculated unit costs of clinic visits and ED or hospital admissions, the cohort of patients in the TCC

program incurred \$25,973 in total costs, or \$302 per patient; the referent group incurred \$55,023 in total costs, or \$774 per patient. The savings per patient was \$442 for health sector savings *SI*.

Characterizing uncertainty

Point estimates for costs and for effects reflect a savings of \$442 per patient for the TCC intervention. Uncertainty in the cost effectiveness by this analysis was addressed by evaluating the efficacy of the TCC at the 95% confidence intervals of the point estimate. In this analysis, TCC remains cost effective ranging

from \$438 to \$445 per patient saved over the 6-month period.

Characterizing heterogeneity

At baseline, patient demographics demonstrated a moderate degree of heterogeneity with regard to age, gender, and insurance status. Baseline differences in co-morbid conditions that would favor increased tendency for ED utilization or admission was characterized using the EPIC readmission rate calculator, finding that there was a lower probability of readmission in the TCC cohort. There was significant heterogeneity in diagnostic categories (Figure 2). Subgroup analysis was not performed out of the concern that the overall small sample size of the registry would not yield reliable findings.

Discussion

Study findings

From this cost-consequence analysis, TCC generates contextually better health outcomes and cost savings and thus dominates usual care. Moreover, sensitivity analysis in the cost-consequence analysis found that TCC was cost effective within the 95% CI for costs. The sample size ($n=160$) was too small to support robust subgroup analyses. This would have allowed for an account of heterogeneity within the dataset. Future analysis could incorporate clinically- and economically-relevant questions such as comorbid mental illness or payor status – factors known to drive utilization and inpatient costs.¹⁷ In the studied cohort, 15% carried a mental health diagnosis, while over 50% were uninsured.

Cost-consequence analysis versus published literature

This study confirms the effectiveness of TCC services in reducing hospital and ED utilization. This study population most resembles the randomized trials by Jack et al. and Gao et al. focusing on post-discharge care coordination targeting low-resource patient cohorts.^{7,18} Because pharmacist support was also available in the current TCC intervention, the present findings are in keeping with the meta-analysis of 32 transitions of care interventions, which likewise reduced utilization by ~30%.⁹ No single element of the TCC intervention likely accounts for its effectiveness. Review of the patient population demonstrates significant variability in presenting diagnoses (Figure 2), while overall predicted recurrent hospitalization and ED utilization was highly variable ($24.5 \pm 22.0\%$ based on the EPIC algorithm). A systematic review of 43 studies of single intervention strategies found none to dominate. Likely the bundle of telephone contact, clinic visits, pharmacy support,

and financial counseling offered effective care coordination, thus reducing unplanned hospitalization or ED use in this cohort relative to the reference group who lacked the intervention.

Moreover, cost reductions observed in this intervention were in keeping with savings estimated by Medicare beneficiaries receiving TCC services as well described by Bindman et al.⁵ Avoidance of readmission and the attendant high costs associated with inpatient care drive savings, in accordance with a study of older adults by Coleman et al. where cost-effectiveness depended on avoidance of inpatient costs.⁸ The magnitude of cost reduction in the current study is relatively modest compared to a difference-in-difference analysis of 2,235 Medicare and Medicaid patients enrolled in a post-discharge follow up program that reduced expenses by \$8,690 per beneficiary.¹⁰ The difference may be accounted for by the costing methodology used in the present study which included only inpatient and outpatient estimates rather than measuring a broader panel of health care expenditures.

Other limitations

The trial was not randomized and thus did not strictly control for threats to internal validity. Selection bias may be the greatest threat, since in this non-randomized sample the groups may have differing characteristics affecting outcomes. While demographic characteristics with regard to age and payor status were not statistically different, estimated readmission risk was slightly higher in the comparator group (Table 1). Other unobserved factors may likewise confound findings by leading to different utilization of the TCC program (*i.e.* other health care resources, transportation constraints, communication issues). Attrition bias is a particular concern since the reference group was identified based on their lack of follow up in the TCC. Less concerning threats to internal validity include historical changes that may have impacted utilization of TCC resources (and thus clinical outcomes). All included subjects would have been exposed to the same external events.

Further limiting the validity of the study is the accuracy of cost computation. Direct medical costs for all analyses were derived from the best available data but limited by exclusion of TCC coordinating service costs and the lack of availability of indirect costs incurred by the cohort. Charges were used as a surrogate for costs, and may over-represent the true cost of inpatient care, while likewise underestimating the costs of outpatient care. Despite the availability of patient level clinical data, constraints in the availability of patient-level cost data preclude using disaggregated measures to isolate disease-related costs from intervention-specific costs.

There were no missing data points for effectiveness endpoints, but the overall dataset was constrained by its inclusion of only Piedmont Healthcare data. Because measurements in this study were not able to capture changes in longevity or quality of life, a cost-utility analysis employing quality adjusted life years (QALY) was not performed. In addition, patient level or system level data about willingness-to-pay was not available to inform a cost-benefit analysis. Indirect costs including patient and family expenses incurred during clinic participation (*i.e.*, co-pays and other out of pocket expenditures, travel costs) were not included in this analysis since these costs were expected to occur regardless of whether patients participated in TCC visits. In addition, productivity losses were not estimated since their marginal impact relative to not participating in the TCC were expected to be minimal. Additionally, a limitation is the inability to consider empirically the impact from a societal perspective given the scope of the investigation.

Generalizability of results for decision-makers. These findings suggest that TCC should be considered as an immediate intervention for hospital leadership seeking to improve health outcomes for patients in their catchment areas and to reduce expenditures related to (often uncompensated) inpatient care, even outside the environment of U.S. healthcare. The core components of a TCC program include a nurse navigator and a provider; other elements of the TCC can be embedded in an existing hospital department or affiliated ambulatory clinic site. TCC interventions are cost effective even if reducing readmission rates only by 10% since the cost of inpatient care is $\sim 14\times$ greater than outpatient management.

Innovation

Hospital managers as decision makers must recognize that the unorthodox nature of this model – directly encouraging uninsured patients to utilize their services – challenges their core competency of maintaining profitability. The example of an open-access TCC program in this case illustrates success in the mode of the Christensen’s “Innovator’s Dilemma.”¹⁹ The traditional way of managing patients in a catchment area by constraining services to paying patients ultimately limits financial opportunities for cost savings. Only by recasting the metrics of success in the framework of cost-avoidance rather than profit-seeking can hospital managers come to understand the value of open-access TCC programs.

Conclusions

This economic analysis describes an open-access TCC program that is cost effective while reducing ED utilization and readmissions. Further research is indicated to

explore indirect costs and further societal impacts from this intervention. Meanwhile, decision makers should seek to expand adoption of this strategy in order to more efficiently and effectively improve the lives of these patients.


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Appendix

Factors considered in EPIC Readmission Risk Calculator reported in Table 1.

- Primary care physician
- Prior hospital admissions
- Prior ED visits
- Medicaid
- Medicare
- In a relationship
- Anemia
- Asthma
- Atrial fibrillation
- CVD
- CKD
- COPD
- CHF
- Connective tissue disorder
- Depression