



# Care Transitions Program Evaluation

*Examining the Impact of Social Risk  
Factors on Pay for Performance Outcome  
Metrics at Bronx Lebanon Hospital Center*

Capstone Project

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## Abstract

In the healthcare industry, a growing focus on improving quality, increasing access, and lowering costs has led to the era of pay-for-performance (also known as value-based payments). Under this model, providers have the opportunity to earn financial incentives but also risk incurring financial penalties in exchange for taking on greater responsibility for patient health outcomes. This has led to the development of varied population health interventions that target the most vulnerable patients with the goal of meeting the various performance metrics. This study used a quantitative approach to examine the effectiveness of one provider-led outreach program, the Care Transitions Intervention, at Bronx Lebanon Hospital Center on thirty-day readmissions (a common pay-for-performance metric). This intervention is designed to provide formalized discharge planning and post-discharge follow-up to help guide patients as they transition from the inpatient setting back to their own homes. The study also examined the impact of various patient level factors on readmissions. These factors can be grouped into two major categories: medical risk factors and social risk factors. Using a logistic regression, it was determined that the top three risk factors increasing the odds of a readmission were presence of heart failure, chronic obstructive pulmonary disease (COPD), and homelessness. The effect of the Care Transitions Program was highly associated with readmission, but did not reverse the risk of readmission from the top 6 factors. From these results, it can be concluded that despite considerable effort and investment by providers, readmissions are difficult to tackle due to the various patient level risk factors. The program is appropriately and actively targeting the riskiest members for the program, but it often takes more than one exposure to the intervention to have an impact on the outcome variable. Just as the medical risks of the population are accounted for using risk-adjustment, social risk factors should also be considered for risk adjustment in current pay-for-performance contracts. Providing social risk adjustment in both federal and state level pay-for-performance programs is vital to ensuring the financial health of critical access hospitals that provide care to the most vulnerable populations in America.

*Key words: Pay for Performance (P4P), Value-Based Payments (VBP), Social Risk Adjustment, Care Transitions, Bronx Lebanon Hospital, Delivery System Reform Incentive Payment (DSRIP)*

## Introduction

Healthcare is a universal need. At every stage in life, from one's first cries to the inevitable final breaths of death, most people will rely on a wide spectrum of healthcare services to maintain their health. Although every individual personally understands the need for quality healthcare, systemic access to care is often much more limited. In the United States (U.S.), access to healthcare services is generally governed by one's insurance coverage. Coverage is provided through a mix of both government and employer-sponsored options. Unfortunately, some people qualify for neither and thus receive only limited emergency services. In addition to the need for increased access and quality, policymakers have determined that the rate at which healthcare costs are rising is unsustainable for both public and individual payers. Critics claim that although the United States spends considerably more per capita than other industrialized nations on its healthcare system, this spending has not led to considerably better health for many of America's most vulnerable residents. (Kaiser Family Foundation, 2017) Together, these three tenets of increasing access, increasing quality, and lowering costs form the backbone or triple aim of healthcare reform for new policies.

While policymakers have pinpointed several reasons why the U.S. does not achieve value for its spending, the most recent wave of reforms has targeted healthcare payment methodology. It is believed that moving away from paying "fee-for-service", (pay providers for each service) towards "paying for performance" (pay providers for meeting health outcomes) will transform the healthcare system from the current state of generating high *volume* into a system that provides high *value*. In the hopes of engaging the healthcare delivery system to make these substantive changes, the federal government and many states have made funds available for healthcare providers to create innovative population health programs. In addition to the funding

of pilot programs, the Centers of Medicare and Medicaid Innovation (CMMI) has also championed large changes to reimbursement policies. These policies and programs often employ a financial “*carrot*” of incentive payments for improving outcomes and/or a financial “*stick*” of penalty payment reductions for adverse outcomes. **This movement towards “pay-for-performance” has created a climate where provider reimbursement is heavily tied to meeting various structural, process, and health outcome measures.**

## Statement of the Problem

Although this shift is generating much needed positive change, it also has potentially significant ramifications for safety-net providers (Gilman et.al, 2015). Existing research on healthcare disparities illustrates that the baseline need for reform is **not** uniform. Areas of poverty tend to not only have higher chronic and infectious disease burdens, but are also more likely to be disproportionately impacted by various systemic social determinants of health (Sandro Galeo et.al, 2007). Together, these factors can help explain why impoverished neighborhoods experience poorer baseline health outcomes. Performance-based reimbursement is intended to reward providers who take responsibility for their patients’ health outcomes. However, compared to the general population, patients with numerous co-morbid conditions are at greater “medical risk” to develop complications and may fail to meet health outcomes despite a provider’s best efforts. Since pay-for-performance was first implemented on the Medicare population (which is elderly and has a high chronic disease burden), most pay-for-performance contracts and programs provide some level of risk adjustment for populations with a high burden of chronic diseases. In comparison, providers with a disproportionate share of “socially risky” patients may also fail to meet health outcomes, due to circumstances outside of the realm of the traditional healthcare industry. Social risk factors such as low income, homelessness, and food insecurity

cannot be treated in a hospital, but can have significant impact on a patient's continued ability to manage his or her conditions outside of acute care settings. Thus, these patients may continue to have high utilization despite considerable efforts by providers to treat their medical needs.

The question of whether social risk factors should be considered when calculating value-based payments is an ongoing debate within the healthcare arena. On the one hand, such calibration would reflect the complex circumstances outside of the traditional healthcare system that impact outcomes. On the other hand, creating risk-adjusted (lower) standards for patients in less affluent neighborhoods may remove the financial imperative to create systemic change to address these social barriers to care. Currently, few programs actively risk adjust for social risk factors. Therefore, providers that have historically struggled to care for patients with high prevalence of social risk factors may find their revenue streams are further depleted unintentionally by new payment reforms.

## Purpose of Study

In light of Medicare pay-for-performance reforms, many states such as New York and California have begun to employ this methodology in Medicaid populations. This research project aims to investigate the feasibility of achieving pay-for-performance metrics at Bronx Lebanon Hospital Center located in the Bronx, NY. Using a sample of patients enrolled in the Care Transition Program intervention, a specific population health program that focuses on formal discharge planning, this study will examine the impact of this program on lowering annual 30 day all cause readmission rates. This program evaluation will further investigate the presence of various social risk factors such as homelessness and low-income (Medicaid status), within the population and their general impact on readmission rates.

## Significance of Study

This study, though narrowly focused on patients in one program at a specific hospital, is relevant to the healthcare reform policy discussions that are occurring at the local, state, and national levels. At the local level, this study is primarily a program evaluation and the results are significant for the various stakeholders of the Care Transitions Program at Bronx Lebanon Hospital Center. Stakeholders include both Senior Leadership and those who are responsible for the day-to-day operations of the program. For the nurses that work directly with patients on discharge planning, the results may inform strategies for improving the operations of the program. Both the quantitative and the qualitative results of this study may inform strategic decisions Senior Leadership will make about resource allocation, process improvement, and future partnerships with other organizations.

At the state level, the Care Transitions Program is one of the population health projects for the Bronx Health Access (BHA) Performing Provider System (PPS) as part of the larger NYS Delivery System Reform Incentive Program (DSRIP). DSRIP is a Medicaid redesign project that aims to improve population health by encouraging greater collaboration between direct healthcare providers and community-based organizations that provide social support. Through grants, DSRIP allocates funds for various PPS projects if they meet reporting and outcome milestones. Therefore, positive performance in this program (meeting process and outcomes measures) has a real monetary impact on the hospital's revenue stream. Consequently, the stakeholders at Bronx Health Access (a conglomerate of organizations, led by Bronx Lebanon Hospital Center) are curious to have a preview of their performance with the patients who may be the most vulnerable within their systems. This may inform leadership of various targets for improvement.

This study and similar studies contribute to the larger, ongoing national debate regarding the merits of social risk adjustment for value-based payments. To inform this debate, this study evaluates the correlation between various social risk factors and the risk for readmission. It also considers whether the Care Transitions Intervention program is able to overcome the medical and social risks of the patients they serve to reduce readmissions. This study may be useful as a point of reference or comparison for other safety-net hospitals that serve a disproportionate share of the homeless population. Similarly, hospitals that treat urban, low-income populations may find this study useful when considering their own programs and value-based contracts.

As new reforms are implemented at the state and federal levels, such studies may inform policymakers about the unintended consequences of current reforms and the need for greater monetary support for providers that treat the nation's most socially vulnerable patients. Readmissions are a common performance metric and it is generally assumed that readmissions are always a result of poor quality of care. This study aims to show that patient level risk factors greatly impact outcomes and should be an important factor that is more accurately captured in the risk adjustment process. The financial implications of failing to risk adjust for socially risky patients are significant. For example, the CMS Hospital Readmission Reduction Program compares readmissions against a national average and deducts up to 3% of Medicare reimbursements for hospitals that have readmission rates worse than the national average. For New York City's public hospital network, Health and Hospitals, the impact of the 2016 penalties was \$1.16 million out of its \$7 billion operating budget (Modern Healthcare, 2016). While this may seem inconsequential, losing reimbursements in a safety net hospital that is already strapped for cash can lead to layoffs and ongoing difficulties to improve performance on metrics. Thus,



existing challenges of treating the nation's poor, homeless, and sickest patients can be worsened by readmission penalties levied by Medicare and other programs and should be examined.

## Literature Review

The literature review examines many topics within healthcare reform to provide substantial context concerning the current climate in the healthcare industry. This information is intended to illustrate the shifts in payment methodology and introduce the debate regarding social risk adjustment. The literature review has 6 sections. It begins with a background on healthcare reform on the national, state, and local arenas. Next it describes the role of data integration and the need for social risk adjustment. Finally, it moves to describe the history of the Care Transitions Intervention and details the specific program at Bronx Lebanon that is examined in this study.

### *Healthcare reform: Creating a shift from volume to value*

The United States, compared to other industrialized nations, has a unique healthcare system, one that many believe could be vastly improved. It has come under intensifying scrutiny due to many reports which show that although the U.S. spends far more on health care than any other country, the quality of care that patients receive varies considerably and is not notably superior to far less expensive systems in other nations (Squires, 2012). In 2015, health care spending was 17.8 percent of Gross Domestic Product (GDP) and cost \$3.2 trillion (CDC NHE Statistics, 2017). Public spending through Medicare and Medicaid services currently account for over 45% of this cost and is expected to rise to 51% by 2025 (CDC NHE Projections, 2017). As the American population ages, the public's dependency on Medicare is expected to increase due to the high chronic disease burden of this population (Advisory Board, 2017). Furthermore, overall health care costs are expected to increase by 5.6 percent annually from 2016 to 2025, in

part because of increased utilization of medical services, higher prices for services, and new technologies (CDC NHE Projections, 2017). As general healthcare costs have risen, the US government has become increasingly fiscally conscious about its portion of the cost associated with providing Americans with healthcare access and treatment.

Spending money on healthcare is important; but many critics feel that the US does not achieve adequate value for its spending. In December 2011, the outgoing Administrator of the Centers for Medicare & Medicaid Services, Dr. Donald Berwick, asserted that 20% to 30% of healthcare spending is waste. He listed five causes for the waste: (1) overtreatment of patients, (2) the failure to coordinate care, (3) the administrative complexity of the health care system, (4) burdensome rules and (5) fraud (Berwick, 2012). A national study also revealed that only 55% percent of patients receive what is considered the “standard of evidence-based care” (McGlynn et.al, 2003). The overtreatment of patients is often labeled as one of the most critical reasons for waste. High costs for poor quality led to a call for healthcare cost reform, beginning with Medicare.

Cost reforms aimed to augment prevailing reimbursement methodologies. The prevailing payment system is largely “quality-blind”, generally providing payments that are independent of patient health outcomes. One target of reforms to reduce health care spending and improve quality has been the Fee-For-Service (FFS) payment model, where providers receive a contracted amount for each service or procedure that is performed. This model has long been criticized for creating incentives for providers to increase the *volume* of services, rather than improve the *value* by increasing quality and efficiency of care. In fact, when complications arise due to errors, providers are paid for the extra services they provide, despite having contributed to the illness. This intensity model of “paying for sickness” provides little incentive to be concerned

with the quality of care patients receive. To curb this trend, providers meeting basic requirements can also be paid on a full capitation rate—essentially a one-time payment for a bundle of services. However, this payment model also creates little financial incentive to increase health (MedPac, 2003). Instead, patients are at risk for under-treatment as providers try to stretch the dollars they receive per patient or per episode. Pay for performance thus emerged as an alternative payment model that aimed to align providers' incentives with increasing value rather than volume.

In May 2005 MedPac, the advisory committee for Medicare, proposed that payment for Medicare services be based on performance with the goal of increasing quality of care and saving Medicare dollars. This system of “**pay-for-performance**” rewards providers for activities that are aimed at promoting health in their populations such as: completing various preventative screenings, running disease-specific tests for early detection of complications, measuring and improving laboratory outcomes compared to a benchmark, and reducing emergency and repetitive utilization due to inadequate or uncoordinated primary care. These evidence-based measures are numerous and are used as a **proxy** to measure the current quality of care, track the improvement over time, and ultimately to raise the standard of care that is provided by the healthcare delivery system to its patients. Pay for performance has two major models: “downside risk” and “upside risk”. Payment contracts vary, but often include both components. Upside risk provides supplementary payments (outside of normal contracted rates) for quality improvement (meeting certain benchmarks on quality measures) and decreasing the total cost of care. Providers may also face downside financial risk for not meeting quality benchmarks or increasing the costs of a population, in which payments may be reduced or a penalty is levied for poor population health management.

Pay-for-performance was first tested with a series of pilot programs championed by the Center of Medicaid Services (CMS) to determine the feasibility of such an approach (CMS Fact Sheet, 2011). States also actively created their own pay-for-performance environments to test how this financing model would affect the delivery and subsequent quality of care in their own patient populations. Currently, there are over 30 Medicaid pay-for-performance programs and about 70% of them plan to expand (Werner et.al, 2011) Private insurance companies have also begun to create shared savings arrangements with provider groups to tie reimbursement to value-based purchasing rather than volume-based transactions. Despite mixed results and various critiques, pay-for-performance (P4P) introduced to the US healthcare system a pivotal shift in the way healthcare is financed. Although each contract or program application may vary, fundamentally this methodology requires providers to accept and manage financial and clinical risk for the population it serves (United Hospital Fund, 2013). By tying this payment toward population-based payments, rather than transaction-based payments, provider groups will have to consider system-level changes to provide high quality, cost- effective care to survive this era of aggressive cost-containment policy.

While pay-for-performance has noble intentions, there are many limitations to this approach. The principle that healthcare payments should be linked to performance metrics is borrowed from the business world where outputs and outcomes are generally more straightforward to measure. In comparison, in healthcare the process of measuring the creation or maintenance of health can be problematic. Therefore, the industry has agreed upon various **proxy** measures rooted in evidence-based medicine that are believed to improve the quality of care patients receive. However, there is considerable administrative burden in documenting and reporting these outputs. The ability to measure the various quality metrics has been made

possible by the rapid and pervasive adoption of electronic medical charts. However, this is a costly investment and prohibitive for smaller, independent physician groups. Even for well-established provider groups and hospitals, reporting quality metrics has required considerable effort to train providers on documentation guidelines for proper coding (to receive credit for various procedures performed). Some data elements are so difficult to collect that some pay-for-performance contracts provide payments simply for reporting the elements correctly. This is known as pay-for-reporting. Not all data can simply be mined from the electronic database and often provider groups are required to do manual chart reviews to review performance.

In addition to the implementation and administrative burden, benchmarks are a significant concern in pay-for-performance methodology. Benchmarks are used to determine if a provider or hospital will face penalties or receive additional payments. However, providers across the nation face varied barriers to providing quality care for their patients. National benchmarks fail to take into consideration these regional variations. Populations that are concentrated in areas of high poverty tend to have a higher baseline risk for poor outcomes. This can lead to higher risk for providers who serve the most vulnerable patients. Benchmarks are also constantly shifting. As providers become more acquainted to taking risk, the room for improvement will decrease and thus the potential for financial gain will also decrease. However, the costs that are required to create an infrastructure that improves patient engagement and maintains high quality care remains expensive. Thus, although there is no question that traditional payment schemes are being replaced, there are many questions about the long-term sustainability of pay-for-performance models.

### ***Pay for Performance in the New York State Medicaid Market:***

In the policy arena, New York State (NYS) has aligned itself with the national goals of healthcare reform to increase access, lower costs, and increase quality. Medicaid in NYS covers

close to 6 million people each year and costs roughly 60 billion each year. Since the implementation of the Patient Protection and Affordable Care Act (PPACA), NYS chose to expand Medicaid, increasing coverage and subsequently healthcare access for over 700,000 individuals who would have not been previously eligible (even under NYS's historically relatively generous income limits). Alongside expansion of coverage for individuals up to age 26 (allowed to use their parents' insurance coverage), this reduced the uninsured rate by 32% from 2013 to 2015 (Health Insurance Organization, 2017).

In addition to increasing access, NYS has taken many steps to try and curb the cost trends for its Medicaid population. New York State has placed most of its Medicaid population in managed care plans, which takes patients out of the traditional FFS model and takes the state out of the business of paying their claims. Instead, NYS provides a monthly premium to insurance companies, which are then tasked with managing the cost of care for their patients. This in turn impacts the contracts that insurance companies will create with the providers who are seeking reimbursement for the care they provide.

Furthermore, through a groundbreaking effort, NYS and CMS entered an agreement that allowed NYS to invest \$8 billion into Medicaid delivery and payment reform through a program called the Delivery System Reform Incentive Payment Program (DSRIP). This program aims to restructure the healthcare delivery system to reduce potentially avoidable hospital use by 25% over 5 years (NYSDOH, 2017). This program intends to increase collaboration between large hospital systems and much smaller, less powerful community-based organizations to provide more coordinated care for the spectrum of services a patient may receive across the healthcare continuum. DSRIP provides funding for various population health projects, based on the demonstrated needs of each community. Funding is given to each Performing Provider System, a

coalition of organizations with a shared attributed population, upon meeting project milestones and performance metrics each quarter. These funds are meant to support the new programs and be reinvested by the various hospital partners and community based organizations into their system to continue to improve the quality of care patients receive. Additionally, the DSRIP program seeks to create long-term sustainability for these funding investments through a Value-Based Purchasing roadmap. The goal is to guide 80-90% of Medicaid payments to Value Based contracts by 2020 (NYSDOH, 2017). The roadmap to this initiative continues to be fleshed out as the national perspectives and best practices evolve. In general, it requires managed care organizations that contract with providers to incorporate elements of pay-for-performance using various quality measures. There are many nuances to this roadmap (various levels, suggested populations, etc), but generally it aims to create a statewide focus on quality preventive and primary care and encourage coordination between organizations in the hopes of reducing future complications and comorbidities.

### ***DSRIP and Measuring Pay-for-Performance in the Bronx:***

In NYS, 25 Performing Provider Systems (PPSs) have come together to participate in DSRIP. There are two major PPSs in the Bronx: Bronx Health Access (BHA) and Bronx Partners for Healthy Communities (BPHC). Led by Bronx Lebanon Hospital Center and St. Barnabas Hospital Center respectively, they have each undertaken 10 population health projects focusing on various vulnerable populations. Data sharing between entities is essential to creating a collaborative atmosphere and to identify patients at need for enhanced services to inform and improve patient care for each of these projects. Both BHA and BPHC have chosen to use the Bronx Regional Health Information Organization (RHIO) as an analytic extension of their data analysis efforts.

In this era of healthcare reform, data collection and analysis has a vital role to play. Historical data and trends has alerted policymakers to the need for reform to improve the quality of care. It has shown us that the need for reform of the healthcare delivery system is **not** uniform. Research has shown that communities of color and poverty experience healthcare disparities, the disproportionate prevalence of various disease burdens, inadequate access to needed care, and poorer quality of care (Kaiser Family Foundation Healthcare Disparities Brief, 2016). These underserved populations exist across the nation. In New York City, data illustrates that residents of the South Bronx suffer from a disproportionate share of chronic diseases such as asthma and diabetes. This neighborhood level phenomenon of inequality can be further understood at the intersections of income, race, and other demographic factors that were historically considered outside the scope of concern by the traditional healthcare system. For example, according to the NYS SPARCS Hospital Discharge data provided by New York City, in 2014 asthma Emergency Department rates (per 10,000 residents) were 4.4 times higher in Mott Haven, Bronx (low-income neighborhood) in comparison to Riverdale, Bronx (higher income neighborhood) (NYCDOH SPARCS, 2014). Similarly, according to the 2015 Community Health Profiles produced by NYC Health, Mott Haven and Melrose have the second-highest rates of avoidable diabetes related hospital admissions, which is double the comparable rate for New York City, at large (NYCDOH Community Profiles, 2015). These historical trends greatly impacted the selection of the population health projects identified by each of the two PPSs in the Bronx such as programs that target patients with asthma, diabetes, mental health conditions, and pregnant mothers.

In addition to identifying the areas of poor performance, data drives the establishment of best practices as new policies and programs are implemented and evaluated by their associated



health outcomes. As new programs are piloted throughout the nation, the availability of current, complete, and accurate health information is a vital element to understanding the needs of patients and for assessing the impact of various intervention programs. Current data collection efforts are used to measure the direct and proxy outcomes that are integral to the pay-for-performance reimbursement methodology. Thus, in recent times, providers and payers have become subject to higher requirements for data collection, reporting, analysis, and ultimately more accountable for providing satisfactory performance. Data is used to determine financial rewards for generating health care savings for avoiding preventable utilization (due to poor outpatient care) and to determine penalties for poor quality. In an era of pay-for-performance, much of the healthcare delivery system is now hungry for data analysis and business insights to improve clinical operations as their performance is directly tied to their revenue streams.

***The Role of the Bronx RHIO:***

In the Bronx, the Bronx Regional Health Information Organization (RHIO) has stepped up to the challenge to provide such health information to the various providers and payers in the region. The Bronx RHIO is a Health Information Exchange organization (HIE) that contains both clinical and financial data for more than 2.1 million patients, describing utilization of healthcare services in hospitals, community-based organizations, and various outpatient settings throughout the Bronx. The network reach of the Bronx RHIO makes it a strong ally in the efforts to reduce healthcare disparities in the Bronx. It is a unifying and driving force for the exchange of data between organizations to increase transparency and ultimately improve the coordination of care that patients receive. By aggregating and sharing the data through a Virtual Health Record, the Bronx RHIO creates interoperability and transparency between systems and organizations that are otherwise siloed. Without the RHIO, providers of care would be limited to the information provided by their discrete systems. This data is also stored in a database that is being leveraged

for population health projects by the two Bronx DSRIP PPSs. It is routinely used for various actionable reports to target patients who may be in need of enhanced services. **The clinical data collected by the Bronx RHIO will be the primary source of data for this research project.**

*Pay for Performance and Social Risk Adjustment:*

Data has also shown us that there are many limitations to the pay-for-performance route for healthcare reform. In particular, it can have devastating effects for safety-net providers. Providers who treat some of the nation's most vulnerable patients become responsible for lowering healthcare costs without any consideration of the difficult barriers these patients face that the traditional health care system is ill-equipped to handle. While few programs will exclude riskier patients from value-based payments, most do not make this consideration at all.

These factors play out prominently for the Bronx population. The South Bronx consists of many minority-majority enclaves. Economically, the population is skewed towards lower income brackets compared to the New York City (NYC) average due to a long history of systemic inequity. These factors lead to poorer health outcomes than NYC overall in many condition categories such as: pre-natal health, asthma, diabetes, preventable hospitalizations, mental health screening, and new HIV diagnosis (NYCDOH Community Profiles, 2015). The causes of these healthcare disparities are numerous. The impact of the traditional healthcare system is limited in scope to address many of the underlying factors.

This has led to a larger debate within healthcare about the need for social risk adjustment in value-based contracts. This study aims to inform that debate, albeit on a small scale. There are many patient level risk factors that can affect readmissions. Most studies focus on subsets of the population based on medical risk factors. It can be seen that for older patients the presence of heart failure and COPD are highly common among patients that are frequently readmitted (Jiang et.al, 2016). Most studies also focus on Medicare patients because 1 in 5 patients in the FFS

world were readmitted within 30 days of hospital discharge (Jiang et.al, 2016). However, some qualitative and quantitative studies have shown that some Medicaid patients can also be at high risk for readmission. Based on a study conducted on a national scale, readmission rates are higher for patients with African American/Black race and for males over females (Trudak, et.al, 2014). Additionally, readmission rates were higher for patients with mental and behavioral health conditions (Trudak et.al, 2014). One important social risk factor that has been studied, but often with limited sample sizes, is homelessness. Leading studies show that almost 50% of the patients who were homeless were readmitted within 30 days and over 70% had some kind of encounter in the acute setting (inpatient, observation stay, ED visit) within 30 days of discharge (Doren, et al, 2013). Other studies show similar patterns for homeless populations as high utilizers of healthcare services. Other factors that led to significant readmission risk in the Medicaid population were medication noncompliance, unstable post-discharge environments, and substance abuse (Regenstein, 2014).

There is a debate about the need for social risk adjustment because other studies have shown that socio-economic status can have little impact on readmission. A very popular study in Health Affairs examined the effect of socioeconomic status on hospital readmission penalties and determined that in aggregate there is little to no effect and therefore risk adjustment would be pointless (Berheim et.al, 2016). This study only looked at Medicaid status and neighborhood income and did not consider other specific indicators such as homelessness or food insecurity.

As CMS pay-for-performance programs have a national impact on reimbursement, the government has also examined the impact of social risk factors. “In October 2014, Congress passed the Improving Medicare Post-Acute Care Transformation (IMPACT) Act, which required the Office of the Assistant Secretary for Planning and Evaluation (ASPE) of the Department of

Health and Human Services to review the evidence linking social risk factors with performance under existing federal payment systems” — and to suggest strategies to remedy any deficits they found (Joynt et.al, 2016). That report was sent to Congress in December 2016.<sup>1</sup> They found that in the Medicare population, beneficiaries with dual enrollment in Medicare and Medicaid (as a marker of low income) had worse outcomes on many quality metrics. The safety-net providers were more likely to face financial penalties in most of the value-based purchasing programs. However, there were some providers serving a high proportion of beneficiaries with social risk factors that achieved high performance level (Joynt et.al, 2016). Therefore it is possible to provide high quality care with the right strategies and financial supports. Based on this report, Medicare is now re-visiting the idea of social risk adjustment in the Hospital Readmissions Program. As hospitals in urban areas continue to lobby for social risk adjustment, the literature in this arena is starting to grow. This study hopes to contribute to this debate using a quantitative approach in an urban, diverse, low-income population.

### *Care Transitions Models/Principles:*

In the light of the national and NYS focus on improving coordination of care, this study will examine the impact of the Care Transitions Intervention (one specific population health program) by Bronx Lebanon Hospital on a common pay-for-performance measures: thirty day readmissions. Care transitions is generally understood as the movement of a patient from one care setting to another due to changes in the patient’s condition (CMS Transitions Summary, 2014). For example, a patient may no longer suffer from an acute condition and may be discharged home from the inpatient setting. Conversely, the condition of a patient may worsen and a patient may be transferred to a more specialized care setting from their primary care

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<sup>1</sup> The official report can be found here: <https://aspe.hhs.gov/system/files/pdf/253976/RTCAppendices.pdf>

doctor's office. Research has shown that the healthcare system has historically failed to provide quality communication to both the patient and other providers during these transitions (Health Affairs Health Policy Brief, 2012). Researchers estimate that this poor care coordination and “subsequent avoidable complications and readmissions were responsible for \$25 to \$45 billion” in unnecessary spending in Medicare patients (Health Affairs Health Policy Brief, 2012).

Care Transitions interventions are a set of actions designed to ensure the coordination and continuity of health care as patients” make these transfers between care settings (Coleman, 2003). This can include: “logistical arrangements, education of the patient and family, and coordination among health professionals involved in the transition” (Coleman, 2003). Strong planning during these transitions can help reduce adverse events that often occur shortly after a patient is in a new care setting. In particular, various models have looked to improve the discharge planning process as patients leave the inpatient setting (where they are monitored by healthcare professionals) to return home (where caretakers are often ill-equipped to pick up the next steps to help patients manage their conditions). To improve care transitions, a shift must occur from institution-centered team care to patient-centered team care. Successful and innovative models are described below.

**(1) Eric Coleman Model:**

This model is the seminal force around which most other care transition programs have subsequently been structured. It was designed based on a provider's clinical observations with the Medicare population and was informed by literature on interdisciplinary teams as well as concerns expressed by Medicare patient focus groups. It describes care transition planning as having 4 key pillars: (1) Medication Self-Management (2) Dynamic Patient Centered Record (3)

Primary Care and Specialist Follow-Up (4) Knowledge of Red Flags. These components are addressed using a series of interventions that begin with a “Transition Coach” that provides formal discharge planning and patient education in the inpatient setting and continues to follow the patient through phone calls and a home visit. The four pillars were also operationalized through the creation of a Personal Health Record (PHR). This booklet was meant to empower patients to be more aware of their care needs and ask important questions of their healthcare providers. The book contained: a record of the patient’s medical history, medications and allergies, a list of red flags, or warning signs, services that they would have in place, and any appropriate discharge instructions, and the dates of their upcoming appointments (Coleman, 2003). Together, these two components are meant to give the patient and any associated caregivers more information, empowering them to be more active participants in care. The intervention also facilitates a direct link between the patient’s inpatient care and the primary care or specialist provider that to help provide appropriate follow-up care.

The study was ground-breaking for its novel approach to a common issue and for its positive results, albeit in a small population in Colorado. In the study, the Transition Coach determined which patients were eligible for the intervention based on several eligibility factors. Initial contact between the patient and Transition Coach was made in the hospital, and was followed by a home (or SNF) visit shortly after discharge, and three phone calls at 2, 7, and 14 days post-discharge. Ideally, the home visit took place within 24-48 hours of discharge. Patients in the intervention group (n=158) were approximately 50% less likely (OR=0.52) to be readmitted within 30 days than patients in the control group (n=1,235) (Coleman, 2004). Since the results of this study, more than 700 organizations nationwide have adopted the intervention components for use with their own populations (Health Affairs Policy Brief, 2012).

## **(2) Project Re-Engineered Discharge (RED):**

The other seminal care transitions project was developed by the Boston University Medical Center. It led to a 30% reduction in hospital readmissions and emergency room visits. The researchers were subsequently asked by the Agency for Healthcare Research and Quality (AHRQ) to create a toolkit to inform provider systems to implement similar programs across the nation. This toolkit identifies 12 components that are essentially to discharge planning and successful coordination of care: (1) Ascertain the need for and obtain language assistance (2) Make appointments for follow-up care (3) Plan for the follow-up of results from tests or labs that are pending at discharge (4) Organize post discharge outpatient services and medical equipment (5) Identify the correct medicines and a plan for the patient to obtain them (6) Reconcile the discharge plan with national guidelines (7) Teach a written discharge plan the patient can understand (8) Educate the patient about his or her diagnosis and medicines (9) Review with the patient what to do if a problem arises. (10) Assess the degree of the patient's understanding of the discharge plan (11) Expedite transmission of the discharge summary to clinicians accepting care of the patient (12) Provide telephone reinforcement of the discharge plan (AHRQ RED Tool 1, 2013). In many ways, these components are similar to the ones proposed by the Coleman model. The major differences include considerations for language and more systemic additions: electronic transmission of the discharge summary to other clinicians and organizing for lab and test results to be provided to clinicians.

Due to the national exposure for this study, many institutions across the nation have also implemented this model. In New York City, Bellevue Hospital (part of the public Health and Hospitals network) implemented this intervention alongside a medical chart color-coding system that outlines risk of readmission. Together, these interventions have whittled away at the

readmission penalty from 0.95% in 2013 to only 0.31% in 2017 (Modern Healthcare, 2016). These are significant improvements among some of the nation's riskiest members.

### **Other Care Transition Intervention Studies in the Literature:**

There are several studies that have been conducted which consider the impact of a Care Transitions intervention on hospital readmissions. Across the literature one can observe mixed results. The studies vary in 2 key factors: patient population studied and scope of the intervention. Regarding patient populations, many studies focused on Medicare patients in well-established, integrated healthcare systems. A handful of studies considered dually enrolled (Medicare + Medicaid) populations and few studies have looked at exclusively Medicaid patients. Few studies have been conducted in urban or economically disadvantaged populations. Other studies focus very narrowly on patients with specific chronic conditions and cannot be used to generalize for a larger patient population. Interventions studied vary greatly. Care transition programs can employ the use of Registered Nurses, Social Workers, Pharmacists, and other Community Health Workers to lead the intervention. Various programs have also moved away from simply focusing on engaging the patient to making larger, sweeping systemic changes (such as subscription alerts for primary care providers) to better coordinate care. These studies are not explored in depth in this literature review.

Due to the vast amount of research that is being conducted across the nation (particularly for Medicare patients), the Patient Centered Outcomes Research Institute (PCORI) launched Project Achieve to systemically research the factors that are the most important in care transitions interventions. Results from across the nation are slowly being gathered (PCORI, 2017).



### *The Bronx Lebanon Care Transitions Program:*

The Bronx Lebanon Care Transitions Program employs many of the components present in both the Coleman and Project RED studies. This program began in 2012 with just one RN Transition Coach for inpatient admissions and has since expanded to include patients in the Emergency Room and a team of Transition Coaches. Today, there is a team of 7 nurses for patients who are discharged from either psychiatric or general inpatient floors. These nurses work the day shift (8am to 8pm) and therefore do not see patients who may be discharged at night. In the Emergency Room, the intervention is led by a Social Worker and is conducted for a much smaller group of patients. Both pediatric and adult patients are eligible for this intervention. Patients must be either English or Spanish speaking, have a phone, be able to pass a brief mental status screening (or have an able/willing caregiver available), and must have a planned discharge home. Patients who are discharged to skilled nursing facilities (SNF) or leave against medical advice are not considered for this intervention. Patients are chosen for the intervention based on their LACE score (explained below) and can also be recommended by providers who round on the patients. Therefore, the patients who receive the intervention tend to be sicker or at greater perceived or actual risk for readmission compared to their counterparts at baseline. Patients are not visited at home by the “Transition Coach”. However, they do receive up to 3 phone calls up to 30 days post discharge to reinforce discharge instructions and follow up with any patient concerns.

### Research Question

Is the Care Transition Intervention Program (independent variable) effective at reducing thirty day annual all-cause readmissions (dependent variable)? Additionally, are social risk

factors such as homelessness and Medicaid status intervening variables that affect this relationship?

## Hypothesis

It is hypothesized that the Care Transitions Intervention would reduce the readmissions risk for patients who receive this intervention. It is also hypothesized that social risk factors such as homelessness and Medicaid status would increase readmission risk, regardless of intervention status.

## Methodology

### *Data collection*

The Bronx Regional Health Information Organization (Bronx RHIO) will be the primary source of clinical and administrative data. It collects Electronic Medical Record (EMR) data from three hospitals in the Bronx: Montefiore Medical Center, Bronx Lebanon Hospital Center, and St. Barnabas Hospital. Together, this covers about 60% of the Bronx inpatient admissions. The Bronx RHIO also collects data from various community-based organizations and small physician practice sites. The specific data elements vary from site-to-site, but are generally transmitted to the Bronx RHIO in almost real-time. Once a feed is live, all patient data flows to the RHIO, but individual records can only be viewed with a patient's consent. For Quality Initiatives (such as this research), aggregate information can be accessed without specific patient consent. For the three major hospitals, historical utilization data is available from 2012 onwards.<sup>2</sup> Based on a complex patient matching algorithm, the RHIO maintains a Master Patient Identity,

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<sup>2</sup> Due to a recent system migration, data for this analysis was only available from July 2015 onwards for querying. System upgrades loading the historical data (back to 2012) will only be complete on January 1, 2018, which is past the timeline for this project.

allowing for a seamless and more complete view of a patient's medical history than would generally be present in any one hospital system. This data is made available in two platforms: (1) Virtual Health Record (VHR) and the (2) Bronx RHIO Analytics Database (BRAD). The Virtual Health Record is a web-based platform that is made available to healthcare practitioners and can be used to inform providers about patients' medical histories. The BRAD stores this information in a server that can be accessed by researchers and analysts through either an identified or a de-identified approach. For this analysis, the data was extracted without any patient identifiers (to avoid the IRB process) using Python scripting tools. Each encounter was tagged with the following factors/features: Features: Heart Failure, COPD, Asthma, Diabetes, Medicaid, Homeless, Age, Gender, Race, Care Transitions Intervention, Admit Source, LOS, Readmission (outcome variable). A logistic regression was conducted in R (statistical software) to determine the relationship between each of these features and the odds of readmission within 30 days.

Qualitative information will be collected by interviewing the main stakeholders of the Care Transitions Program at Bronx Lebanon Hospital Center. This information will inform the researcher about their current operational focus, patient selection methodology, historical performance on various benchmarks, and future areas slated for improvement. These interviews will help with the collection of background information to inform the analysis.

### *Selection of participants:*

Patients will be included in the study if they meet any of the following criteria:

- Patients with an eligible index admission to Bronx Lebanon Hospital Center from July 1<sup>st</sup>, 2015 to June 30<sup>th</sup>, 2017
- Patients must be greater than 2 years of age by the date of the index admission

Exclusion criteria for index admissions (based on 3M logic) (3M Readmissions, 2015):

- Psychiatric or Obstetric diagnosis for the visit
- Discharge Dispositions: Left Against Medical Advice, Walked Out, Transferred to Other Medical Facility, Transferred to Skilled Nursing Facility

Exclusion criteria for readmission counts (based on 3M logic) (3M Readmissions, 2015):

- Psychiatric or Obstetric diagnosis for the visit
- Elective admission
- Readmission on the same day as the discharge of the index admission
- Expired patients

### *Cohort Logic:*

Patients who have ever received a Care Transitions Intervention will form the Intervention Group. Patients are not chosen at random to receive this intervention. Bronx Lebanon Hospital uses two main criteria to target this intervention towards patients who are the most likely to be readmitted: high LACE score<sup>3</sup> and provider recommendation. While it is impossible to recreate the clinical judgment and reasoning that is used to recommend patients for an intervention, components of the LACE score methodology will be used to understand the spectrum of patients served and not served by the Care Transitions Intervention.

Patients who have never received a Care Transitions Intervention will form the Control Group. Naturally, this may skew towards patients who are healthier and are at a lower baseline risk of readmission. In order to better match the Intervention and Control Groups, each feature (factor/variable) will be considered in the logistic regression to determine which factors (alongside the intervention) may have the greatest impact on risk of readmission.

### *Data analyses and sub analyses:*

By using Bronx RHIO data, one receives a more complete view than when viewing one EHR system alone. Though this study focuses on patients with an index admission at Bronx Lebanon Hospital Center, it is possible to see if patients were subsequently readmitted to other Bronx hospitals (Montefiore, St. Barnabas). Although these readmissions would not impact

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<sup>3</sup> The LACE score methodology is described in depth in Appendix A: Operationalization of Key Terms. For quick reference, it is comprised of 4 major parts: Length of Stay of Index Admission, Acuity of Admission, Chronic Disease Burden, and ER Visits in the Last 6 months

Bronx Lebanon's readmission penalty calculations in the current model, there are future payment models that are considering the inclusion of leakage to other institutions for utilization metrics.

Rates for 30 Day All-Cause Readmissions will be calculated on an annual basis. This is the primary outcome variable. Some general statistics will be made available about both the Control and Intervention groups. Multiple factor analysis was not conducted in this study. Each potential risk factor will be evaluated separately. This is a known limitation as risk factors do occur in clusters (ex: old age is highly associated with higher burden of chronic illnesses, or having more than one chronic illness is common). Due to the seasonality (some months have higher rates of admissions and readmissions due to flu prevalence, cold weather, etc), the readmission rates are calculated on an annual basis.

## **Limitations**

The methodology used in this study has several limitations that make it difficult to ascertain if there is a true correlation between the Care Transitions Program and thirty day readmissions. Although the study divides patients into two groups for comparison (control and intervention), the patient selection methodology for neither the control group nor the intervention group is randomized. The patient population in the intervention group is likely to be at a greater risk for readmission than the control group because they were chosen based on high LACE score and by provider referral. The control group may have refused the intervention, may have been on a floor/discharge time that did not have a Care Transitions Nurse, or may be at generally low risk for readmission.

Although the study tried to determine several medical and social risk factors for readmission and control for them (in the logistic regression), there are many intervening variables that could not be controlled for in a semester-long project. Many studies that consider

readmission risk will calculate medical acuity using a validated tool such as the Charlson Score. This score looks at an aggregate combination of major co-morbid conditions and assigns a risk score accordingly. In this study, each disease factor was considered in the model independently. If the combination of diseases (ex: having heart failure + diabetes) is a significant feature, the regression model (as currently executed) would not have been able to determine this effectively. Time and resource constraints prohibited the calculation of an aggregate medical risk score such as the Charlson. Poor behavioral health is another major factor that can lead to readmissions. Although psychiatric admissions were excluded, patients with alcohol and substance abuse diagnoses were not excluded. This is because this data is considered sensitive and is protected by NYS and could not be accessed without an IRB. They are an unknown quantity in this analysis. Ideally, patients with these conditions would be also be considered as having a separate medical and social risk factor.

In addition to medical risk factors, the universe of social factors is numerous and only a few could be captured using the available data source. It would have been ideal to capture additional information such as SNAP status, immigration status, and caregiver status. If there was more time, it would have been ideal to create several flags within the data set: persons with multiple readmission, more than 5 ER visits in last 6 months, and presence of a PCP visit within 14 days after discharge. It would have been interesting to see the impact of these factors on readmission risk. Additionally, unlike chronic conditions which do not generally disappear, social risk factors can be much more fluid and can change over the course of time. A major limitation for the factors that were studied (homelessness and Medicaid status) is that they are not always reliably coded in the patient chart. With more studies that focus on the effects of these factors on outcomes, there may be increased pressure to better document various social

determinants of health in the patient record. Although the study identified patients with Medicaid status, it did not actively identify the other forms of insurance patients had. The literature points to the relatively high risk of dual-eligible patients (have both Medicaid and Medicare) and the relatively low risk of readmission for patients with commercial insurance as the primary payer (Karen et.al, 2017). It would have been ideal to identify patients that are dual-eligible and use this as a feature for testing readmission risk.

In an era of pay-for-performance, it is understood that Bronx Lebanon will have many programs that aim to reduce readmissions. The Care Transitions Intervention is not an isolated program. It is used to link patients to many other programs and resources. It is important to consider that institutional changes have been occurring over the span of the 2-year period for this study. These changes are not well documented and could not be controlled for given the time constraints in this project. The standard of care that is provided at Bronx Lebanon is constantly being changed to reflect new guidelines and protocol. Thus, patients over the course of time may be exposed to many different interventions, which may have each had an impact on readmission risk. Additionally, since 2017 the Care Transitions Intervention group has become increasingly connected to Community Based Organizations (CBOs) and began receiving the CTP interventions in the ED room, if appropriate. These CBOs provide supplementary services that may help patients mitigate social risk factors. These changes are not accounted for in the current model.

## **Qualitative Findings: Interview with Natalie Cruz RN**

I had the opportunity to interview Mrs. Natalie Cruz who is a Registered Nurse (RN) at Bronx Lebanon Hospital Center. She was hired in 2012 for the original Care Transitions Pilot program, a collaborative effort between Bronx Lebanon Hospital Center, Montefiore Medical

Center, and St. Barnabas Health System. At the time, she was the only nurse in the hospital who was responsible for any formal discharge planning with patients. In our interview, she described how much the program has changed and grown since its inception. She began with Medicare patients who were being discharged from the general inpatient setting. Following high patient satisfaction scores and some minor reductions in readmission (about 1%) from the original pilot evaluation, the program has expanded. Today, there are 6 other RNs who provide this intervention. They are now spread out across the hospital floors, speak to patients with all types of insurance coverage, and cover psychiatric and pediatric patients as well. The program has essentially tripled in size and scope!

Over time, they have also changed their methodology for selecting patients for intervention. Back in 2012, for the pilot program they relied solely on the LACE score (highest score is prioritized for outreach) to select patients. Patients without a score did not have any prior utilization in the past one year and therefore excluded from receiving the intervention. Today, they use both the LACE score and allow providers to refer patients who they believe are frequent utilizers or may be at high risk for readmission. Patients are often selected after morning rounds conducted by the inpatient interdisciplinary team (doctor, nurse, pharmacist, residents, etc.) and potentially deteriorating patient conditions have been assessed. Therefore, the patients that are selected for the Care Transitions Intervention are likely to be at greater risk for readmission than the general population. Additionally, greater provider involvement has led to increased provider satisfaction with the program and has increased the demand for this intervention.

Anecdotally, Natalie described the impact of social risk factors on the general risk of readmission. Many of the patients she works with are indeed homeless. They are usually first encountered in the Emergency Room, complain of chest pain, and are subsequently admitted to



an inpatient unit. To combat this trend, Bronx Lebanon is now looking to employ this intervention more effectively in the ER. Over the years, they have intermittently employed ED navigators to work with frequent flyers, but there was little formalized process or documentation for their findings. Since January 2017, the RNs and Social Workers who lead this intervention in the ED have begun to make a more concerted effort to document their interventions in a standardized manner. This informs providers and case managers (who will see the patient during their inpatient visit) of the social needs of the patient. These efforts have been formalized due to the lessons learned from the inpatient Care Transitions program. This study lends itself as a supporter for the need for thoughtful planning for patients with social risk factors.

One of the biggest changes that Natalie described was an increased collaboration with Community Based Organizations (CBOs). Recognizing the complex social needs of their population has led to greater integration with organizations that are specialized to meet specific social needs. Case managers from organizations like Bronx Works and Housing Works are regularly present in the ER of Bronx Lebanon for consultation or follow-up on their cases. Support from these organizations has grown due to funding from the DSRIP programs and has been crucial to better meeting the real needs of the socially risky patient population. This is an area that Natalie hopes will continue to grow to include an even wider spectrum of organizations and covered services.

The conversation with Natalie was extremely informative. It provided insight into the current operations of the program that was vital to constructing the data analysis efforts. Additionally, she provided context for many of the ways in which the program has changed over time and continues to improve its offerings. Natalie's willingness to be interviewed was vital to better understanding this program and its plans for improvement.

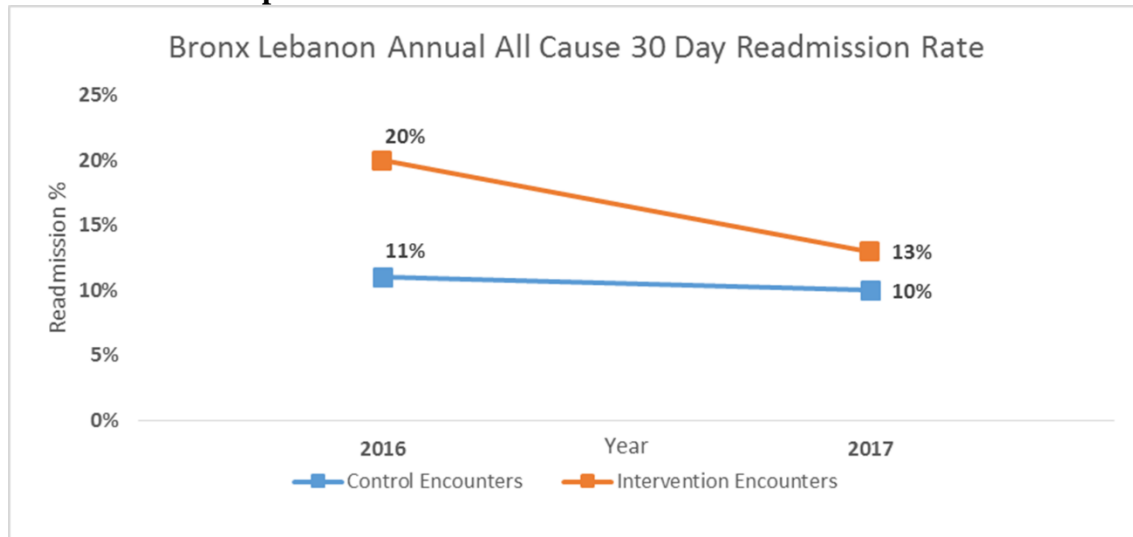
## Quantitative Findings

Admission data was collected for a period of two years. The total population consisted of **31,866 patients that had 53,149 admissions** in this time period. Each encounter was tagged with demographic factors and the encounter was used as the unit of analysis (rather than the patient). Data is provided in the table below to describe the demographic and risk factor variables found in both the control and intervention encounters.

**Table 1: Demographic Comparison of Control and Intervention Groups**

<b>Variables affecting Readmission</b>	<b>Control Group (n=47,833)</b>	<b>Intervention Group (n=5,316)</b>	<b>Difference Between Groups</b>
<i>Age</i>			
2 – 21	66.4 %	61.8 %	4.6 %
22 – 64	22.3 %	29.8 %	- 7.5 %
65 – 85	8.0 %	4.6 %	3.4 %
85+	3.3 %	3.8 %	- 0.6 %
<i>Race</i>			
White	9.5 %	9.3 %	0.2 %
Hispanic	38.3 %	39.0 %	- 0.8 %
Black	39.7 %	41.7 %	- 2.0 %
Other	4.8 %	4.9 %	- 0.1 %
<i>Gender</i>			
Female	49.0 %	48.6 %	0.4 %
Male	51.0 %	51.4 %	- 0.4 %
<i>Medicaid Status</i>			
Yes	68.8 %	84.8 %	- 16.0 %
No	31.2 %	15.2 %	16.0 %
<i>Disease Conditions</i>			
Heart Failure	19.8 %	36.3 %	- 16.5 %
COPD	19.3 %	35.3 %	- 16.0 %
Asthma	24.3 %	34.9 %	- 10.6 %
Diabetes	36.1 %	51.6 %	- 15.5 %
<i>Homeless</i>			
Yes	11.6 %	11.2 %	0.4 %
No	88.4 %	88.8 %	- 0.4 %
<i>Length of Stay of Index Admission</i>			
0-2 days	27.6 %	8.8 %	18.2 %
3-5 days	46.4 %	39.3 %	7.1 %
6+ days	26.2 %	52.0 %	- 25.8 %
<i>Admit Source</i>			
Emergency Room	83.8 %	93.4 %	- 9.5 %
Other	16.2 %	6.6 %	9.5 %

**Figure 1: Unadjusted Readmission Rates on an Annual Basis for 2016 – 2017 for Control and Intervention Groups**



**Table 2: Ranked Order of Features from Logistic Regression: Odds Ratio and P Values**

	<b>Factor Affecting Readmission</b>	<b>Odds</b>	<b>P Value</b>
1	Heart Failure	1.786	>0.001
2	COPD	1.732	>0.001
3	Homeless	1.394	>0.001
4	Medicaid	1.240	>0.001
5	African American/Black	1.223	0.001
6	Asthma	1.199	>0.001
7	Care Transitions Intervention	1.185	>0.001
8	Latino/Hispanic	1.176	0.011
9	Male	1.109	0.000
10	Age (65 - 85)	0.584	>0.001

All of the top 10 factors affecting readmission were statistically significant (p value less than 0.05)

## Discussion

The initial demographic comparison (Table 1) between the Control and Intervention groups confirmed that the Care Transitions Program is actively identifying patients that are at higher risk for readmission. The Intervention group had higher rates of all chronic diseases: Heart Failure, Diabetes, Asthma, and COPD. They also were more likely to be admitted to the Inpatient setting through the Emergency room, had longer average length of stay, and a higher percentage of Medicaid patients compared to the Control group. These are all found to be statistically significant risk factors for readmission in the logistic regression. In comparison, age, race, and gender were all comparable between the two groups of encounters. All of these factors were singularly considered in the logistic regression to determine their relationship with readmission risk. From the logistic regression, it was determined that the top two factors increasing the odds for readmission were presence of heart failure and COPD. This is in line with the findings in the broader literature. The number three risk factor was homelessness, which was prevalent (over 10% across all admissions). It was a significant risk factor—greater than age and Medicaid status. This is an important finding, as it speaks to the need for social risk adjustment in pay-for-performance programs. Ms. Natalie Cruz also spoke of the difficulties of treating homeless patients. These patients lack the fundamental resources needed to maintain their health once discharged from the hospital. All of the top ten risk factors were statistically significant in regards to increasing readmission risk.

The Care Transitions program intervention was highly and positively associated with readmission (Table 2). This is the opposite effect of what was hypothesized. It was expected that the Care Transitions program would have a negative odds ratio with readmission. However, the regression did not take into account the year of the intervention (2015, 2016, or 2017). When

annual 30 day all cause readmission rates were plotted for the Control and Intervention encounters, clear trends emerged (Figure 1). The graph clearly illustrated that the patients who received the intervention were significantly different from those who had not been chosen for the intervention. As can be seen in Figure 1, the readmission rate for the Intervention encounters at baseline was 20% compared to only 11% for the Control encounters in 2016. However, after one year (of potentially multiple Care Transitions interventions), the readmission rate for the Intervention encounters was 13%, much closer to the Control Group which had a readmission rate of 10% in 2017. From these findings, we can see that the Care Transitions Program is having some effect on reducing readmission risk, about 7% for these patients between 2016 and 2017. However, presence of just a single Care Transitions Intervention at an encounter did not overcome the risk factors presented in Table 2. Therefore, it is important to consider that despite the efforts and investment by leadership at Bronx Lebanon into the Care Transitions program, readmission risk is primarily dictated by the patient level medical and social risk factors. These findings support the need for social risk adjustment and the need for funds to support programs like Care Transitions, so that multiple exposure to such interventions can reduce readmission rates for the most vulnerable patients.

From the programmatic standpoint, Bronx Lebanon is looking to better target their members with social risk factors. The conversation with Natalie showed that Bronx Lebanon recognized the need for greater collaboration with Community Based Organizations with effective case managers that are equipped to tackle ongoing social risk factors. Additionally, preventing readmissions needs to begin in the Emergency Room where a subsequent readmission can truly be prevented. Thus, the efforts they have made to transfer the principles of this program to ER based interventions is logical and in line with the data that is presented (much of the

intervention encounters are admitted through the ER). It is exciting to hear about the changes the program is making. It is reassuring to see that the hospital recognizes the need for quality transitions of care for patient health and outcomes.

As a society, how do we ensure that payment reflects the resources required to provide high-quality care while also providing incentives to ameliorate existing disparities in care? It is important to continue to measure and report quality metrics for patients with social risk factors. Without understanding disparities and creating specific incentives to reduce them, there is little hope for a future without them. Additionally, pay-for-performance programs should monitor the impact of their programs on provider groups to ensure that financial penalties are not so steep that critical access providers find themselves insolvent. Consider adjusting some quality metrics, particular those that are the most likely to be affected by social risk factors and are not as easily impacted by provider/hospital led efforts. Finally, determine if current payment incentives/models are meeting the needs of provider networks that care for the country's most vulnerable patients. Caring for those who are uninsured and socially-risky may come at high cost and current reimbursement models may not be meeting those financial burdens---and may be further depleting hospitals of resources through penalties. With thoughtful consideration and tweaks for safety-net providers, pay-for-performance models may be one step closer to achieving their aims of decreasing cost and improving quality without eroding access in less affluent neighborhoods.

## Conclusion

This program evaluation contributed to the current debate in healthcare policy concerning the need for social risk adjustment. In a climate where Medicare and Medicaid payments are increasingly tied to outcome metrics, it is important to consider the potentially disastrous effects payment penalties may have for critical access hospitals. This study showed the importance of studying this topic and the need for programs to pay greater attention to the social risks of their population while designing interventions. There is a need for greater focus in documenting social determinants of health. It is possible that the prevalence of social needs presented in this study is understated, as diagnosis codes for social risk factors may not be used uniformly by all providers. This is an important consideration, because the inability to measure these risk factors is a major reason why most researchers have failed to recognize their importance. The fact that homelessness was a significant risk factor for increased readmission risk is a telling story. It provides

It can be seen from this study that readmissions are a difficult measure to tackle. Readmission risk can be reduced by provider-led efforts, but is highly tied to patient-level risk factors—both medical and social in nature. The Care Transitions Program is a valiant effort towards reducing readmission risk for the most vulnerable portion of the population. Although repeated exposure over time can reduce the rate of readmission, the logistic regression showed that a single instance of the intervention did not lead to a direct decrease in readmission risk. Therefore, the need for social risk adjustment is clear. This study examined a few key social risk factors, but illustrated the need for greater focus and research on the impact of social risk factors and effective programs that can mitigate these risks. While critical access hospitals work to change the course of their patients' health outcomes, it is imperative that they do not lose critical funding needed for such projects. Critical access hospitals see a disproportionate share of the



patients with high medical and social risk and this evaluation points to the need for greater monetary resources to tackle these healthcare disparities—not financial penalties to deepen these barriers. It is hoped that such studies will lead programs at the national and state level to consider the unintended consequences of policies that promote financial penalties for hospitals that treat the nation’s poorest and sickest patients.

## Acknowledgements

I would like to thank those who have supported me in this endeavor and throughout my journey towards completing this Master's degree. I would like to begin by thanking my parents. They have always encouraged me to pursue excellence in my education, seek out new opportunities, and strive to be a lifelong student. Their nurturing home and Keurig machine have provided me with the stamina to balance my classes alongside a demanding job. I would like to thank my sister for being my late-night study buddy and reading through the paper with a fresh perspective. Next, I need to thank the leadership at the Bronx RHIO. Their willingness to entrust me with their clinical data allowed me to explore my interests in healthcare policy and evaluation and use my programming skills for this project. Thank you to Stephanie Berger and Shawn Varughese for consulting on the data analysis components. I would not have any results to report without their guidance and late hours of code review. Last, but definitely not least, a special thanks to Professor Steven London for his patience, guidance, enthusiasm, compassion, and support as I slowly pieced together this project.

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## Appendix

### *Appendix A: Definition and Operationalization of Key Terms*

**Care Transitions:** the movement of patients from one healthcare practitioner or setting to another because their conditions and care needs change.

*Examples:* Patient is stable and can be discharged from the hospital to one's home. Patient's medical condition has worsened and patient must be transferred to a more specialized facility.

**Care Transitions Program:** intervention that begins at the time of patient's discharge from the hospital setting that aims to improve the patient's ability to manage care needs at home. There are various types of interventions that may be included in this program: Pharmacist-led medication reconciliation, post-discharge home visits by a nurse, post-discharge follow up calls, patient instructions, etc. None of these elements are required, except that the intervention must begin in the acute setting before discharge and must involve the patient and his or her caregivers in discharge planning. The program generally aims to reduce the likelihood of a readmission event within 30 days. This intervention can be led by a Registered Nurse (RN) or a Social Worker (LSW) in either the inpatient discharge or the emergency room discharge setting.

**30 Day Readmissions:** An admission that takes place within 30 days of a previous (index) admission. This is a common pay-for-performance measure in both Medicare and increasingly in Medicaid populations. This is a quality measure that assumes that thirty day readmissions are considered preventable if a patient receives quality hospital care and quality discharge planning.

*Note:* Not all admissions/readmissions are considered preventable. Common exclusion logic has been created by 3M (3M Readmission Methodology, 2012). Elective (scheduled visit) admissions are excluded from readmission consideration. Index and readmission events that have a primary diagnosis of psychiatry and maternity are excluded. Index admission events that have a discharge disposition of "Left Against Medical Advice, Walked Out, Transferred to Skilled Nursing Facility, Transferred to Another Medical Facility" are all excluded. This measure is concerned primarily with patients who are discharged to their homes and are not expected to return to the acute setting within 30 days.

**Frequent Emergency Room (ER) use:** Patients may overuse the ER for many reasons: lack of a relationship with primary care, homelessness, proximity to the ER compared to regular care options, and substance abuse and/or mental health diagnosis. Some literature points to the idea that a higher number of ER visits in a year is one of the factors that puts a patient at risk for higher rates of readmission, as the ER is often a gateway to an admission. (Walraven et. al, 2010)

Different studies set varying thresholds to categorize patients as "frequent flyers" or "high utilizers". For this study, patients with more than 5 ER visits in a year were considered "ER super utilizers". This categorization is based on the utilization study conducted by the NYS Department of Health in 2013 that analyzed ER visits across the state to understand key patterns. (NYSDOH Statistical Brief #8, 2015)

3M has also created logic for Potentially Preventable ER Visits (PPV). However, this logic utilizes a proprietary algorithm that could not be adapted for this study in during the project timeframe. This may be an area for improvement for a future study as this tags visits that have ambulatory care-sensitive diagnoses that could have been treated outpatient with greater care coordination. (Medicare Payment Advisory Committee, 2014)

**Homelessness:** This is identified in the clinical data as having the diagnosis code V60.0 (ICD-9) or **Z59.0** (ICD-10) within +/- 6 months of the index date. Additionally, patient addresses will be compared to known shelter addresses and patients can be also be flagged using this indicator. (UCHC,2017)

**Low-income:** Medicaid status will be used a proxy to designate individuals as low-income. Diagnosis codes of **Z59.5** for Extreme poverty and **Z59.6** for Low income at any point in a patient's record will also be considered as an indicator of low-income status.

**LACE Score:** predicts the likelihood of readmission using four main criteria. This is a score used by Bronx Lebanon Hospital Center to prioritize patients for the Care Transitions Intervention. LACE scores range from 1 – 19, with higher scores predicting a higher likelihood of readmission within 30 days of discharge. This methodology has been studied extensively and has shown to have moderate to high predictive value for readmissions and more accurate predictive value for frequent ER use (Besler, 2017).

- **L:** length of stay of index admission
- **A:** acuity of index admission (for example, admissions through the ER are more severe than elective admissions)
- **C:** co-morbidities as indicated by the Charlson score
- **E:** number of emergency room visits in the past 6 months



## *Appendix B: Acronyms and Definitions*

**ACO:** Accountable Care Organization

**BRAD:** Bronx RHIO Analytics Database

**BRIC:** Bronx RHIO Informatics Center

**CBO:** Community Based Organization

**CTP:** Care Transitions Program

**CMMI/CMS:** Centers of Medicare and Medicaid Innovation

**DSRIP:** Delivery System Reform Incentive Payment

**ED/ER:** Emergency Department/Emergency Room

**EMR/EHR:** Electronic Medical Record/Electronic Health Record

**HIE:** Health Information Exchange

**ICD:** International Classification of Diseases

**LOS:** Length of Stay

**NYS:** New York State

**P4P:** Pay-for-performance

**PPS:** Performing Provider System

**RHIO:** Regional Health Information Organization

**RN:** Registered Nurse

**SNAP:** Supplemental Nutrition Assistance Program (Food Stamps)

**VBP:** Value Based Payments

**VHR:** Virtual Health Record

## Appendix C: Raw Output from Logistic Regression

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.5076	-0.5173	-0.4181	-0.3572	2.7056

Coefficients: (2 not defined because of singularities)

	Estimate	Std. Error	z value	Pr(> z )	
(Intercept)	-1.2502454	0.4486601	-2.787	0.00533	**
male	-0.2991912	0.1519186	-1.969	0.04891	*
female	-0.4073983	0.1515986	-2.687	0.00720	**
latino	0.1622279	0.0636887	2.547	0.01086	*
african	0.2026204	0.0633180	3.200	0.00137	**
not_latino	-0.1344494	0.0971019	-1.385	0.16617	
white	0.3490941	0.0727430	4.799	1.59e-06	***
age1	0.0908885	0.0773205	1.175	0.23980	
age2	0.1247232	0.0783500	1.592	0.11141	
age3	-0.4283780	0.1076109	-3.981	6.87e-05	***
age4	NA	NA	NA	NA	
Homeless_1	0.3340214	0.0404647	8.255	< 2e-16	***
Heart_Failure_1	0.5896331	0.0327748	17.990	< 2e-16	***
Diabetes_1	0.3134233	0.0297707	10.528	< 2e-16	***
COPD_1	0.5541313	0.0344054	16.106	< 2e-16	***
Asthma_1	0.1809615	0.0332334	5.445	5.18e-08	***
Medicaid_1	0.2194216	0.0334441	6.561	5.35e-11	***
LOS	0.0003502	0.0013139	0.267	0.78981	
EMERGENCY	-1.4238515	0.4109372	-3.465	0.00053	***
CLINIC_REFERRAL	-1.2487889	0.4176631	-2.990	0.00279	**
PHYSICIAN_REFERRAL	-1.2957806	0.4127197	-3.140	0.00169	**
COURT	NA	NA	NA	NA	
Care_Transitions_Note	0.1787899	0.0416969	4.288	1.80e-05	***

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 38309 on 53148 degrees of freedom  
Residual deviance: 36239 on 53128 degrees of freedom  
AIC: 36281

Number of Fisher Scoring iterations: 5

Call: glm(formula = Readmission\_Final ~ male + female + latino + african + not\_latino + white + age1 + age2 + age3 + age4 + Homeless\_1 + Heart\_Failure\_1 + Diabetes\_1 + COPD\_1 + Asthma\_1 + Medicaid\_1 + LOS + EMERGENCY + CLINIC\_REFERRAL + PHYSICIAN\_REFERRAL + COURT + Care\_Transitions\_Note, family = "binomial", data = Readmission\_Bronx\_Leb\_Data\_Source)

Coefficients:

(Intercept)	male	female	latino	african
-1.2502454	-0.2991912	-0.4073983	0.1622279	0.2026204
not_latino	white	age1	age2	age3
-0.1344494	0.3490941	0.0908885	0.1247232	-0.4283780
age4	Homeless_1	Heart_Failure_1	Diabetes_1	COPD_1
NA	0.3340214	0.5896331	0.3134233	0.5541313
Asthma_1	Medicaid_1	LOS	EMERGENCY	CLINIC_REFERRAL
0.1809615	0.2194216	0.0003502	-1.4238515	-1.2487889
PHYSICIAN_REFERRAL	COURT	Care_Transitions_Note		
-1.2957806	NA	0.1787899		

Degrees of Freedom: 53148 Total (i.e. Null); 53128 Residual  
Null Deviance: 38310  
Residual Deviance: 36240 AIC: 36280  
> summary(model)