ABSTRACT

Improving Post-Hospital Care for Patients with Complex Medical and Social Needs: Evaluation of a Transitional Care Clinic

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The Hospital Readmissions Reduction Program (HRRP), created in 2010, was a sweeping national effort to reduce preventable readmissions by linking them to hospital payment. However, the law's effects at the aggregate level have been mixed. Aiming to find a path forward on readmissions, this thesis studies one Arizona hospital's approach to improving post-hospital care through developing a multidisciplinary transitional care clinic. It describes the clinic's model of addressing the needs of its largely low-income and chronically ill patient population and analyzes data to evaluate this model. Patients who attended the clinic were found to have a significantly lower readmission rate over 30 and 90 days compared to patients who enrolled but did not attend. This effect held after accounting for several other factors that predict readmission. This thesis concludes by discussing how lessons from this hospital's experience could be applied to other institutions and detailing areas for further study.

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IMPROVING POST-HOSPITAL CARE FOR PATIENTS WITH COMPLEX MEDICAL AND SOCIAL NEEDS: EVALUATION OF A TRANSITIONAL CARE CLINIC

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CHAPTER ONE

Background and Introduction

Introduction: The Shifting Paradigm of U.S. Healthcare

The United States' healthcare system has historically functioned upon a fee-for-service, acute intervention-based model specialized in providing advanced treatment for specific disease. Despite its technical strengths, this system faces significant challenges. The American healthcare system has been criticized for its high costs, unequal access, and poor outcomes compared to those of other high-income countries.[1,2] Annual U.S. spending on healthcare totals to $3.3 trillion, or 18% of its Gross Domestic Product (GDP)—an amount that far exceeds that of other nations and continues to rise.[3,4] Experts estimate that waste—from sources such as overtreatment, failures of care coordination, administrative complexity, and fraud—accounts for between 21% and 47% of this spending.[5] Meanwhile, the U.S. performs worse than other countries on population-level health measures such as primary care access and mortality amenable to healthcare.[1,2] Significant health disparities persist in the U.S. along racial, geographic, and socioeconomic lines.[6,7] Going into the future, this system will face growing pressures stemming from the aging population and rising burden of chronic disease.[8]

Improving health care system performance requires special focus on those who depend on it the most—"high-need, high cost" patients who have complex medical and social needs that limit their ability to care for themselves at home.[9,10] How the system cares for these vulnerable patients is of central importance to its quality, morality, and sustainability. Due to their frequent contact with the system, these patients are most likely

to be affected by preventable gaps in care quality and continuity. Furthermore, care for these patients is a key part of the discussion on spending, as 50% of total U.S. healthcare spending is driven by 5% of the population.[11] Designing a system that cares for these patients involves creating innovative approaches to assess and meet their needs. Special consideration of the needs of most vulnerable patients serves as a key litmus test for efforts to build a better healthcare system.

A major policy focus of the last two decades has been shifting the paradigm of U.S. healthcare into a new direction. This shift brings together a diverse series of reforms centered around "The Triple Aim"—improving population health and patient experience of care while reducing per-capita costs.[12] Elements of these reforms include adopting value-based payment systems, greater focus on primary care and prevention, and a more inclusive model of medicine that recognizes and addresses social determinants of health.[13–16] The passage of the Patient Protection and Affordable Care Act of 2010 represented a significant move in this direction at the national level. The nearly thousand-page law implemented not only a major expansion in insurance coverage, but also dozens of new programs and initiatives aimed to incentivize local change and innovation.

Using a lens that gives focus to the needs of vulnerable patients, this thesis will examine one specific part of this paradigm shift in U.S. healthcare: the move to set reductions in short-term hospital readmissions as a target measure for improving quality and cost of care. Chapter 1 will lay out the background and rationale for this move, describe the policy behind it, and discuss its effects at the national and local level. The remaining chapters will examine one hospital's approach to preventing readmissions. Chapter 2 will detail the data and methods used to evaluate the transitional care program

of focus in this study. Chapter 3 will report the results of this investigation and Chapter 4 will discuss the meaning and significance of the findings within the greater context of what is happening nationwide. Overall, this thesis seeks to explore an instance of the complex, challenging and promising process of improving healthcare in the United States.

30-day Hospital Readmissions: A Target to Improve Care?

Hospital Readmissions and the Hospital Readmissions Reduction Program (HRRP)

In the United States, hospital readmissions are a frequent and costly occurrence. A landmark study published in 2009 found that almost one-fifth of Medicare patients discharged from a hospital were rehospitalized within just 30 days, amounting to a cost of over $17.4 billion.[17]

Hospital readmissions pose a problem from multiple perspectives. For the patient, a readmission means that his or her health has worsened again and entails an undesirable trip back to the hospital. The patient's stay is often accompanied with physical and emotional distress, as well as a significant financial burden on the patient and his or her family. For hospitals, readmissions on one hand provide opportunities to generate revenue but on the other may imply poor quality of care and overburden crowded Emergency Departments and inpatient wards. Finally, healthcare policymakers see high rates of readmissions as contributing to the unsustainable growth in spending and sub-optimal outcomes of the American healthcare system.[15]

In light of their impact on patients and the healthcare system, readmissions have become the subject of a growing body of research attempting to understand why they

occur and what can be done to prevent them.[18] Overall, readmissions are multifaceted, involving the complex interplay between hospital, patient, and community. While no two readmissions are exactly alike, researchers have begun to identify patterns and predisposing factors, develop frameworks to understand them, and build models to address them.

Patients discharged from the hospital are vulnerable to readmission as they make the transition back to living at home and receiving care from outpatient providers. During this period, patients are physically vulnerable and experience what Krumholz calls "post-hospital syndrome."[19] Patients are not only recovering from the acute illness that caused their hospitalization; they are also feeling the lingering effects of stressors caused by the hospital stay itself, such as sleep deprivation, poor nutrition, coordination or cognition-altering medications, and deconditioning due to inactivity. Each of these stressors contributes to "substantial impairments during the early recovery period, an inability to fend off disease, and susceptibility to mental error."[19]

For patients in this state of vulnerability, timely medical follow up after discharge is essential. However, patients are often subject to fragmented care systems that hinder more than they help toward this goal. Within these systems, discharge entails a series of "handoffs" between different providers and care settings in which lapses in care continuity are common.[20,21] This is particularly true for patients with multiple comorbid chronic conditions, who may need to see a number of different specialists in addition to a primary care doctor to manage their care. One study found that Medicare patients saw a median of two primary care physicians and five specialists within four practices during a two year period.[22] Miscommunication or lack of communication between inpatient and

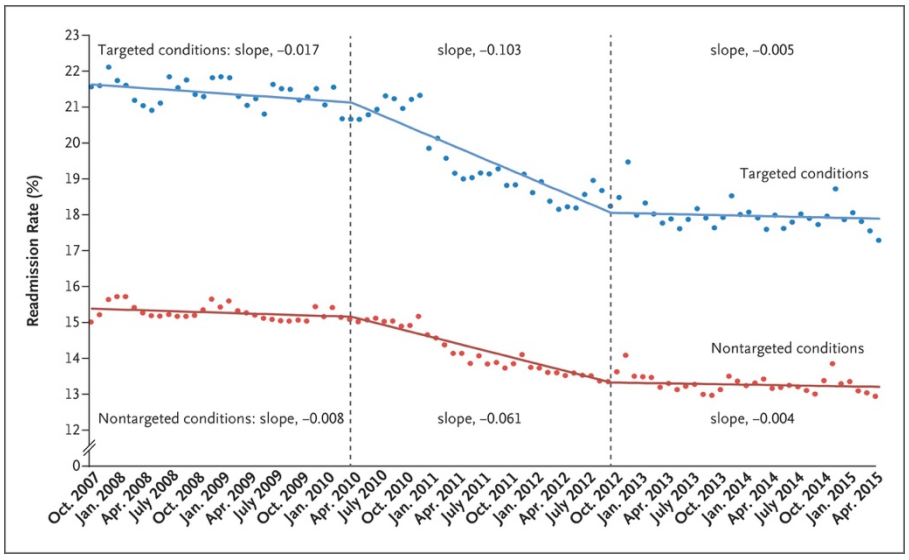
outpatient providers (such as failing to promptly share notes, test results, or medication changes) can lead to errors and duplicated services— lower quality care at greater cost.[20,23] Hospitals often fall short by providing inadequate planning and education of patients before discharge and offering sub-optimal care coordination, causing delays in follow-up.[24] Altogether, failures of care coordination amounted to between $25 to $45 billion in wasteful spending in 2011.[5] For all these reasons, short-term readmissions reveal serious problems within the healthcare system but also various opportunities for reform.[21]

With the passage of the Affordable Care Act in 2010, Congress authorized the creation of the Hospital Readmissions Reduction Program (HRRP) to incentivize hospitals to reduce excess readmissions. Beginning in 2012, the HRRP penalized hospitals a percentage share of their total Medicare reimbursements for having higher than expected 30-day readmission rates for Medicare patients hospitalized with several targeted conditions.[25] In the first year of the program, the penalty could equal up to 1% of total reimbursements and included three conditions: pneumonia, heart failure, and acute myocardial infarction. In subsequent years, the program was expanded to include more diagnoses and a higher maximum penalty rate of 3%. As of 2017, targeted conditions include hip or knee replacement, coronary artery bypass grafting (CABG), and chronic obstructive pulmonary disease (COPD) in addition to the original three diagnoses.

So far, the effects of the HRRP have been far-reaching. Data from the Center for Medicaid and Medicare Services (CMS), which levies the program's penalties, shows that about two-thirds of US hospitals were penalized in 2012, amounting to a total of $290 million.[26] As the program's maximum penalty amount and list of target conditions

expanded, so too did its total penalty burden. The most recent data projects penalties to affect 79% of hospitals and encompass $528 million in withheld payments in 2017.

National Medicare 30-day readmission rates for the conditions targeted by the HRRP began to decrease significantly after the program's creation in 2010, providing evidence for its effectiveness.[26–28] Rates of pneumonia, heart failure, and myocardial infarction readmissions collectively dropped by about 15% between 2010 and 2015 (Figure 1). Further, the effects of the law seem to spill over to patients outside of its direct scope. Overall readmission rates for nontargeted conditions followed a similar, though less pronounced, downward trend over five years. Observers heralded these lower rates as representing hundreds of thousands of potential readmissions avoided on the national level. While this evidence is promising, the observational method of these studies do not allow researchers to ascribe a cause to the effects seen.



Source: Zuckerman RB et al. N Engl J Med 2016;374:1543-1551

Figure 1: Change in National Readmission Rates Following HRRP Passage

Notably, the decline in readmission rates began to plateau after 2012, the year penalties went into effect. One explanation for this slowdown is that hospitals made significant changes to reduce readmissions during the implementation period of the law but were not able to continue such a high rate of reductions in the longer term.[27] This slowdown of progress in recent years points to the urgent need for continued innovation, research, and adoption of best practices in hospitals around the country.

Understanding and Addressing the Unintended Effects of the HRRP

The Impact of Illness Complexity and Socioeconomic Status on Readmissions

Despite the early signs of the HRRP's success in lowering national readmissions, some have raised concerns about the unintended consequences of the program.[29–33] A chief criticism of the program among policy experts is that the HRRP's penalties hold hospitals as the sole institution accountable for patient readmissions but do not account for the host of factors driving rates that the hospital cannot control—namely the conditions of the patients and community the hospital serves.

A significant body of research has demonstrated that patients with complex illness and those with low socioeconomic status (SES) are at greater risk for readmission.[34–37] In one study, Kind and colleagues analyzed linked Medicare and 2000 Census data and showed that neighborhood socioeconomic disadvantage (measured using the Area Deprivation Index, which compiles indicators of education, employment, poverty, and housing) was associated with higher rates of 30-day readmissions and higher rates of chronic comorbidities such as heart failure and hypertension.[36] The authors found that after adjustment, living in the most disadvantaged neighborhoods was associated with a

rehospitalization risk similar to having chronic pulmonary disease and greater than having diabetes.

Survey and interview studies conducted by Kangovi and colleagues identified a number of specific challenges faced by patients of low socioeconomic status during their post-hospital transitions. Common challenges reported by patients included poor social support, lack of basic resources, difficulty understanding and executing discharge instructions, and substance abuse.[38] In interviews, patients expressed feeling disconnected with their care teams, whom they felt could not relate to their socioeconomic circumstances outside the hospital, resulting in unrealistic or confusing discharge goals they could not meet (such as being prescribed medications or care they could not afford). Patients conveyed feeling abandoned by social supports and the health care system after leaving the hospital, undermining their confidence and ability to follow recommended actions.[39] Lastly, many patients of low SES expressed preferring acute hospital care over outpatient care because they perceived hospital care as being more accessible, of better quality, and a respite from hardship experienced at home.[40]

Despite the strong evidence linking these factors to readmissions, the CMS penalty calculation model does not adjust for patient socioeconomic status. Expected 30-day readmission rates for hospitals are adjusted only for patient age, sex, and selected comorbidities. Moreover, since the formula uses data from administrative claims rather than clinical charts, many argue that its adjustment for illness complexity is inadequate. The absence of proper adjustment places the onus on hospitals themselves to address and overcome complex socioeconomic disparities in post-discharge outcomes.

It is worrying then, but not surprising, to observe that a disproportionate share of the HRRP's penalties have fallen on hospitals that serve a greater proportion of low-income and medically complex patients, such as teaching and safety-net hospitals.[26,37,41–43] Urban, major teaching, and safety-net hospitals were penalized more often and had higher average penalties in the early years of the program and were most likely to be penalized in all five years.[43]

Additional evidence supports the argument that hospitals may be unfairly penalized based on the patients they serve. In a large study of readmissions in the Medicare population, Barnett and colleagues found that many social and clinical patient characteristics not currently included in Medicare's penalty risk adjustments were both significantly predictive of readmission and more prevalent at hospitals with higher reported readmission rates.[37] On average, patients admitted to hospitals in the highest readmission rate quintile had more chronic conditions, less education, lower income, less prescription drug coverage, worse depressive and cognition scores, more difficulties with Activities of Daily Living (ADLs), and worse self-rated health than patients admitted to hospitals in the lowest quintile. Each one of these factors was by itself predictive of higher readmissions in the study. Adjusting for these patient differences accounted for about 50% of the observed difference in readmission probabilities between hospitals in the highest and lowest quintiles. Another study of hospitals that received HRRP penalties similarly found that 60% of the difference in readmissions between safety net hospitals and other hospitals could be explained by differences in patient features.[42]

Notably, safety-net hospitals did achieve significant reductions in readmission rates under the HRRP, and the disparity in rates between hospitals that serve high shares

of poor patients and those serving low shares of such patients has narrowed slightly.[44] However, safety-net hospitals made smaller improvements compared to other hospitals with high baseline readmission rates, a difference likely related to patient population.

As initial gains slow (Figure 1) and the "low-hanging fruit" is picked through, it is becoming increasingly clear that effective interventions to reduce readmissions must address the needs of the patients who are most at-risk: those who are poor and chronically ill. During this time, persistent penalization of hospitals that care for these groups might be counterproductive, placing financial strain that can make it more and more difficult to implement solutions.

A number of approaches for amending HRRP penalties have been proposed, including amending the formula to adjust for SES, using comparative rates of hospitals that serve a similar share of low-income patients, and using benchmarks based on the individual hospital's past performance.[30,43,44] A little-noticed provision in the 21st Century Cures Act, signed into law on December 2016, will implement a version of the second option.[45] The law instructs the department of Health and Human Services to set different penalty thresholds for hospitals based on the hospital's share of Medicare-Medicaid dual eligible patients beginning in 2019. In this way, the amendment hopes to relieve the disproportionate burden on hospitals that care for socially disadvantaged patients without simply lowering standards of care for these patients as an adjustment might do. While this change marks a step in the right direction, the challenge remains for all hospitals to improve transitions of care for their most vulnerable patients.

The Relationship between Readmission and Mortality Rates

Another serious potential consequence of the HRRP's readmission penalties is their possible link to increasing mortality rates for certain conditions. Understanding the relationship between hospital readmissions and mortality rates is not a simple task. While both are measures of healthcare quality to some degree, they are tied to distinct processes during and after the hospitalization.[46] Factors that strongly predict mortality (e.g. rapid triage and early intervention in the hospital) may not be the same as those that strongly predict readmission (e.g. patient education and support, transition from inpatient to outpatient care). In some cases, there could conceivably be an inverse relationship between these factors. Several experts have noted that hospitals with lower mortality rates for patients with heart failure often have higher readmission rates, presumably because they have more surviving sick patients eligible for readmission.[31,47] Conversely, hospitals with more early deaths could have lower readmission rates because they have fewer surviving patients that can be readmitted.

Joynt outlines two possible mechanisms by which readmission penalties could increase mortality.[48] First, in the name of reducing readmissions, hospitals could adopt policies or practices that are ultimately harmful to patients. For example, hospitals might avoid admitting patients who medically warrant admission by treating them in the ED or using more observation stays. Second, hospitals' focus on readmissions could divert attention and resources away from quality improvement efforts aimed at mortality and other metrics.

Regarding the first of these mechanisms, such "gaming the system" is a common challenge faced by pay-for-performance policies.[49] There is some evidence that rates of

ED and observation stay use went up since HRRP implementation,[50] but a large study found that changes in observation rates were not significant.[27] Other potential ways hospitals could shortcut the readmission penalties without directly harming patients would be to alter administrative coding practices, affecting the HRRP's risk adjustment formula. There is some evidence that this is occurring, raising questions to the extent of HRPP's true readmissions reduction.[51]

As for Joynt's second concern, experts have noted that hospitals' financial incentives for reducing readmissions are between six and ten times greater than those for reducing mortality.[52] One large study found that weighting 30-day readmission and mortality rates equally would have substantially changed CMS financial penalties for one-third of U.S. hospitals in 2014.[53] As the authors dryly note, current payment structure does reflect the fact that "under most circumstances, hospitalized patients would much rather avoid death than readmission." Reweighting these incentives might make hospital reimbursement more fair and better aligned with outcomes that matter most to patients.[48,52,53]

What effects has the HRRP had on mortality on the national level? An emerging body of literature assesses this important question. In a major study published in July 2017, Dharmarajan et al. analyzed 5 million Medicare fee-for-service hospitalizations for heart failure, acute myocardial infarction, and pneumonia across 5,000 hospitals between 2008-2014.[54] The authors found that while 30-day readmission rates declined over this time for the three conditions studied, trends in 30-day mortality rates differed—risk-adjusted mortality rates slightly decreased for acute myocardial infarction patients (-.003% per month), held constant for pneumonia patients (.001% per month), and

slightly increased for those with heart failure (.008% per month). Overall, reduction in hospital readmission rates were weakly but significantly correlated with reductions in hospital 30-day mortality rates for each of the conditions. In other words, hospitals that had larger reductions in readmission rates were more likely to also have reductions in mortality rates—an encouraging finding for supporters of the law. This trend even held true for heart failure, despite the aggregate increase in heart failure mortality observed over the study period.

In a second study published November 2017, Gupta et al. analyzed 115,245 Medicare patients across 416 hospitals participating in an American Heart Association heart failure registry from 2006 to 2014.[55] The study found that the implementation of the HRRP was associated with increases in risk adjusted mortality rates for heart failure patients over both 30-days (7.2% to 8.6%) and 1-year (31.3% to 36.3%). These trends were robust to time-series, survival, and sensitivity analyses. This finding is consistent with the aggregate increase in heart failure mortality observed in the Dharmarajan study. While this research cannot ascribe a causative link to the HRRP, some have argued strongly that the increase in heart failure deaths is reason to reevaluate the law entirely.[31]

Putting all this together, the impact of the HRRP on the national level has been mixed. It appears that there has been both important progress in reducing readmissions and serious unintended consequences on other fronts. It is evident that not all hospitals have responded to the policy incentives as the makers of the law intended, and short term fixes have not yielded desirable outcomes. However, it is also evident that many hospitals that made the investment to improve patient care across transition points succeeded in

genuinely improving outcomes. The next section of this chapter will look at these hospitals and the innovative approaches they have developed to improving care.

Transitional Care Interventions

The new financial incentives set in motion by the Affordable Care Act (ACA) initiated a significant shift in hospitals' attitudes toward actively preventing readmissions. Transitional care (TC) programs have emerged as a promising model in this effort.

Transitional Care has been defined as "a broad range of time-limited services designed to ensure health care continuity, avoid preventable poor outcomes among at-risk populations, and promote the safe transfer of patients from one level of care to another or from one type of setting to another."[21] While pioneers such as Mary Naylor and Eric Coleman have been developing and reporting on TC programs for over two decades,[56,57] the TC model has received renewed attention in the wake of the ACA's reforms.[21] This attention has been supported with new federal funding—for instance, the Community Based Care Transitions Program, established by the ACA, allocates $500 million to health systems and community organizations that provide TC interventions to high-risk Medicare patients. Two other programs established by the ACA, the Center for Medicare and Medicaid Innovation and the Federal Coordinated Care Office, oversee and provide support for these local and large-scale efforts. Finally, CMS recently began offering to reimburse physicians for "transitional care management," including services such as care coordination that were previously uncompensated.[26]

TC programs at different institutions vary widely in design and target population, but share a common aim to bridge gaps in care continuity during patients' hospital-to-

home transition.[21] Many programs reported in the literature are targeted towards older patients and patients with specific conditions, most commonly heart failure. Reported interventions vary widely in design and intensity, commonly involving a mix of features such as discharge planning, telephone follow-up, medication reconciliation, outpatient follow-up, and home visits. Different models of care involve different types of personnel, including specialized nurses, social workers, pharmacists, and physicians. Notably, advanced practice nurses (APNs) such as nurse practitioners commonly play a central role in transitional care.

Table 1 summarizes several successful and evidence-based transitional care models in the U.S. Each of these models was shown to be effective at reducing 30-day readmissions among other positive outcomes in randomized controlled trials.[57–60] The demonstrated success of these models has led to each receiving some form of federal funds and being implemented in hospitals around the country. It is instructive to note that there is not one singular formula to providing effective transitional care. Each of these interventions varies significantly in organization and approach. For example, while the Transitional Care Model (TCM) and the Care Transitions Interventions (CTI) both utilize APNs, their roles differ between the programs: in TCM, APNs play more of a medical role through home visits and telephone triage, whereas CTI uses them primarily as patient advocates and coaches. The Bridge Model is particularly unique in its social worker-led approach and its focus on addressing the psychosocial needs of patients, an important but often overlooked driver of readmissions. Despite their differences, however, these models share several core features in common: namely, providing care coordination, following-up with patients after discharge, and engaging patients and their caregivers on self-care.

Table 1: Notable Evidence-Based Transitional Care Models

Name	Institution	Targeted Patients	Intervention
Transitional Care Model (TCM)	University of Pennsylvania Health System	Hospitalized older adults with chronic illness	An Advanced Practice Nurse (APN) assess the patient and form a comprehensive discharge plan in the hospital. After discharge, they conduct home visits for an average of 2 months after discharge and offer 7 day/week telephone support. APNs engage patient and family caregivers, coordinate care, and accompany patients to follow-up appointments.
Care Transitions Interventions (CTI)	University of Colorado Health System	Hospitalized older adults with chronic illness	APNs serve as "transition coaches," promoting patient and caregiver self-care and providing continuity across settings through visits and telephone calls. The program has 4 pillars: (1) assistance with medication management, (2) creation of a patient-centered personal health record, (3) timely follow-up, and (4) patient education about "red flags" (signs of worsening condition) and how to respond to them.
The Bridge Model	Rush University Health Center	Hospitalized older adults with psychosocial needs	Social workers serve as "Bridge Care Coordinators" and work with patients, their care teams, and their families to carry out the model's three components: care coordination, case management, and patient engagement. This model focuses on identifying and addressing patient psychosocial needs.
Project RED (Re-Engineered Discharge)	Boston University Health System	Hospitalized adults	Nurse "discharge advocates" coordinate discharge plan with the hospital team, prepare patients for discharge, and create a personal health record for each patient, which they also send to the patient's follow up providers. A pharmacist calls patients 2-4 days after discharge to review the medications they are taking and reinforce the discharge plan.

In addition to studying these successful examples, it is also informative to look at the wider transitional care literature. Table 2 displays selected recent systematic reviews and meta-analyses of published studies on transitional care interventions. TC programs show promising results overall, but certain characteristics may predict the most effective programs. Two meta-analyses performed by Leppin et al. and Verhaegh et al. of randomized controlled trials on TC interventions both showed significant overall reductions in readmission rates.[61,62] The study performed by Leppin and colleagues examined the pooled effect of 42 randomized trials and found that the tested interventions were effective overall at reducing 30-day readmissions, and that the most effective programs were those that addressed multiple components of the hospital-home transition and supported patients' capacity for self-care. The study by Verhaegh and colleagues analyzed 26 randomized trials and found that the tested interventions were effective at reducing readmissions in the intermediate (31-180 days) and long (181-365 days) term, but not the short term (30 days). Only "high-intensity" interventions, such as those involving care coordination by a nurse, a home visit within three days of discharge, and communication between the primary care provider and the hospital, were effective at reducing 30-day readmissions. Systematic reviews by Kansagara et al. and Naylor et al. found similar predictors of successful TC programs such as providing comprehensive and individualized care, extending beyond discharge, offering discharge planning with home follow-up, using telehealth monitoring, and focusing on self-care.[21,63]

Table 2: Systematic Reviews and Meta-Analyses of Transitional Care

Source	Studies Included	Measures	Results	Predictors of success
Kansagara et al, 2016[63]	17 Systematic reviews of TC interventions	Readmission rates	Enhanced discharge planning and hospital-at-home interventions reduced readmissions. Interventions reduced readmissions in patients with congestive heart failure and general medical populations.	Successful interventions were comprehensive, extend beyond the hospital stay, and are flexible to respond to individual patient needs
Leppin et al, 2014[61]	42 Randomized controlled trials on interventions to reduce early readmissions	30 day readmission rates	Tested interventions were effective at reducing readmissions (Pooled relative risk, 0.82; [95% CI, 0.73-0.91]; P<.001)	More effective interventions were complex (multiple components/more personnel involved) and supported patient capacity for self-care
Naylor et al, 2011[21]	21 Randomized controlled trials focusing on TC interventions for chronically ill adults	Readmission rates	Eight studies reported reductions in all cause readmissions at least 30 days after discharge	Comprehensive discharge planning plus home follow up; telehealth monitoring support; focus on patient self-care management
Verhaegh et al, 2014[62]	26 Randomized controlled trials of TC interventions (N=7,932)	Short (≤30 days), intermediate (31-180 days), and long (181-365 days) term all-cause readmissions	Tested interventions were effective in reducing readmissions in intermediate (OR: 0.77; 95% CI: 0.62-0.96) and long term (OR: 0.58; 95% CI: 0.46-0.75), but not the short term (OR: 0.76; 95% CI: 0.52-1.10)	Only high intensity interventions that include care coordination, hospital-provider communication, and home visit were able to reduce short term readmission rates

Conclusion

This chapter examined the move to tie readmissions to hospital payment from a largely top-down perspective. The Hospital Readmissions Reduction Program (HRRP), passed in 2010, signaled a key shift in how hospitals were held accountable for patient outcomes after discharge. While national readmission rates did decline significantly following the law's passage, questions were raised about the HRRP's narrow focus on hospitals as the sole institution responsible for readmission. Unintended consequences of the law included persistent penalization of hospitals, especially those caring for the poorest and sickest patients. Differing responses to the HRRP's incentives led to a mixed national picture, with gains not equally shared and a worrying uptick in heart failure mortality.

Studying individual cases of success offers another way to understand a path forward on readmissions. The transitional care model was developed to tackle the root causes of readmission through addressing underlying medical and social needs of patients during the vulnerable period after discharge. Transitional care comprises an umbrella of different models that share this goal. Studying the growing body of literature on transitional care reveals that there is no one-size-fits-all approach to meeting the varied local needs of patients. Successful models tend to be address more components of the hospital-to-home transition, extend beyond discharge, and promote patients' self-care.

The following three chapters will examine the case of one hospital's approach to improving post-discharge care through creating an multidisciplinary transitional care clinic. Chapter 2 will describe this model of care and outline the methods used to evaluate it.

CHAPTER TWO

Setting and Methodology of Evaluating an Outpatient Transitional Care Program

Chapter 1 discussed the context, role, and effects of the Hospital Readmissions Reduction Program (HRRP) within the shifting national landscape of the United States healthcare system. Through targeting 30-day readmissions, the HRRP aimed to incentivize better integrated and higher quality care while lowering costs. There is now evidence that this policy led to noteworthy progress in lowering readmissions on the national level; however, it has also had the unintended effect of persistently penalizing hospitals, especially those that care for the most vulnerable patients.

The remainder of this thesis will focus on the effects of these factors on a local scale. The following chapters examine one institution's approach to the readmissions challenge through establishing a novel outpatient transitional care program. Chapter 2 will describe the setting of this intervention in greater depth along with the data and methods used in my study.

Setting and Population

St. Joseph's Hospital and Medical Center (SJHMC) is a nonprofit 595-bed hospital located in downtown Phoenix, Arizona. In line with its founding mission, the hospital serves a socially and ethnically diverse population, including a large share of vulnerable and underserved patients.[64]

In November 2015, SJHMC launched the Center for Transitional Care (CTC), an outpatient transitional care program aiming to bridge gaps in post-hospital care for its

patients. The CTC employs a multidisciplinary care team that includes physicians, advanced practice providers (Nurse Practitioners and Physician Assistants), medical assistants, and a clinic-dedicated social worker. Together, the team works together to assess and address the medical and social needs that might impede a patient's smooth transition back home.

The patients referred to the CTC represent a subset of patients that are at high risk for early decompensation and readmission after leaving the hospital. Referred patients typically have multiple chronic health conditions and may be carrying new diagnoses and medications at discharge. Additionally, psychosocial barriers can hinder many patients' abilities to receive timely follow-up and care for themselves at home. Experience and preliminary studies show that most CTC patients are low income, uninsured and/or on Medicaid. Many do not have a primary care provider, and a number have a history of frequent visits to the ED to obtain care. A number of patients do not speak English and/or are undocumented. Other common barriers in this population include homelessness, mental illness, low health literacy, lack of transportation, and substance abuse.

Intervention

Elements of the CTC model are summarized in Figure 2. Patients who are at high-risk for readmission are identified by SJHMC physicians and case managers and referred to the CTC prior to discharge. Once enrolled in the program, patients are followed by a CTC provider for approximately thirty days depending on need and case complexity. New patient appointments last one to two hours and include a review of the patient's medical history and hospital course, a physical exam, medication reconciliation, disease

and self-care education, and care coordination. Patients are referred to the appropriate specialists for follow-up and set up with a long-term primary care provider if they do not already have one. Additional appointments are made with the CTC during the thirty-day period to follow up with patients until permanent care has been established. In between visits, the clinic's medical assistants conduct telephone follow-up with patients; for urgent needs, patients also have around-the-clock access to an on-call CTC provider via telephone.

Symptom management is another key tool to prevent readmission. The CTC offers several outpatient procedures for patients who present with certain distressing conditions. These include ultrasound-guided therapeutic paracentesis for patients with tense ascites, intravenous diuresis for patients with heart failure, and intravenous hydration for severely dehydrated patients. Patients are assessed for suitability of the procedure during the visit; procedures are performed in clinic supervised by the head physician. In this way, the clinic provides an avenue for patients to obtain relief of urgent symptoms in a non-ED setting, thereby reducing acute care use.

In cases where there are external needs, the clinic's social worker works alongside the provider to connect the patient with the appropriate community resources to assist in meeting those needs. The CTC partners with entities within the SJHMC group and in the community that provide various financial, social, and healthcare services. Home visits are occasionally conducted to better assess a patient's medical and nonmedical needs during the transitional period. All of these services are offered to patients regardless of their insurance status or ability to pay.

Figure 2: Components of the Transitional Care Model

Objectives and Rationale

The primary objectives of this study are to describe characteristics and needs of the CTC patient population and to evaluate the outcomes of its intervention. More precisely defined, this study aims to address three questions:

1. *What are the demographic and clinical features of the CTC patient population?*

The CTC provides transitional care to a diverse patient population with a wide range of complex medical problems and social barriers to care. The descriptive data on patient features gathered in this study could help the CTC better tailor its intervention to the specific needs of the patient population it serves.

2. *Do patients who enroll in and attend the CTC program differ in features from patients who enroll in the program but do not attend?*

This question investigates whether factors related to clinical and demographic features affect the likelihood of enrolled patients to attend the CTC and receive the transitional care intervention. Differences in baseline features between the two groups, if they exist, could confound any observed differences in outcomes.

3. *Do patients who are enrolled in and attend the CTC program have fewer readmissions and lower readmission rates than those who are enrolled and do not attend?*

Because the goal of transitional care is to improve continuity of care between the hospital and home, readmissions are the main metric used to evaluate effectiveness. The CTC's model is predicated on cost-saving rather than generating revenue; thus, its effectiveness at preventing readmissions also determines its sustainability. It was predicted that patients who received the transitional care intervention will have lower readmission rates and fewer readmissions than those that received standard hospital discharge procedures.

Data and Methods

The data used for this study was collected from a retrospective chart review of consecutive patients enrolled in the Center for Transitional Care (CTC) program at St. Joseph's Hospital and Medical Center (SJHMC) from January 1, 2016 to June 30, 2017. Patients were considered enrolled in the program if they meet the following criteria:

1. The patient was referred to the CTC by a SJHMC physician or nurse case manager
2. The patient received information about the CTC program and consented to participate
3. The patient scheduled an appointment at the CTC

Patients were excluded from the study based on the following criteria:

1. The patient's age was younger than 18 years of age
2. The patient did not have a prior hospitalization history at SJHMC or its affiliated hospitals (thus being ineligible for readmission)
3. There were greater than 30 days between the patient's index hospitalization discharge date and his or her first transitional care appointment

Notably, patients were considered enrolled in the program regardless of whether they attended a CTC appointment or not (see inclusion criteria above). The study included patients who were enrolled in the program but did not attend any appointments to serve as a reference group for the intervention group that enrolled and attended.

The study uses a pseudo-experimental design in which the baseline features and outcomes of the two groups (hereafter referred to as the *Attend* and *Not Attend* groups) were compared. It was hypothesized that the two groups would have similar baseline clinical and demographic features because they both came from the same pool of high-risk patients who were referred to the CTC. This baseline similarity was not assumed, but tested (Objective 2). If the groups were sufficiently similar, the Not Attend group would serve as a natural control group for the Attend group, with no adjustment needed. If the

groups were dissimilar on baseline, however, multivariate analysis could be used to identify the independent effect of receiving the intervention by adjusting for the effects of the other collected variables. Outcome measures (i.e. readmission rates) of the groups were compared to examine the effect of receiving the CTC intervention versus the standard hospital discharge procedure (Objective 3).

Study Variables

A summary of the variables used in this study is shown in Table 3. The descriptive variables used in this study were chosen based on availability in the chart, relevance to clinical care, and potential value for predicting clinic attendance or readmission. Demographic measures included age, sex, race, ethnicity, primary language, and insurance status. Clinical measures included index admission type (inpatient, Emergency Department, observation unit stay), index length of stay, and primary diagnosis. In addition, data was collected on each patient's ED and admission history up to 90 days before their first transitional care appointment. This measure allowed consideration of patients' baseline patterns of acute care use prior to their referral to the CTC. Measures relating to CTC appointments included days between discharge and first CTC appointment and total number of CTC appointments. For patients in the Not Attend group, the date of their missed or canceled appointment was used to calculate the "number of prior acute care visits" and "days between discharge and appointment" measures.

Table 3: Variables Used in This Study

Category	**Measures used**
Demographic measures	Age, sex, race, ethnicity, primary language, insurance status
Clinical measures	Index admission type (inpatient, Emergency Department., observation), index length of stay, primary diagnosis, hospitalization history up to 90 days before the index hospitalization
CTC appointment measures	Days between discharge and first CTC appointment, total number of CTC appointments
Outcome measures	30- and 90-day readmission rate, 30- and 90-day ED visit/Observation rate; number of 30- and 90-day readmissions; number of 30- and 90 day ED/Observation stays

The primary outcome measure studied for the two groups was all-cause 30-day readmission rate to SJHMC or its affiliated hospitals. This study also examines other readmission-related measures such as 90-day readmission rates and number of 30 and 90 day readmissions. To obtain a more complete picture of acute care use, data on number and rates of 30-day ED visits and observation unit stays was also gathered. To focus on the effect of the transitional care intervention, the 30-day and 90-day timeframes were calculated starting from the date of first attended transitional care appointment for patients in the Attend group and the first missed/canceled appointment for patients in the Not Attend group. Notably, only readmissions and ED visits to SJHMC and affiliated hospitals could be tracked using the available data from the Electronic Health Record.

Data Collection

Data was collected retrospectively by study investigators from patient electronic medical records. All patient information gathered for this study was de-identified and linked to unique subject IDs created for this study. No direct patient identifiers or Protected Health Information (PHI) were recorded in the data collection tool. A separate master list was created to link each subject's medical record number with his or her unique study subject ID number. The data collection tool and the master list were stored separately on a password-protected and encrypted hard drive accessible only to the study investigators. The master list will be destroyed shortly after the conclusion of the study, after the required data storage period.

Statistical Analysis

SPSS 18.0 (SPSS, Inc., 2010) was used along with Microsoft® Office Excel 2010 for data analysis. Discrete data are reported as frequencies and compared by chi-square and Fisher's exact tests as appropriate. Continuous variables are reported as means with confidence intervals, and T-tests are calculated to determine significance. An unadjusted survival curve comparing the Attend and Not Attend groups was estimated using the Kaplan-Meier method. Differences in survival were tested using the log rank test. A multivariable Cox proportional-hazards model was used to analyze factors associated with likelihood of readmission after 90 days. Covariates in the multivariate analysis included age, gender, race, insurance, number of prior acute care visits, index length of stay, and receiving the transitional care intervention. Comparative differences were considered statistically significant when the P value is <0.05.

Compliance

The St. Joseph's Hospital and Medical Center Institutional Review Board reviewed and approved this study (Reference Number: 015970). This study was considered minimal risk research as it was retrospective and did not collect patient identifiers. Therefore, informed consent was waived. The Baylor University Institutional Review Board entered into an Institutional Authorization Agreement with the SJHMC Institutional Review Board for this research (#1111068).

CHAPTER THREE

Results

Study Population and Patient Characteristics

Of the 841 unique patients who attended at least one appointment at the Center for Transitional Care (CTC) between January 1, 2015 and June 30, 2017, 797 were included in the final analysis, constituting the "Attend group." 15 patients were excluded for having no prior record of hospitalization at SJHMC prior to their first transitional care appointment, and 26 patients were excluded for having greater than 30 days between discharge and their first attended transitional appointment. Three patients were excluded because their age was less than 18 at the time of their first appointment.

In addition, 255 patients were identified that scheduled an appointment with the CTC but never attended. Of these, 238 patients were included in the final analysis, constituting the "Not Attend Group." Eight patients were excluded for having no prior record of hospitalization at SJHMC prior to their scheduled transitional care appointment, and nine patients were excluded for having greater than 30 days between discharge and their scheduled appointment date. This information is summarized in Figure 3.

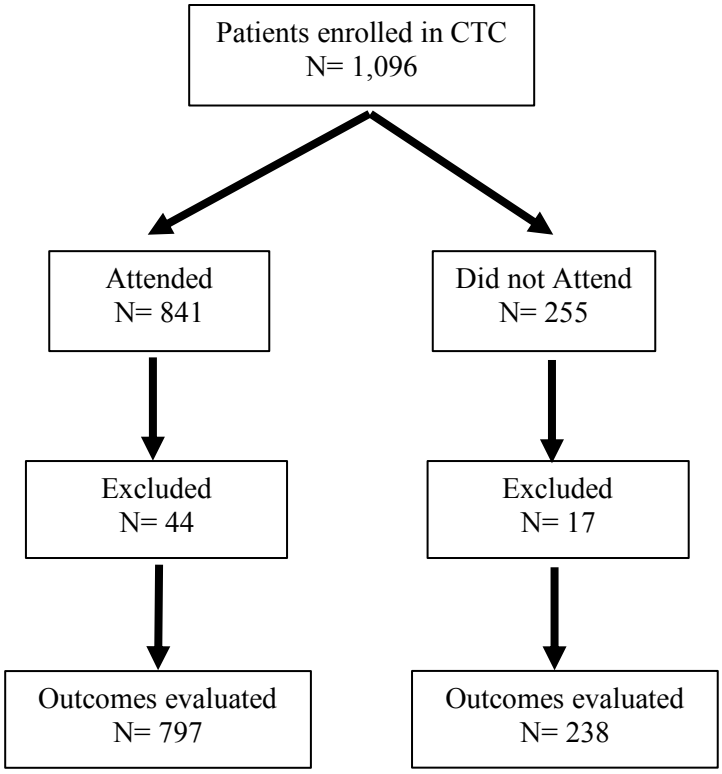


Figure 3: Patient Sample Flow Chart

Figure 4 shows the distribution of patients in the analysis by the month of their first appointment. As the clinic's referral base and patient volume grew over time, the number of patients each month that met the inclusion criteria for the study increased substantially, from 17 patients in January 2016 to a high of 92 patients in May 2017. Throughout the study period, the proportion of patients in the Not Attend Group was relatively small.

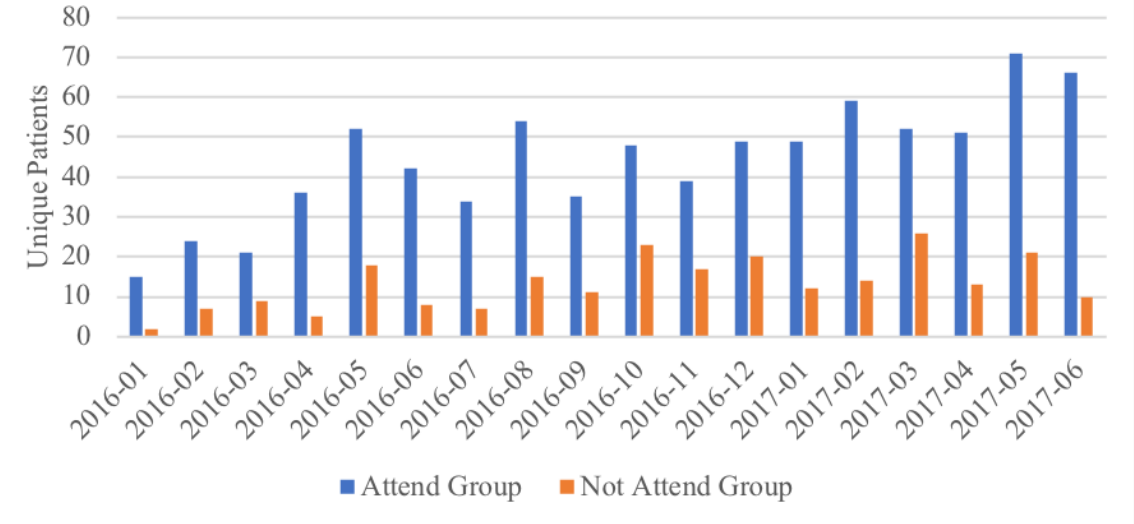


Figure 4: Number of Unique Patients by Month of First Appointment

Demographic characteristics of the patients included in the study are summarized in Table 4. In the Attend Group sample, mean age was 48.5 years (standard deviation=15.6), and a majority (56.3%) was male. Race and ethnicity were recorded as separate variables. 52.4% of the sample was White, 15.9% Black, and 30.5% other race (American Indian, Asian, etc.). 42.9% of patients were of Hispanic or Latino ethnicity and 56.7% were of some other ethnicity. Primary language was largely split between English (78.3%) and Spanish (19.1%). The most common insurance category was Medicaid, administered in Arizona under the Arizona Health Care Cost Containment System (AHCCCS), covering 43.8% of the patients seen at the clinic. This was followed by No Insurance (25.2%), Medicare (17.7%), and Commercial Insurance (12.7%).

Age and gender composition of the Not Attend group sample was similar to that of the Attend group. The Not Attend group had a higher share of Black patients (20.2%) and lower share of Other race patients (24.4%) than the Attend group. Incomplete data for ethnicity (39.9% unknown) and primary language (19.7% unknown) made it difficult

to meaningfully assess these characteristics for the Not Attend group. Lastly, the Not Attend Group had a higher share of patients insured through Medicaid (51.7%) and Medicare (29.8%), and a lower share of patients with no insurance (10.5%) or commercial insurance (7.6%) compared to the Attend group.

Table 4: Demographic Characteristics of Study Sample

Variable	Attended CTC (n=797)	Did not Attend (n=238)	p-value
Age (mean yr ± SD)	48.5 ± 15.6	48.1 ± 15.4	.689
Gender (Female)	348 (43.7%)	108 (45.4%)	.640
Race			
White	418 (52.4%)	122 (51.3%)	.748
Black	127 (15.9%)	48 (20.2%)	.126
Other	243 (30.5%)	58 (24.4%)	.068
Unknown	9 (1.1%)	10 (4.6%)	.002*
Ethnicity			
Hispanic or Latino	342 (42.9%)	41 (17.2%)	<.001*
Not Hispanic or Latino	452 (56.7%)	102 (42.9%)	<.001*
Unknown	3 (0.4%)	95 (39.9%)	<.001*
Language			
English	624 (78.3%)	178 (74.8%)	.256
Spanish	152 (19.1%)	13 (5.5%)	<.001*
Other	16 (2.0%)	0	<.001*
Unknown	5 (0.6%)	47 (19.7%)	<.001*
Insurance Type			
Medicaid (AHCCCS)	349 (43.8%)	123 (51.7%)	.032*
Uninsured	201 (25.2%)	25 (10.5%)	<.001*
Medicare	141 (17.7%)	71 (29.8%)	<.001*
Commercial	100 (12.7%)	18 (7.6%)	.034*
Other/No information	5 (0.6%)	1 (0.4%)	.712

Other baseline characteristics related to patients' index hospitalization are displayed in Table 5. The "Number of Prior Acute Care Visits" variable assessed the total number of SJHMC Emergency Department (ED), observation, and inpatient encounters each patient had up to 90 days prior to his or her first Transitional Care appointment. This measure was slightly higher for the Did Not Attend Group (mean 1.8 visits) compared to the Attend group (mean 1.6 visits). Index Length of Stay measured the length in days of the patient's last hospitalization before his or her first Transitional Care appointment. Index Length of Stay was significantly higher for the Attend Group patients (mean 4.6 days) than the Not Attend Group (mean 3.6 days). Mean days between discharge to first CTC appointment was also higher for the Attend Group (mean 5.8 days) versus the Did Not Attend Group (4.6 days). Date of first attended appointment was used for the Attend Group, whereas the date of their missed or canceled appointment was used for the Not Attend Group. The "Days to CTC appointment" number was likely higher for the Attend Group due to the inclusion of rescheduled appointments. Patients in the Attend group attended a mean of 2.4 transitional care clinic appointments (standard deviation = 1.9 appointments).

Table 5: Other Baseline Characteristics of Study Sample

Variable	Attended CTC (n=797)	Did not Attend (n=238)	p-value
Number of Prior Acute Care Visits (mean ± SD)	1.6 ± 1.3	1.8 ± 1.7	.076
Index Length of Stay (mean days ± SD)	4.6 ± 6.1	3.6 ± 3.3	<.001*
Days to CTC appointment	5.8 ± 4.8	4.6 ± 3.6	<.001*

The top 20 primary diagnoses of patients that attended the CTC are summarized in Table 6. These diagnoses are listed by their ICD10 code descriptions. Primary diagnosis data was not able to be collected for the Not Attend Group.

Overall, a large share of the CTC's patient population suffers from the effects of chronic disease. Diabetes mellitus, the top primary diagnosis, applied to 13% of patients. Diseases of the heart, including heart failure, cardiac dysrhythmias, chronic ischemic heart disease, acute pulmonary heart disease, and cardiomyopathy were also common among this patient population. Blood and vascular diseases (essential hypertension, anemias, occlusion of the cerebral arteries, venous embolism and thrombosis) were additionally prevalent. Other notable common diagnoses include infection (cellulitis and abscess), respiratory disease (asthma, symptoms involving respiratory system and other chest symptoms, chronic airway obstruction), chronic liver disease, and chronic kidney disease.

It is reasonable to imply that some of these frequently seen pathologies could be related to one another and/or present together in the same patients (e.g. diabetes, hypertension, and vascular disease). However, the method used for this study collected data on only one condition per patient. Thus, these primary diagnosis counts certainly underestimate the true prevalence of these diseases within the overall CTC patient population. More detailed clinical data would be needed to assess the presence of comorbid conditions and disease complexity in a future study.

Table 6: Top 20 Primary Diagnoses of Patients that Attended the CTC

Primary Diagnosis	Count of Patients	Percentage
Diabetes mellitus	104	13.0%
Essential hypertension	63	7.9%
Heart failure	43	5.4%
Occlusion of cerebral arteries	27	3.4%
Cardiac dysrhythmias	20	2.5%
Other forms of chronic ischemic heart disease	18	2.3%
Other cellulitis and abscess	16	2.0%
Chronic liver disease and cirrhosis	15	1.9%
Other symptoms involving abdomen and pelvis	15	1.9%
Other and unspecified anemias	14	1.8%
Acute pulmonary heart disease	11	1.4%
Symptoms involving respiratory system and other chest symptoms	11	1.4%
Other venous embolism and thrombosis	11	1.4%
Asthma	11	1.4%
Nonspecific findings on examination of blood	11	1.4%
Chronic airway obstruction, not elsewhere classified	10	1.3%
Chronic kidney disease (CKD)	8	1.0%
Encounter for other and unspecified procedures and aftercare	8	1.0%
Cardiomyopathy	8	1.0%
Diseases of pancreas	7	0.9%

Outcomes: Reduction in Readmissions and Acute Care Use

Table 7 and Figure 5 show outcomes for the two study groups in terms of 30- and 90-day readmissions as well as Emergency Department (ED) visits or observation stays. Days to each hospital event were calculated for each patient from the date of his or her Transitional Care appointment. Patients who attended the CTC had a significantly lower rate of 30-day readmissions compared to those that did not attend (7.15% vs. 13.87%). This trend also held for 90-day readmission rate, which was 12.92% for the Attend Group compared to 22.27% in the Not Attend Group.

The rates of ED Visit/Observation were slightly lower for the Attend Group compared to the Not Attend Group over both 30 days (11.92% vs. 13.03%) and 90 days (22.71% vs. 24.79%). However, observed differences in ED Visit/Observation rates between the two groups were not statistically significant.

Table 7: Outcomes

Outcome	Attended CTC (n=797)	Did not Attend (n=238)	p-value
Patients with 30-Day Readmission	57 (7.15%)	33 (13.87%)	.001*
Patients with 30-Day ED Visit/Observation	95 (11.92%)	31 (13.03%)	.647
Patients with 90-Day Readmission	103 (12.92%)	53 (22.27%)	<.001*
Patients with 90-Day ED Visit/Observation	181 (22.71%)	59 (24.79%)	.505

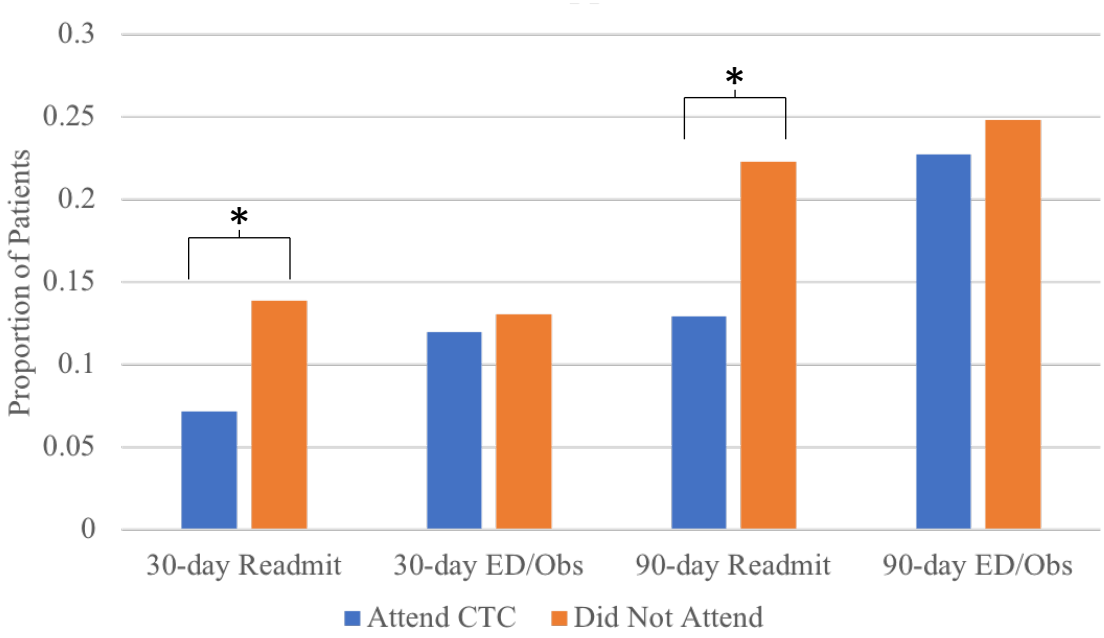


Figure 5: Proportion of Patients Using Acute Care 90 Days After Transitional Care Appointment Date

Figure 6 presents a Kaplan-Meier plot showing the proportion of patients without readmission in the Attend and Not Attend Groups up to 90 days after first transitional care appointment. A clear divergence is seen between the two groups (p=.001) beginning early on and lasting the duration of the 90-day period, with the Attend Group having a significantly higher proportion of patients remaining readmission-free compared to the Not Attend Group.

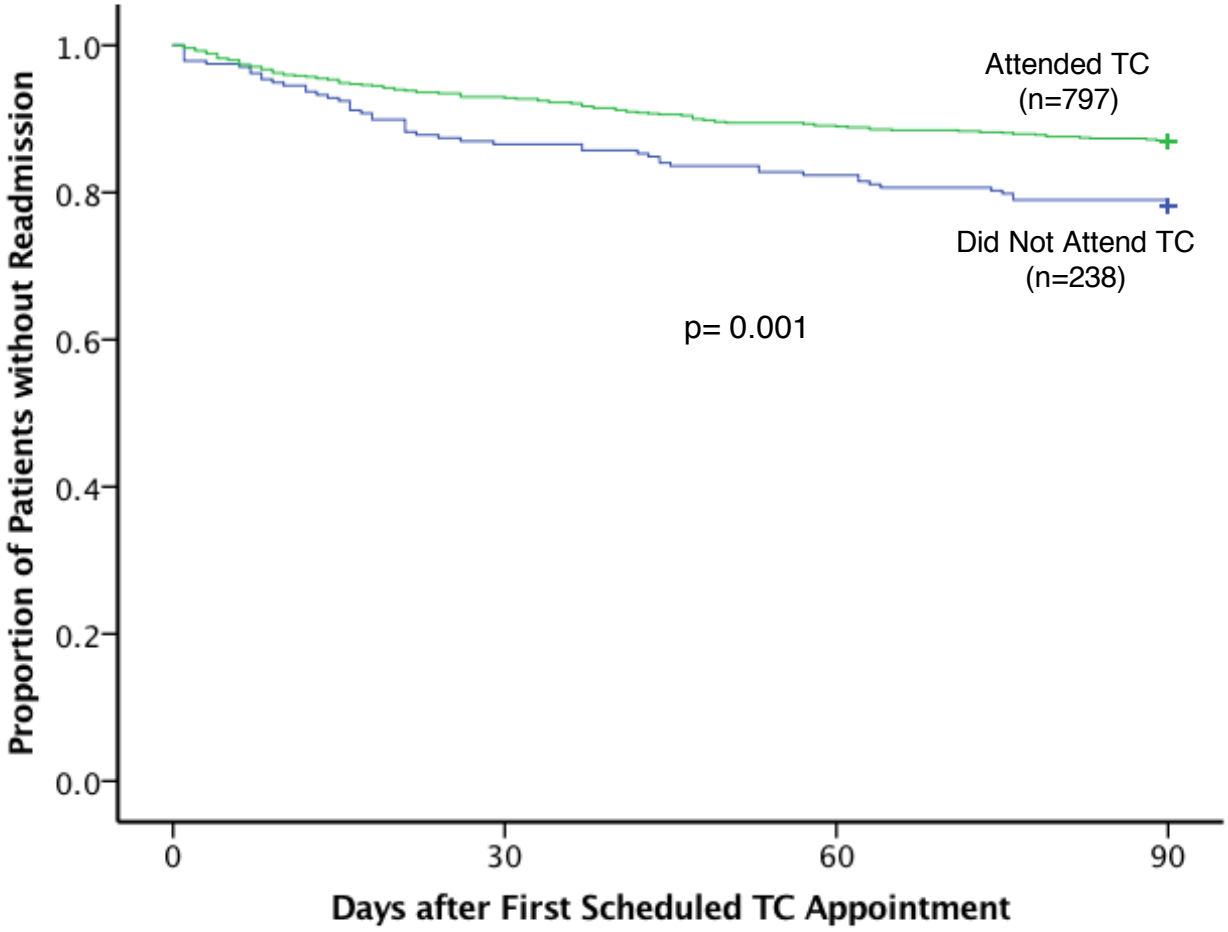


Figure 6: Kaplan-Meier Plot of proportion of patients without readmission

Multivariate Analysis

Table 8 shows the results of a Cox Regression analysis of factors associated with readmission up to 90 days after first TC appointment date. Of the variables studied, index length of stay, number of prior acute care visits within 90 days, insurance type, and the transitional care intervention were independently associated with likelihood of readmission. Having an index length of stay greater than or equal to 3 days was associated with a 1.72 times higher chance of readmission compared to having a length of stay of less than 3 days (95% CI: 1.233-2.391; p=.001). Patients with 2 or more prior acute care visits within 90 days of their TC appointment had a 2.07 times higher chance of being readmitted compared to those with less than 2 prior visits (95% CI: 1.505-2.858; p<.001). Patients with Medicaid or Medicare were 2.40 (95% CI: 1.104-5.303; p=.027) and 3.83 (95% CI: 1.692-8.667; p=.001) times more likely to be readmitted than patients with commercial insurance, respectively. Finally, attending the transitional care intervention was independently associated with a 35% decreased chance for readmission (HR: .653; 95% CI: .465-.918; p=.014).

Table 8: Multivariate Analysis of Factors Associated with Hospital Readmission Up to 90 Days After Transitional Care Appointment Date

Characteristics	Group	Hazard Ratio (95% CI)	P Value
Age			
	<65	1	
	≥65	.967 (.600-1.558)	.890
Gender			
	Male	1	
	Female	.990 (.720-1.362)	.952
Race			
	White	1	
	Nonwhite	.948 (.684-1.315)	.750
	Unknown	1.037 (.325-3.313)	.951
Index Length of Stay			
	<3 Days	1	
	≥3 Days	1.717 (1.233-2.391)	.001*
Number of Prior Acute Care Visits within 90 days			
	<2	1	
	≥2	2.074 (1.505-2.858)	<.001*
Insurance Type			
	Commercial	1	
	Medicaid	2.403 (1.104-5.303)	.027*
	Uninsured	1.674 (.711-3.940)	.238
	Medicare	3.829 (1.692-8.667)	.001*
	Other Insurance	4.357 (.531-35.750)	.171
Transitional Care Intervention			
	Not Attend	1	
	Attend	0.653 (.465-.918)	0.014*

Legend: CI: Confidence Interval, * indicates p-value below .05

Table 9 shows the results of a Cox Regression analysis of factors associated with ED visit or Observation stay up to 90 days after first TC appointment date. Of the variables studied, race, number of prior acute care visits within 90 days, and insurance type were independently associated with likelihood of readmission. Patients of nonwhite race were 0.696 times as likely to have an ED or Observation encounter during the follow-up period compared to patients of white race (95% CI: .532-.910; p<.008). Patients with 2 or more prior acute care visits had a 2.57 times higher chance of having an ED or Observation encounter compared to those with less than 2 prior visits (95% CI: 1.982-3.330; p<.001). Patients on Medicaid were 2.439 (95% CI: 1.402-4.244; p=.002) times more likely to have an ED visit or Observation stay than patients with commercial insurance. Uninsured patients were 1.917 (95% CI: 1.045-3.514; p=.036) times as likely to have an ED or Observation encounter compared to patients with commercial insurance. Lastly, Other Insurance was a significant predictor of ED/Observation use, but this finding is not given much weight due to the very small sample of patients fitting into this category (n=6).

Table 9: Multivariate Analysis of Factors associated with ED/Observation visits up to 90 days after Transitional Care appointment date

Characteristics	Group	Hazard Ratio (95% CI)	P Value
Age			
	<65	1	
	≥65	.935 (.594-1.472)	.772
Gender			
	Male	1	
	Female	1.186 (.918-1.533)	.192
Race			
	White	1	
	Nonwhite	.696 (.532-.910)	.008*
	Unknown	1.062 (.389-2.902)	.906
Index Length of Stay			
	<3 Days	1	
	≥3 Days	.840 (.650-1.084)	.180
Number of Prior Acute Care Visits within 90 days			
	<2	1	
	≥2	2.569 (1.982-3.330)	<.001*
Insurance Type			
	Commercial	1	
	Medicaid	2.439 (1.402-4.244)	.002*
	Uninsured	1.917 (1.045-3.514)	.036*
	Medicare	1.764 (.941-3.309)	.077
	Other Insurance	5.419 (1.194-23.692)	.028*
Transitional Care Intervention			
	Not Attend	1	
	Attend	1.001 (.741-1.353)	.995

Reduction in Acute Care Use for CTC Patients Relative to Past Usage History

Another way of evaluating the efficacy of the transitional care intervention is to compare the acute care use of the patients who attended the transitional care clinic before and after their initial appointment. In this way, each patient's prior acute care use history serves as his or her own control. Figure 7 shows the number of acute care events (including inpatient, ED, and observation stays) per patient up to 90 days before and after the transitional care intervention, breaking them down by month of patients' first appointment. Similarly, Table 10 displays these numbers before adjustment for patient volume. Over the 18-month study period, there was a 64% average reduction in total acute care events in the 90 days after the transitional care intervention compared to the 90 days before, from 1,273 events before to 455 events after. During this time, the number of acute care events per patient fell from 1.61 events before TC appointment to .58 events after the TC appointment. This reduction was seen consistently over the study period.

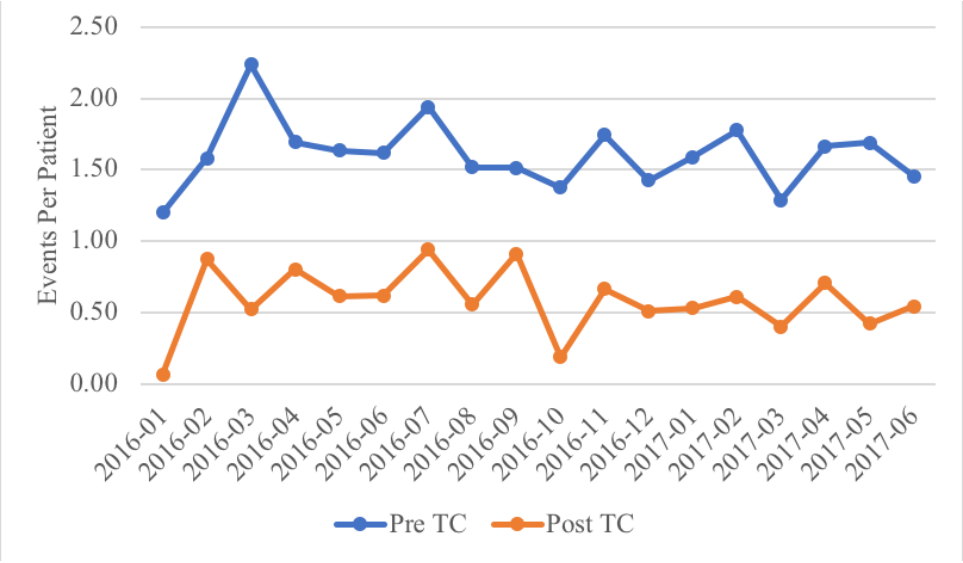


Figure 7: Acute Care Events per Patient 90 days Before and After Transitional Care Intervention

Table 10: Acute Care Events 90 days Before and After Transitional Care (TC) Intervention

Month	Pre TC Events	Post TC Events	Percent Change
2016-01	18	1	-94%
2016-02	38	21	-45%
2016-03	47	10	-79%
2016-04	61	29	-52%
2016-05	85	32	-62%
2016-06	68	26	-62%
2016-07	66	32	-52%
2016-08	82	30	-63%
2016-09	53	32	-40%
2016-10	66	9	-86%
2016-11	68	26	-62%
2016-12	70	25	-64%
2017-01	78	24	-69%
2017-02	105	36	-66%
2017-03	67	21	-69%
2017-04	85	36	-58%
2017-05	120	29	-76%
2017-06	97	36	-63%
Total	**1274**	**455**	**-64%**

CHAPTER FOUR

Discussion

This study compared the features and outcomes of two groups of hospitalized patients who were enrolled to follow-up with a transitional care program after discharge—one group that attended the clinic and another that did not. These groups were roughly similar in age, gender, and racial composition but differed in insurance status and index hospital length of stay. Patients who attended the transitional care program had significantly lower rates of readmissions during the follow-up period compared to those who did not attend—7.15% of Attend group patients were readmitted within 30 days of their first appointment date compared to 13.87% of patients in the Not Attend group. Over 90 days, rates of readmission for the Attend and Not Attend groups were 12.92% and 22.27%, respectively. This difference remained significant after accounting for patient characteristics such as age, gender, race, index length of stay, number of prior acute care visits, and insurance type using multivariate analysis. According to the study's model, receiving the transitional care intervention was independently associated with a 35% lower chance of readmission within 90 days. These findings suggest that the transitional care intervention played an important role in bridging gaps in post-hospital care for patients with complex medical and social needs.

Among the patients studied, factors associated with higher chance of readmission during the 90 day follow-up period were having an index length of stay of two days or greater, two or more prior acute care visits, and being insured through Medicaid or Medicare. These measures provide insight into the complex web of factors that drive

readmissions and suggest directions for further study. Hospital length of stay may be a proxy for factors such as patients' disease severity and their access to social support or caretakers at home. The number of prior acute care visits may reveal information on disease chronicity along with patient care preferences and use patterns. Being insured through Medicaid is a secondary marker of socioeconomic status—in order to qualify for the program in Arizona, individuals and families must earn below 138% of the Federal Poverty Level or have qualifying disability.[65] Medicare, on the other hand, is the federal insurance program for citizens older than 65 years of age and those under 65 who receive Social Security Disability Insurance (SSDI) benefits.[66] Individuals who qualify for SSDI have medically-determined physical or mental impairment that prevents them from engaging in "substantial gainful activity" for at least one year.[67]

Because age greater than 65 was not by itself a predictor of readmission, it appears that factors other than age drove increased readmission risk among Medicare patients in this study. This finding highlights the high-risk population of Medicare recipients under age 65 with disabilities. Notably, over half of the Medicare patients in this study were under age 65 (50.4% in the Attend group and 58% in the Not Attend group). Nationwide, 9.1 million people or 16% of the total Medicare population fall into this category.[67] Medicare patients under 65 are more likely to have low incomes, be black or Hispanic, have cognitive or mental impairment, and rate their health as fair or poor than those over 65. They are also more likely to be dually eligible for Medicaid and Medicare, and a higher share report cost-related barriers to care. This younger disabled population also has higher per capita spending compared to the older Medicare population—$13,098 versus $9,972 in 2014. The higher readmission risk of the younger

Medicare patients in this study should draw attention to the special needs of this population.

The predictors of readmission identified in this study point to the profound and interrelated impacts of socioeconomic status, chronic disease, disability, and social support on patients' health during the post-hospital transition. These findings align with the strong body of literature that illustrates how these factors relate to patterns of acute care use.[35–37,39,40,68] Patients with chronic illness and those of low socioeconomic status face numerous barriers to a smooth transition back home from the hospital. They may lack the resources, capacity, and support from others to care for themselves at home and/or obtain the care they need from providers. Thus, these patients are particularly vulnerable to early decompensation and readmission.

Though readmissions are the primary target of policy incentives and public reporting, they are not the only measure of post-hospital acute care use to consider. In a large study of over 4 million patients hospitalized in three states, Vashi and colleagues found that Emergency Department (ED) treat-and-release visits accounted for 40% of all post-discharge acute care encounters within 30 days.[69] Noting the potential for policies that target readmissions to shift care to EDs, the authors suggest taking ED use into account in the evaluation of care transitions. Others have raised similar points about tracking observation unit stays alongside readmissions.[50] In this study, the transitional care intervention was not associated with any change to rates of ED visits and observation stays after discharge. On one hand, this finding suggests that the decrease in readmissions in patients receiving transitional care was not offset by shifts to other forms of acute care at our hospital. On the other, it signals the need for further study of ED

visits and observation stays among these patients to craft approaches to address these measures as well.

This study found interesting comparisons between the drivers of ED visits and observation stays and those for readmission. In multivariate analysis, the study found that having two or more prior acute care visits, being on Medicaid, and being uninsured were predictors of having an ED or observation stay during the 90 day follow-up period. Of these, being uninsured was a unique predictor to ED/observation stays—it was not significant for readmissions. Medicare and index length of stay were not associated with ED/observation risk, despite both predicting readmission. Interestingly, nonwhite race was associated with lower odds of having an ED or observation stay; race was not a predictor of readmission in this study. This result within the CTC's population differs from that of a large study of Medicare recipients that found higher readmission rates among black patients and minority-serving hospitals.[34]

The relationship between insurance status and ED use is well-studied, but complex.[70] In a recent study using nationally representative survey data, Zhou and colleagues found that uninsured patients used the ED slightly more than those with commercial insurance, but that patients with Medicaid had the highest ED use by far (the study did not assess the effect of Medicare because its sample did not include patients over the age of 65).[71] Uninsured patients also had much lower use of other types of care such as outpatient and hospital care compared to patients with insurance. These complex trends likely involve the interacting effects of insurance and socioeconomic status.

Evidence shows that programs successful at preventing readmissions go beyond a narrow focus to address the broad spectrum of challenges patients face post-discharge.[61–

[63] There is no single "quick fix" to the complex medical and social needs of patients during the hospital-to-home transition. Therefore, effective approaches must address multiple aspects in tandem rather than focusing on a single metric. Programs should also respond to the specific local needs of a patient population rather than adopting a rigid one-size-fits-all plan.

A 2013 study by Dharmarajan and colleagues characterized the diagnoses and timing of readmissions within the Medicare population for three major conditions.[72] The authors found that most 30-day readmissions were caused by diagnoses different than that of the index hospitalization. Most readmissions occurred early after discharge, with median time to readmission of 10-12 days. These findings suggest that patients are vulnerable to a broad spectrum of conditions after discharge from the hospital. With this in mind, the authors write, "Strategies that are specific to particular diseases or periods may only address a fraction of patients at risk for rehospitalization." Instead, the study's findings support a "generalized approach to preventing readmissions that is broadly applicable across potential readmission diagnoses and effective for at least the full month after hospitalization."

The Center for Transitional Care (CTC) intervention fits this description closely. The CTC's care model is multidisciplinary and adaptive to meet the diverse needs of its patients. Its team of medical providers works in tandem with its social worker to address patients' medical and social needs. The clinic establishes contact with patients before they leave the hospital and follows them throughout the vulnerable 30-day period after discharge, or longer based on individual need. The program is open to patients of all conditions, reflecting the wide range of potential readmission diagnoses. In this way, the

effectiveness of the CTC's model in reducing readmissions can be seen in light of the literature on best practice.

The CTC's experience should also be viewed within the context of the patients it serves: an urban, racially diverse, mixed age, and lower socioeconomic status population with intersecting health and social needs. The patients referred to the CTC were each identified as being at-risk for readmission by their hospital physicians and case managers. The clinic offers a spectrum of services to meet the varied needs of its patients. Many of the transitional care models reported in the literature focus on older populations with specific conditions such as heart failure. Few include the services of a social worker, perhaps due in part to the differing needs of their target populations. Notably, the Rush University Medical Center pioneered a social worker-led program designed to target the psychosocial needs of at-risk older adults after discharge.[59] There is much to be learned from models like this one that take seriously the role of social factors in patient health and readmission. While it shares some similarities with the Rush model, the CTC's model remains distinct in that it combines medical and social services in an outpatient setting. Thus, the CTC's experience constitutes a unique addition to the transitional care literature and calls attention to the needs of underserved populations after discharge.

While this study describes the clinic's model in broad strokes and shows its overall effectiveness in reducing readmissions, it does not examine the mechanism through which these results are achieved. Further studies are needed to evaluate specific components of the model, such as social worker consults, medication reconciliation, or performing certain procedures in clinic. The CTC recently published a paper examining the clinic's use of therapeutic paracentesis, a procedure used to relieve symptoms of fluid

overload in patients with ascites.[73] The paper showed that the procedure was safe to use in the clinic, and that it was more cost-effective in the clinic than in the hospital. Offering paracentesis in-clinic provides an avenue for patients to obtain timely relief of urgent symptoms that might otherwise send them to the ED. This example highlighted one small, but effective component of the CTC's intervention that other transitional care programs could adopt. It showcases the important place of small-scope studies in the broader literature.

What, if anything, does this study of one hospital's experience reveal about the bigger national picture of healthcare policy and innovation? Examining an individual case grounds the larger policy discussion in tangible terms and draws applicable lessons for other hospitals. As discussed in chapter 1, the effect of the Hospital Readmissions Reduction Program (HRRP) at the national level has been mixed, in large part because hospitals responded to the law's incentives in different ways. Different hospitals' approaches to readmission penalties varied widely in scope, investment, and success. This has led to a confusing picture at the aggregate scale: readmission rates have declined, but other measures such as penalties and heart failure mortality have increased. Thus, studying these approaches only in terms of their average effects gives a limited picture.

This study contextualized these larger dynamics through the lens of one hospital's response to them. The study examined the case of the CTC at St. Joseph's Hospital and Medical Center (SJHMC) with the aim to describe and evaluate its model of intervention. In doing so, the first goal of this research is to benefit the patients of the CTC by helping inform clinicians about the patient population, outcomes, and best practices. Specific

lessons can be drawn from studying the strengths and weaknesses of the CTC's innovative approach to patient care. These lessons can then be applied to other institutions and adapted to serve the needs of their local populations. In this way, this analysis adds to the literature on evidence-based practices for improving post-discharge care for vulnerable populations.

This study has several limitations. First, only readmissions and acute care visits to SJHMC and its affiliated hospitals could be tracked for this study. Data on admissions, ED visits, and observation stays to outside institutions during the study period was not accessible through patient medical records. Thus, the acute care use rates calculated in this study likely underestimate the total rates of acute care use within the patient population. Since the same limitation applied to the two groups of patients in the study, their rates could be compared to one another without issue. However, the raw rates from this study cannot be directly compared to publically reported rates calculated through different methodology (i.e. using Medicare claims data). This information gap between hospitals highlights the need for improved infrastructure for information-sharing between care settings. A promising effort toward this goal is the Arizona Health Information Exchange, a project that aims to improve care continuity for patients across different providers through a secure electronic health information database.[74]

Another limitation of this study is due to the gaps in data for the Not Attend group. 39.9% of the Not Attend group patients were listed with "Unknown" ethnicity, compared to 0.4% of Attend group patients. Similarly, language was listed as "Unknown" for 19.7% of patients in the Not Attend group versus 0.6% in the Attend group. Consequently, ethnicity and language could not be meaningfully compared

between the two groups or used in later analyses. Missing demographic data is part of a broader issue—a recent study found that race, ethnicity, and language data were largely incomplete among patients enrolled in commercial, Medicare, and Medicaid managed care plans.[75] The stark difference in data availability between the two study groups may have been due to the Not Attend group patients having less contact with the hospital system. Missing clinical data was another part of this shortcoming—this study did not collect primary diagnosis data on Not Attend group patients due to data availability and time constraints. In addition to filling in these information gaps, future studies might follow up with patients that did not attend the clinic to study their reasons for not attending and their alternative plans for follow-up, if any.

A third limitation is the difficulty of accounting for selection bias in an observational study such as this one. The two groups of patients studied differed in several features such as race, index length of stay, and insurance, though the reasons for these differences are not well understood. Multivariate analysis in the form of a Cox Regression was used to study the independent effects of the variables collected, including attending the CTC, on readmission likelihood. However, unstudied differences between the Attend and Not Attend groups (e.g. in clinical severity) could still have confounded the results. Thus, the effects seen should not be interpreted as causal. The usefulness of other statistical techniques such as propensity score matching would be similarly limited by the scope of variables collected. The ideal design for eliminating selection bias would be a randomized controlled trial, though conducting one would require additional time, resources, and administrative approval.

Further research should build on the scope of this study in several more directions. First, future studies should collect more detailed clinical measures to understand how specific conditions and comorbidity relate to patients' risk of readmission and the effect of intervention. For patients with multiple comorbid conditions, disease complexity cannot be adequately measured by primary diagnosis. It is our experience that the CTC's patient population has a high burden of chronic conditions such as diabetes, hypertension, and cardiovascular disease that often occur together and complicate other health problems. Collecting data on comorbidities would allow researchers to study the prevalence of specific conditions like diabetes as well as of the comorbidity burden within the patient population. This data could then be used to identify more specific clinical risk factors for readmission and suggest areas to adopt intervention. Collecting, coding, and analyzing these additional variables would require time and developing new workflows. This investment could provide many useful insights to improve patient care.

Second, future studies should better capture data on social determinants of health and barriers to care in the CTC patient population. These often overlooked factors profoundly affect patients' health during their hospital-to-home transition. Collecting social data for this study was limited by the study's retrospective design, as few social measures are recorded in the electronic health record. This study used insurance status as a useful, but indirect proxy for income and socioeconomic status. Using prospective screeners would be an effective way to gather more specific measures to better understand patients' social needs. Validated tools are available from multiple sources, including the Institute of Medicine, the National Association of Community Health

Centers, and the Boston-based organization Health Leads.[76–78] These screeners can assess needs such as employment, transportation, housing, food security, social support, feelings of safety—all of which influence health. In conjunction the clinic social worker and other staff, workflows could be developed to administer, record, and respond effectively to the surveys. In doing so, measures should be taken to avoid unintended consequences from screening; these might include only screening for factors that the clinic has the capacity to address and involving patients in shared decision-making about their desire for assistance.[79]

A third area for further study is the cost-effectiveness of the CTC intervention. The CTC is sustained on a cost-saving model, rather than a revenue-generating one—it receives funding from the hospital on the premise that it prevents costly readmissions. In this way, the CTC is able to offer its services to patients regardless of their insurance status or ability to pay. To evaluate the sustainability of this model, two parts must be examined: (1) the CTC's efficacy in preventing readmissions and (2) comparing the cost avoided through prevented readmissions to the cost of operating the clinic. This study addressed the first part, showing that patients that attended the CTC had lower readmission rates than those that do not. A further study could quantify the savings of these avoided readmissions against the costs of the clinic.

While this data on cost and sustainability would no doubt be insightful, it is important to frame it in the right perspective. In an editorial published in the New England Journal of Medicine, McWilliams notes that while care coordination is a crucial service for patients with complex needs, there is little evidence that it saves money.[80] Coordinating care is costly, requiring investment in time, technology, and personnel.

Many patients must be treated for each costly complication averted. Further, ensuring timely access to care for patients who previously did not have access by definition increases healthcare use in the short term. For these reasons, McWilliams concludes, “We should coordinate care not to save money but because coordinated care is better care.” This account serves as a reminder that the purpose of all efforts to improve care, ultimately, is for the patients.

Concluding remarks

Hospital readmissions are perhaps best understood as symptoms of a complex set of challenges affecting the hospital-to-home transition rather than as the problem unto themselves.

The national move to tie Medicare payments to readmission rates changed the landscape of responsibilities hospitals had for their patients after discharge. This move sparked significant controversy for holding hospitals as the sole institution accountable for a phenomenon profoundly shaped by patient and community-level factors. Hospitals around the country have responded to incentives in different ways, creating a mixed picture at the national level.

This thesis aimed to find a path forward on readmissions through studying one hospital's approach to improve post-hospital care for its most vulnerable patients. The Center for Transitional Care at SJHMC is an outpatient clinic that provides patients close and timely medical follow-up along with access to social services through the vulnerable period after discharge. Through describing the CTC's intervention and showing its effectiveness in reducing readmissions, this study presents a model that can be studied and adapted by other institutions to meet the needs of their patients. It adds to the literature on factors associated with readmission and transitional care approaches that target those factors. Finally, this thesis calls for further research of care models that address the complex needs of the most vulnerable patients.

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