THE ROLE OF CARE COORDINATION IN MEETING QUALITY PERFORMANCE MEASURES IN AMBULATORY CARE SETTINGS

A Dissertation

by

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ABSTRACT

The accountable care organization (ACO) is a delivery reform initiative that was devised to focus on care, health, and cost; quality of care within these organizations is determined by a set of defined performance measures. The primary goal of this study was to investigate how a care coordination intervention, targeted to patients assigned to the organization's ACO, affected patients' likelihood of meeting performance measures. This is a retrospective longitudinal analysis using a pre post with non-equivalent control group research design. The sample included Medicare patients, age 66 and older, receiving care in a traditional clinic setting (n=718). The intervention took place in 2013, and data from the prior year were used to assess the change in patients' performance over time. Methods used included grouped logistic regression, logistic regression, and difference in differences analyses. The results of these analyses show a positive association between care coordination and meeting defined performance measures for 1) all measures, 2) process measures, and 3) outcome measures. When comparing the impact of care coordination on process measures and outcome measures, process measures were more readily impacted by this care coordination intervention. Care coordination was positively associated with patients meeting defined performance measures. The results of this study can inform like organizations of an intervention to improve population health that does go beyond a structural change. This study also forced the examination of CMS' defined performance measures; having one set of measures used for dual purposes may not be an effective performance management strategy. The performance measures have been highly validated for the purpose of

improved population health, but are doubling as criteria by which both organization's and providers' performance are being assessed. Future research should examine the extent to which the evaluative criteria of defined performance measures are meetable and fair from a performance management purposes.

DEDICATION

To my mom who instilled in us the value of education and insisted that we always we finish what we start.

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NOMENCLATURE

A1c	Glycated hemoglobin
ACE	Angiotensin converting enzyme
ACO	Accountable Care Organization
BP	Blood pressure
CAD	Coronary artery disease
CAHPS	Consumer Assessment of Healthcare Providers and Systems
CMS	Center for Medicaid and Medicare Services
dL	Deciliter
FQHC	Federally Qualified Health Center
HbA1c	Glycated hemoglobin
IOM	Institute of Medicine
IVD	Ischemic vascular disease
LDL	Low-density lipoprotein
LVSD	Left ventricular systolic dysfunction
Mg	Milligram
NQF	National Quality Forum
NCC	Nurse Care Coordination
PPACA	The Patient Protection and Affordable Care Act

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CHAPTER I

INTRODUCTION

The American health care system is broken, with poorly designed care processes (Fanjiang, Grossman, Compton, & Reid, 2005) and barriers to accessing to care, creating fractures in the continuity of patient care. The United States (U.S.) spends more on health care than any other nation, while experiencing relatively low health status. In 2014, the U.S. outspent all other nations on health expenditures, which accounted for 17.5 percent of the gross domestic product, approximately $9,500 per person (Center for Medicaid and Medicare Services, 2015). Yet still, America ranked last overall of 11 industrialized countries included in the Commonwealth Fund report, with specific failings related to administrative cost, provider communication, duplication of testing, access to care, infant mortality, preventable deaths, healthy life expectancy, and coordinating care (Mahon & Fox, 2014).

A search of PubMed for the terms "health care" *or* healthcare *and* fragmented in *title or abstract* revealed over 1000 results, the earliest dating back to 1970 in which Senator Ralph Yarborough wrote:

> "A major element in the solution to any problem is a precise identification of the problem. We see clearly that our healthcare system must be brought together to function in a more efficient and effective manner. We must overcome the fragmentation which currently exists in the provision of services" (Yarborough, 1970, p. 411).

Nearing half a century later, researchers and practitioners continue to seek out means of increasing patients' quality and consistency of care; care coordination offers a bandage to this existing fractured structure of health care. The United States' population increasingly suffers from chronic conditions which require ongoing care while the cost of care continues to rise. It is expected that by 2020, 157 million Americans will have at least one chronic condition; the cost burden of chronic diseases accounted for 78 percent of total health spending in 2009 (Thomas Bodenheimer, Chen, & Bennett, 2009). Therefore, testing new ways in which we can improve care while slowing the rate of cost growth is appropriate and is a focus of current funding initiatives and widely covered in the health care literature.

The accountable care organization (ACO) is a delivery reform initiative that was devised to focus on care, health, and cost, passed under Section 3022 of the Patient Protection and Affordable Care Act (PPACA) in 2010 (Medicare & Medicaid Services 2011), in an effort to encourage health care organizations to be more responsible for the care they provide. This dissertation investigates how care coordination affected patients' likelihood of meeting performance measures defined by the Centers for Medicare and Medicaid Services (CMS). The results of these analyses will inform like organizations of a possible intervention that does go beyond a structural change, implementing a new process of care in an ambulatory care setting, focused on improving population health. The following sections provide an overview of this study's purpose in addition to an introduction to: accountable care organizations, care coordination, and patient compliance.

1.1 Purpose of Study

This study is an analysis of the effects of a care coordination intervention in a federally qualified health center; an additional registered nurse was hired solely to provide care coordination to a defined patient group with a focus on achieving set performance measures.

1.2 Specific Aims

1. To determine if the care coordination intervention was successful in improving patient-level performance measures in this ambulatory care setting.
2. To determine if the care coordination intervention was successful in increasing the completion of the recommended lab test to measure blood glucose levels among diabetic patients (patient compliance/adherence).
3. To examine any difference that receipt of care coordination made on patients' success in 1) meeting process quality measures and 2) outcome measures.

1.3 Literature Review

1.3.1 Accountable Care Organizations

ACOs are defined as groups of providers and suppliers whose purpose is, "to promote accountability for a patient population and coordinate item and services...and encourage investment in infrastructure and redesigned care processes for high quality and efficient service delivery" (United States Congress, 2010, p. 313). With the introduction of ACOs, the role of care coordination extends beyond helping patients mitigate a complex, disjointed system through guided navigation of services, but now also directly relate s to payments received by health care organizations. Patient assignment to accountable care organizations is determined by the payer and is based on receipt of primary care services for public ACOs. "[Medicare] beneficiaries are assigned to participating ACOs if they receive more primary care services from ACO providers than from any other provider group"; primary care is defined by evaluation and management service codes and encompass office or outpatient services, nursing facility services, rest home services, home services, and wellness visits (McWilliams et al., 2013, p. 1527). Since the introduction of this delivery reform initiative, the number of ACOs across the country has grown dramatically, reaching nearly 600 in 2015 (see Table 1).

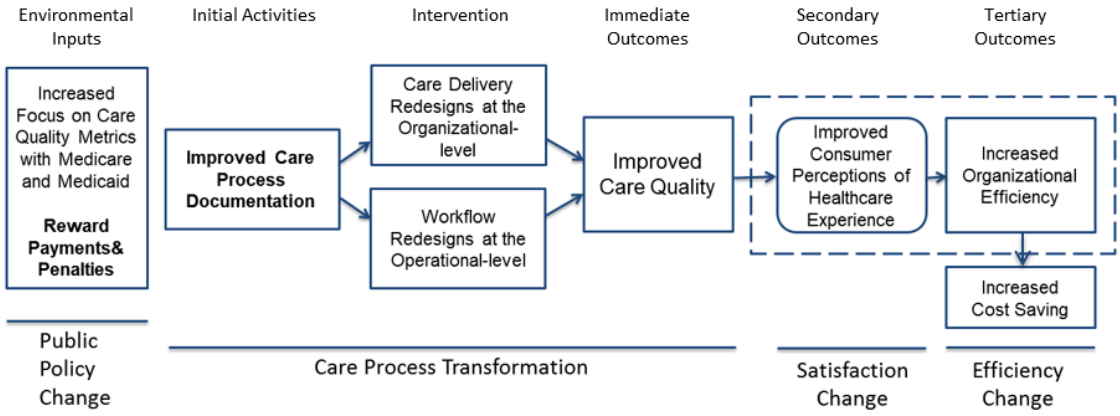
Table 1. Total Number of Accountable Care Organizations

Type of Accountable Care Organization	2013	2014	2015
CMS (Pioneer, Medical Shared Savings program, or the PGP Transition program	134	368	426
Other Accountable Care Organizations	124	154	159

(Calandra, 2015; Ghandi, 2015)

The accountable care organization is a care delivery reform initiative that has created an environmental input, resulting in an increased focus on CMS' defined performance measures (Huerta et al., 2016). Member organizations of ACOs must report the defined measures for purposes of cost sharing/saving. Each measure defines the population to which the measure applies (denominator) and the terms to meet that measure (numerator). These measures are reported to CMS to determine quality of care; similar measures are used by private ACOs. Organizations were paid for reporting all measures in Year 1; 25 out of the 33 measures were pay for performance in Year 2; 32 of the 33 measures were pay for reporting in Year 3 (CMS, 2012). Changes to the measures have occurred since their inception and are briefly covered in Chapter II, though the initial measures are the focus given the date of intervention. This dissertation examines an intervention to coordinate patient care with a focus on process documentation and added communication to improve care delivery and meet defined performance measures. Figure 1 depicts where in an established logic model of health systems' transformation this intervention occurred.

Figure 1. Health Systems' Transformation for Improved Quality and Cost Savings



Source: (Huerta et al., 2016)

1.3.2 Care Coordination

The existence of information asymmetry in addition to the complexity involved with securing appropriate care is key to explaining the need of care coordination to improve health outcomes. Patients with varying levels of health literacy, navigating a fragmented system of care, benefit from the support and direction of care coordination. Combining the National Quality Foundation and the Agency for Healthcare Research and Quality's definitions of care coordination, the American Nurses Association definition of care coordination is as follows:

> "Care coordination is (a) a function that helps ensure that the patient's needs and preferences are met over time with respect to health services and information sharing across people, functions, and sites; and (b) the deliberate organization of

> patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services" (ANA, 2012, p. 1).

There is a wealth of literature on care coordination, though interventions differ greatly as do the targeted conditions. The UCSF Evidence-based Practice Center conducted a synthesis of systematic reviews on care coordination for AHRQ which included 75 review articles; care coordination was found to have improved patient outcomes across varying settings and disease conditions, though there was mixed findings related to the costs of differing care coordination interventions (McDonald et al., 2007).

The Medicare population may be a particularly appropriate population on which to focus care coordination to realize cost savings. Health issues and associated costs tend to increase as individuals age, often requiring care from multiple providers, which can create additional fragmentation and lead to duplication of services and unnecessary medical testing. "Between 2000 and 2002, the typical Medicare beneficiary saw a median of two primary care physicians and five specialists each year, in addition to accessing diagnostic, pharmacy, and other services" (Bodenheimer, 2008, p. 1064). A study evaluating a care coordination intervention of Medicare patients, consisting of disease management, case management, and long-term care management, found total costs for the participating sample to be 15.7% lower than the control group (Atherly & Thorpe, 2011).

Conversely, Berwick & Hackbarth estimated the cost of failed care coordination to Medicaid and Medicare to be between $25 and $45 billion in 2011 (Berwick &

Hackbarth, 2012). This begs the question of how to determine types of care coordination interventions that will prove successful in increasing quality while remaining cost neutral. Pikes and colleagues examined 15 randomized trials of care coordination to determine if hospitalization and health care expenditures were impacted through such interventions for Medicare patients; two of the programs showed significant differences in hospitalizations and three found expenditures to be less for the treatment compared to the control group (2009). Their conclusion was in order for care coordination programs to be financially viable, moderate to severe patients should be targeted and should include in-person contact (Peikes et al., 2009). A qualitative study interviewing 21 experts in care coordination and primary care transformation identified four common characteristics of successful care coordination interventions:

1. "They assume accountability for coordinating their patients' care",
2. "They reach out to key care partners to build relationships and agreements so that they understand each others' expectations and preferences",
3. "They support their patients when they go elsewhere for care", and
4. "They establish connectivity for transmitting standardized information and communicating with care partners".

(Wagner et al., 2014)

1.3.3 Patient Compliance/Adherence

For the purposes of this study, compliance and adherence are used interchangeably to describe patients who follow recommended medical advice. This definition specifically relates to hypothesis two; the purpose in testing whether diabetic patients receiving care coordination were more likely to comply with completing the

recommended lab testing was to determine if the intervention positively affected patients' activation. The term patient activation refers to having "the knowledge, skills, and willingness to manage one's own health and health care" (James, 2013, p.1). Clinicians can assist patients in acquiring the requisite knowledge and skills, and can attempt to influence patients' willingness to adhere to recommended treatment. "Adherence [to complex regimens of medication, diet, exercise, and self-monitoring] depends on clear instructions, supportive teams, and shared decision making about care" (Schoen et al., 2011, p. 2441). Knowledge of chronic conditions has been shown to be significant in explaining the variance in patient adherence to life style changes and medication (Alm-Roijer et al., 2004); one means of conveying knowledge of risk factors and chronic conditions is achieved through care coordination.

According to a study reviewing the 50 years of patient adherence research, the average non-adherence rate is 24.8% when looking at all empirical studies published between 1948 and 1998; the type of adherence (e.g., medication, health behaviors) was shown to be a significant factor as were the resources held by patients (e.g., education, income) (DiMatteo, 2004). Changing patients' habits can be aided through health education and coaching, but ultimately the choice lies with the individual. DiMatteo and colleagues cited reasons for nonadherence to include: misunderstanding, forgetting, or choosing to ignore the recommendations of their provider regarding prevention/treatment of disease (DiMatteo, 2004). Care coordination can help to reduce nonadherence due to misunderstandings and can attempt to inform patients' understanding on the benefits of recommended treatments, potentially impacting

patients' level of activation. In addition, care coordination provides patients with reminders and follow-up communication that can impact nonadherence due to patients' forgetfulness.

1.4 Organization of Dissertation

This dissertation is composed of five separate chapters. Chapter I is an introduction to accountable care organizations, care coordination, and patient compliance. Chapter II discusses the background of Donabedian's structure, process, outcome framework, and relates it to performance measures, defined by the Centers for Medicaid and Medicare (CMS). Chapter III details the methodology used to conduct the analyses, and builds on the information presented in Chapter II. Chapter IV provides an interpretation of the results of the analyses. And lastly, I conclude with a discussion of possible implications in Chapter V.

CHAPTER II

BACKGROUND

2.1 Theoretical Framework

This study will utilize Donabedian's Quality of Care Framework, which was developed to assess the quality of medical care (Donabedian, 1966). Figure 2 depicts Donabedian's Quality of Care Framework and includes the three original domains: structure defines the system's capacity for care delivery, process defines the means of care delivery, and outcome defines the effect of care delivery; CMS added patient experience of care as a fourth domain which is measured through patient satisfaction surveys (Kessell et al., 2015). Structure includes facilities, equipment, personnel, and operational and financial processes supporting medical care (McDonald et al., 2007). Singer and Shortell cite "failure to integrate beyond structural level" as one of the ten potential mistakes to be made when implementing an accountable care organization (Singer & Shortell, 2011, p. 759), indicating changes in processes for delivering care are suggested to realize a successful ACO.

Quality in health care is guided by a mixture of process and outcome measures, making performance management in health care arguably more complex compared to other industries. Process measures are derived from evidence-based clinical guidelines and are intended to improve health outcomes by dictating best practice of care; outcome measures "focus on improvement to a beneficiary's health as a result of the care that is provided"; process measures "capture a method by which health care is provided"

(Kessell et al., 2015, p. 778). The outcome of accountable care organizations is measured through meeting the defined performance measures, which are a mixture of process and outcome measures (see Table 2 for a description and evaluation of the CMS' performance measures), while maintaining/decreasing costs.

Figure 2. Donabedian's Quality Framework

Sources: (Donabedian, 1966; McDonald et al., 2007)

2.2 Center for Medicaid and Medicare Services' Defined Performance Measures

The Centers for Medicare and Medicaid Services has defined 33 performance measures, 20 of which are used as the dependent variables in the analyses described in Chapter IV. Table 2 briefly describes these measures and includes the equivalent National Quality Forum measure number, the endorsement date, the type of measure (i.e., process or outcome), and the benefits of/rationale for each measure provided by either the National Quality Forum or CMS. The following is a more inclusive summary of the 20 performance measures used in this study based on the guidelines provided by CMS (Centers for Medicare and Medicaid, 2013). Related information from recent meta-analyses and other studies specific to these measures are reported to confirm/call into question the validity of defined measures.

Performance Measure 14: Calls for patients over 6 months to receive an influenza immunization if an encounter is scheduled between October and March unless previous receipt is reported or if the vaccine is unavailable. *Performance Measure 15*: Calls for patients 65 and older to receive a pneumococcal vaccine if they have not received this vaccine once in their medical history. Healthy People 2010 set a target of 90 percent immunization coverage for both the pneumococcal and influenza vaccines; in 1998, immunization rates fell short in persons aged 65 and older at 46 and 64 percent, respectively (U. S. Department of Health and Human Services, 2000). The recommendation set forth by the U.S. Department of Health and Human Services in Healthy People 2010 supports performance measures 14 and 15. Lin and colleagues analyzed the cost effectiveness of standing order programs to increase the rate of pneumococcal and influenza vaccination in outpatient settings for elderly patients and found such programs to be an "economically favorable investment"(Lin et al., 2013).

Performance Measure 16: Calls for adult patients to have their BMI calculated, and to have a documented follow-up plan if their BMI falls within either the low or high extremities. Objective 19-2 of Health People 2010 calls for a reduction in proportion of adults who are obese; the threshold for obesity was defined as a BMI of 30 kg/m^2 [Weight (lb) / (Height^2 (in^2) x 704.5)] (United et al., 2000). The focus on individual's weight stems from known associations of obesity with disease (e.g., diabetes, heart disease, etc.).

Both performance measures 17 and 25 focus on tobacco use. *Performance Measure 17*: Calls for adult patients to be screened for tobacco use every two years; brief cessation counseling (three minutes or less) must be provided to tobacco users unless there exists a medical or other allowable exclusion. A meta-analysis of the effects of smoking in older

adults confirmed smoking to be an independent risk factor for cardiovascular events and mortality and found that cessation is beneficial in reducing these risks for this population (Mons et al., 2015). Despite known benefits, providers may be less likely to provide tobacco cessation to older adults; potential reasons for this include: time constraints, it is not considered part of their role as care provider, it is unfair to ask older people to quit smoking, it could cause damage to the patient doctor relationship, and it is inappropriate given patients' health status (Huddlestone et al., 2015). *Performance Measure 25*: Calls for diabetic patients between 18 and 75 years old to be non-tobacco users. The American Diabetes Association recommends that smoking cessation be included as routine care to mitigate risk of cardiovascular disease. (ADA, 2015). Tobacco users become addicted to nicotine, making patient compliance to the recommendation of non-tobacco a questionable measure of care quality. Most smokers are aware of the harmful nature of tobacco but continue use despite the negative health consequences; many tobacco users have a desire to quit using tobacco products, but there is a high degree of relapse (National Institute on Drug Abuse, 2012).

Performance Measure 18: Calls for all people aged 12 or older to receive a depression screening; a documented follow-up plan is required for individuals who screen positive for depression unless there exists a medical or other allowable exclusion. Healthy people 2010 calls for an increase in the depression treatment; screening for depression allows for the identification of mental illness (U. S. Department of Health and Human Services, 2000). The U.S. Preventive Services Task Force recommends depression screening for the entire adult population; this is contrary to the Canadian Task Force on

Preventive Health Care which does not recommend depression screening for adults of average risk (Whooley, 2016).

Performance Measure 19: Calls for all patients between 50 and 75 years of age to be screened for colorectal cancer unless there exists a medical or other allowable exclusion. This measure can be satisfied by an annual fecal occult blood tests (FOBT) or having had either a flexible sigmoidoscopy within the last four years or a colonoscopy within the last nine years. The latter two means of satisfying this measure have little to do with the quality of care currently experienced. Adherence to annual screenings is low with only 10.4 percent of the eligible population reporting the use of FOBT in 2012 (Berger et al., 2016).

Performance Measure 20: Calls for women between 40 and 69 years old to receive a mammogram every 2 years. A recent study found that mammography screening reduces related mortality, though statistical significance varies based on age; the U.S. Preventive Services Task Force recommends women between 50 and 74 be screened (Nelson et al., 2016). The benefits of mammography screenings for women in their forties is debated (Hellquist et al., 2015).

Performance measures 21 and 24 both focus on blood pressure but within different populations. *Performance Measure 21*: Calls for patients with scheduled visits to be screened for high blood pressure; a documented follow-up plan is required but varies based on the result of the initial screening (guidelines provided in CMS, 2013). Screening for high blood pressure is a preventive measure as there are often no symptoms associated with high blood pressure. *Performance Measure 24*: Calls for diabetic patients between 18 and 75 year

old to have a blood pressure of less than 140/90 mmHg. Keeping blood pressure in control usually involves a change in lifestyle (e.g., diet and exercise).

Performance measures 22 and 27 have a similar focus of controlling the blood glucose level of the diabetic population. *Performance Measure 22*: Calls for diabetic patients to have a Alc level of less than 8.0 percent. *Performance Measure 27*: This measure is a measure of poor A1c control in diabetics. Since the organization's goal was to help patients move from poor control into controlled, this measure was inverted to be: Calls for diabetic patients to have an Alc level of less than 9.0 percent. Prevention of diabetes related complications requires both medical and patient self-management; "For every 1 percent reduction in results of HbA1c blood tests, the risk of developing eye, kidney, and nerve disease is reduced by 40 percent while the risk of heart attack is reduced by 14 percent" (U. S. Department of Health and Human Services Health Resources and Services Administration, 2012, p. 1).

Keeping patients' low-density lipoprotein cholesterol (LDL-C) in control is the focus of the following three performance measures. *Performance Measure 23*: Calls for diabetic patients to have an LDL-C of less than 100mg/dL *Performance Measure 29*: Calls for adult patients with IVD to have received a lipid profile in the last year and to have an in control LDL-C (i.e., less than 100/mg/dL). *Performance Measure 32*: Calls for adult patients with coronary artery disease to have either a LDL-C of less than 100 mg/dL or to have a documented plan to lower their LDL-C which includes a statin prescription. The LDL-C is used to predict an individual's risk of heart disease, and treatment decisions are largely based on the LDL-C value (American Association of Clinical Chemistry, 2013). Keeping the LDL-C level in control requires practicing healthy behaviors (e.g., diet, weight,

physical activity, non-use of tobacco, and limited alcohol use), managing chronic medical conditions, and adhering to prescribed medication. Patients with higher levels of activation are more likely to prove successful at keeping LDL-C levels in control (Centers for Disease COntrol and Prevention, 2015); providers can only influence patient activation levels.

Performance measures 26 and 30 both focus on the documented use of aspirin for patients with ischemic vascular disease. *Performance Measure 26*: Calls for diabetic patients who have IVD and are between 18 and 75 years old to have documented use of daily aspirin or antiplatelet medication. *Performance Measure 30*: Calls for adult patients with IVD to have documented use of aspiring or other antithrombotic. Patients who are at high risk for cardiovascular events benefit from continuous use of low-dose aspirin; patient-initiated discontinuation of aspirin use occurred in up to 30 percent of patients in the 32 studies reviewed, and predictors of non-compliance included education, sex, depression, diabetes, and tobacco use (Herlitz et al., 2010).

Performance Measure 28: Calls for hypertensive patients between 18 and 85 years old to have adequately controlled blood pressure (i.e., less than 140/90 mmHg). To control hypertension, patients must be motivated, and motivation can improve through positive interactions with providers, building trust; healthy lifestyle modifications shown to lower blood pressure include weight reduction, increased physical activity, and moderating use of alcohol (Chobanian et al., 2003).

Measures 31 and 33 relate to recommended prescriptions for patients who have a left ventricular ejection fraction (LVEF) of less than forty percent. *Performance Measure 31*: Calls for adult patients with heart failure who have a LVEF of less than 40 percent to be prescribed beta-blocker therapy. *Performance Measure 33*: Calls for adults with coronary

artery disease who are diabetic or have a LVEF of less than forty percent to be prescribed ACE inhibitor or ARB therapy. "There is now conclusive evidence that β-blockers, when added to ACE inhibitors, substantially reduce mortality, decrease sudden death, and improve symptoms in patients with HF"(p. 156), despite substantial evidence, many patients do not receive this treatment (Gheorghiade et al., 2003).

Table 2. Explanation of Intended Benefits of Performance Measures

PM[1]	PM Description	Rationale	Measure Type	Date of Endorsement[2]
ACO #14 NQF#0041	Influenza Immunization	"This measure is intended to promote annual influenza vaccination for all patients aged 6 months and older, thereby reducing the likelihood of patients contracting the disease and associated morbidity and mortality" (NQF, 2010, p. 2).	Process	August 2009
ACO #15 NQF#0043	Pneumococcal Vaccination	"The disease burden is large for older adults and the potential for prevention is high. Pneumococcal infections result in significant health care expenditures each year, and vaccination is safe and effective. Modest cash outlays for vaccination have been shown to result in substantial cost savings and significantly lower morbidity" (NQF, 2011, p. 3).	Process	August 2009
ACO #16 NQF#0421	Adult Weight Screening and Follow-up	"Recent literature indicates nearly 50 percent of primary care physician visits did not include a record of the height and weight data necessary to calculate BMI" (NQF, 2012, p. 3).	Process	July 2008
ACO #17 NQF #0028	Tobacco Use Assessment and Cessation Intervention	"This measure is intended to promote adult tobacco screening and tobacco cessation interventions for those who use tobacco products, thereby increasing the proportion of smokers who successfully quit which in turn results in a decreased risk for heart disease, stroke, and lung disease." (NQF, 2015, p. 2).	Process	August 2009
ACO #18 NQF #0418	Depression Screening	"Depression causes suffering, decreases quality of life, and causes impairment in social and occupational functioning. It is associated with increased health care costs as well as with higher rates of many chronic medical conditions" (Medicare & Services, 2013, p. 33).	Process	July 2008
ACO #19 NQF #0034	Colorectal Cancer Screening	"Reductions in the deaths associated with colorectal cancer. Decreases in medical costs associated with colorectal cancer" (NQF, 2009h, p. 3).	Process	August 2009
ACO #20 NQF #0031	Mammography Screening	"The intent of the measure is to improve secondary prevention of breast cancer in order to catch disease when it is early and more amenable to treatment. Breast cancer treatment costs in the U.S. total nearly $7 billion per year, of which $2 billion is spent on late stage treatment. Low-income women are less likely to have had a mammogram within the past two years, increasing their risk of late-stage diagnosis and decreasing their chance of survival. Numerous trials and evaluations have clearly shown that mammography reduces the risk of dying from breast cancer" (NQF, 2009b, p. 3).	Process	August 2009 *No longer NQF endorsed as of October 2012.

PM[1]	PM Description	Rationale	Measure Type	Date of Endorsement[2]
ACO #21 NA	Adults who had blood pressure screened in past 2 years	"Hypertension is a prevalent condition that contributes to important adverse health outcomes, including premature death, heart attack, renal insufficiency and stroke. The United States Preventive Services Task Force found good evidence that blood pressure measurement can identify adults at increased risk for cardiovascular disease from high blood pressure. The relationship between systolic blood pressure and diastolic blood pressure and cardiovascular risk is continuous and graded" (Medicare & Services, 2013, p. 40).	Process	NA
ACO #22 NQF #0729	Hemoglobin A1c Control (HbA1c) (<8 percent)	"According to the American Diabetes Association, an estimated 23.6 million American children and adults have diabetes. Most people with diabetes have other risk factors, such as high blood pressure and cholesterol that increase the risk for heart disease and stroke. In fact, more than 65% of people with diabetes die from these complications" (Medicare & Services, 2013, p. 41).	Outcome	March 2011
ACO #23 NQF #0729	Low Density Lipoprotein (LDL) (<100 mg/dL)		Outcome	
ACO #24 NQF #0729	Blood Pressure (BP) < 140/90		Outcome	
ACO #25 NQF #0729	Tobacco Non Use		Outcome	
ACO #26 NQF #0729	Aspirin Use		Process	
ACO #27 NQF #0059	Beneficiaries with diabetes whose HbA1c is <9 percent	"While the Committee noted that there was no evidence supporting a particular threshold value for poor control, members acknowledged that HbA1c >9% is a reasonable cutoff given that risk has been demonstrated when values are greater than 9%"(NQF, 2014, p. 16) .	Outcome	Renewed August 2009 *Endorsed by the NQF since 2002.

PM[1]	PM Description	Rationale	Measure Type	Date of Endorsement[2]
ACO #28 NQF #0018	Beneficiaries with hypertension whose BP < 140/90	"The most frequent and serious complications of uncontrolled hypertension include coronary heart disease, congestive heart failure, stroke, ruptured aortic aneurysm, renal disease, and retinopathy. Better control of BP has been shown to significantly reduce the probability that these undesirable and costly outcomes will occur. Thus, the relationship between the measure (control of hypertension) and the long-term clinical outcomes listed is well established" (NQF, 2009c, p. 7).	Outcome	August 2009
ACO #29 NQF #0075	Beneficiaries with IVD with complete lipid profile and LDL control < 100mg/dl	"Research has shown individuals with existing coronary artery disease can reduce their risk of subsequent morbidity and premature mortality by managing their cholesterol levels. Studies show that reducing high lipid levels will reduce cardiovascular morbidity and mortality" (NQF, 2009e, p. 5).	Outcome	August 2009 *No longer NQF endorsed as of September 2014.
ACO #30 NQF #0068	Beneficiaries with IVD who use Aspirin or other antithrombotic	"Aspirin is the safer, more convenient and least expensive form of therapy in reducing cardiovascular events among men and women; reducing the number of strokes, MI, and other vascular events considerably" (NQF, 2009d, p. 4).	Process	August 2009
ACO #31 NQF #0083	Beta-Blocker Therapy for LVSD CAD	"This measure is aimed at improving the number of patients with HF who are prescribed beta-blocker therapy in the outpatient and inpatient setting, particularly the three beta-blockers proven to reduce mortality and recommended in the treatment of patients with heart failure and LVSD" (NQF, 2009a, p. 3).	Process	August 2009
ACO #32 NQF #0074	Drug Therapy for Lowering LDL Cholesterol	The expected benefits of this measure is an "improvement of lipid management and the number of patients on a statin as first line therapy" (NQF, 2009g, p. 3).	Process	August 2009

ACO #33 NQF #0066	ACE Inhibitor or ARB Therapy for Patients with CAD and Diabetes and/or LVSD	The expected benefits of this measure is an “improvement in the number of patients with CAD who have diabetes or LVEF <40% who are prescribed ACE inhibitor or ARB therapy” (NQF, 2009f, p. 3).	Process	August 2009

[1] Centers for Medicare and Medicaid Services. "Accountable care organization 2013 program analysis: quality performance standards narrative measure specifications." (2013).

[2] http://www.qualityforum.org/Measures_Reports_Tools.aspx The date of endorsement for each measures was found in the respective Measures Section.

There have been some changes to the CMS quality performance measures since their inception in 2013. This study focuses only on the 1) preventive health and 2) at-risk population performance measures, which included 20 measures for the 2013 study year. Changes to these measures include reducing the diabetes composite measure from five measures to two measures (i.e., only poor A1c control was retained and an eye exam was added to the performance measures). The 2015 CMS Performance Measure Specifications (Center for Medicare and Medicaid Services, 2013) now include only 15 measures, including the omission of: five diabetes measures, LDL control for beneficiaries with IVD (PM-29), and Drug Therapy for Lowering LDL Cholesterol (PM-32) and the addition of: an eye exam for diabetics (DM-41) and an additional depression measure (ACO-40). Five other measures were added to "patient/caregiver experience" and "care coordination/patient safety" categories, including one additional CAHPS measure focused on the stewardship of patient resources and four care coordination/patient safety measures focused on unplanned admissions and readmissions.

CHAPTER III

METHODOLOGY

This chapter details the methods employed in conducting the analysis for this study, which included specifics of the study design and setting, intervention, study sample, hypotheses, plan for data analysis, and methodological limitations.

3.1 Study Design and Setting

This dissertation is a retrospective analysis of a natural experiment that took place in a federally qualified health center (FQHC) in Texas. The invention occurred in 2013 and can be concisely described as an addition of a registered nurse (RN) to provide care coordination for patients enrolled in their ACO, focusing on the metrics described in Chapter II (see section 3.1.1 for detailed intervention description). The performance measures set by CMS are collected by the organization and are used in this study as the dependent variables to measure change in the achievement of those measures, a proxy for quality of care. Demographic data and disease states are included to control for individual level differences. Further information on the study's population is provided in section 3.1.2 and in Figure 3.

3.1.1 Intervention Description

The care coordination intervention consisted of adding one full time nurse care coordinator (NCC) to staff, specifically to develop a care coordination process and to individually manage the care of a defined Medicare population within a federally

qualified health center. The responsibilities of this position were wide ranging and defined by that employee during an interview held on September 19, 2014. The NCC's sole focus was managing the care of the defined treatment group (members of the ACO). The services the NCC provided were decided autonomously in effort to help population members meet the defined performance measures. At the onset of this project, the NCC spent training staff in each clinic location on the established process specific to changes in the EHR and how communication through the EHR (termed huddle notes) should be used to help achieve the performance measures. Huddle notes can be described as summary information compiled by the NCC and shared with the provider specifying which tests (e.g., mammogram, colonoscopy, etc.) need to be ordered and other specific things to address (e.g., smoking cessation, BMI, etcetera). This allowed the NCC to communicate patient specific information to patients' providers directly through the EHR regarding patient specific information on the day of appointment. Additionally, clinicians were provided with checklists and patient education materials to simplify the steps of care management. This process promotes increased communication between the NCC and each provider. The NCC then audited the charts of treatment group patients the day after a scheduled appointment to stay apprised of their progress.

Communication with the patient was key in successful management of patient care and was maintained largely through telephone calls made by the NCC. This means of communication can provide 1) an opportunity to deliver patient education, 2) to collect self-report metrics, 3) to make an appointment for needed lab work, 4) to inquire about patient needs (e.g., transportation), 5) to make patients aware of area services (e.g.,

transportation providers, food pantries, etc.), and 6) to offer support and answer questions patients have pertaining to their health condition/medications to ease potential patient anxiety. Individual in person patient education appointments were also made to provide information on diet and exercise, tobacco cessation, the benefits of vaccination, the benefits of colon cancer screening, and the benefits of breast cancer screening. Follow-up phone calls were made a week following in person appointments. The NCC also made calls and sent letters to patients to remind them to make an appointment or schedule lab work.

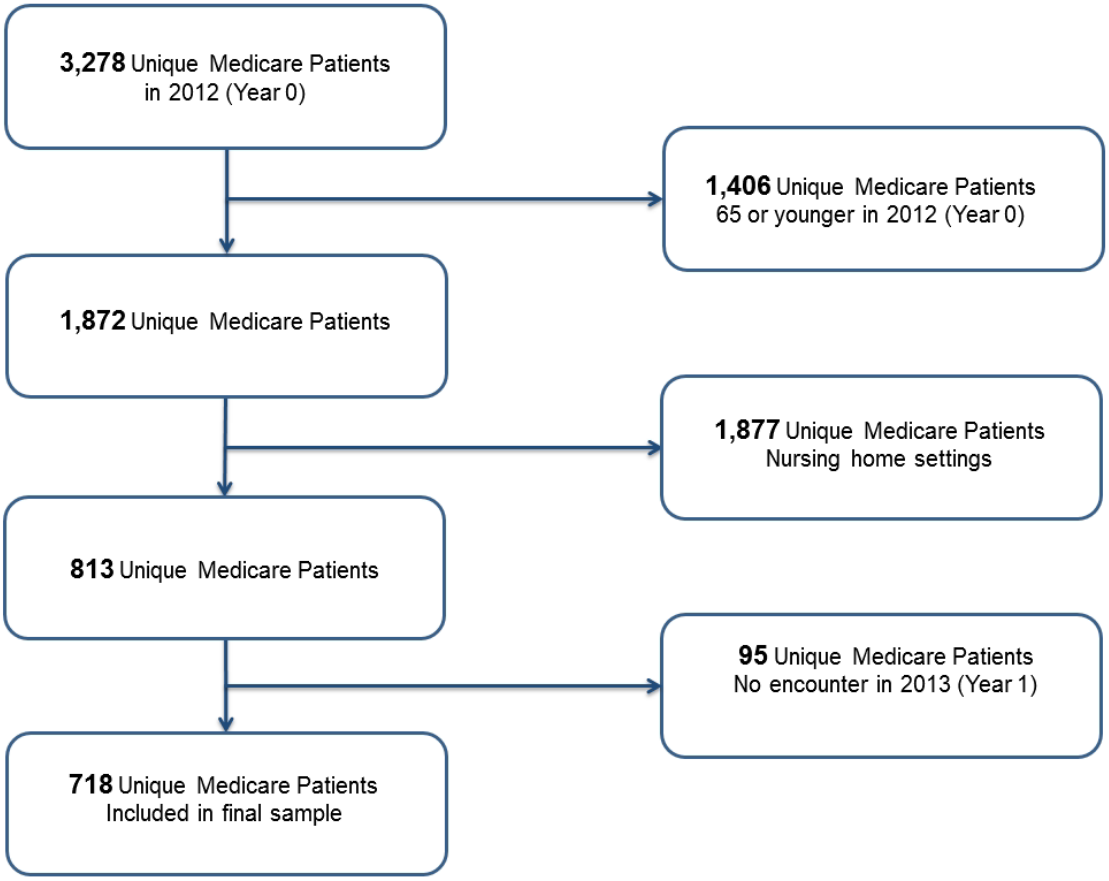
Another component of the NCC's position included facilitating efficiency and reducing redundancy. This was done by "cleaning" patient charts: removing old orders from patients' charts to ensure that charts were current. During that process, past medical history was examined, searching for specialist appointments to be certain that all documentation from these appointments had been successfully added to patients' charts. If notes from these appointments were missing, a request of information was made to secure that data. This was done either directly through the EHR system or via fax. The NCC also makes an effort to pull recent data (e.g., vitals, lab results, immunizations, etc.) from hospital data as another avenue to avoid unnecessary duplication of services.

3.1.2 Study Sample

Secondary data from the Medicare population at a federally qualified health center in Texas comprise the sample used in this study. Use of this data was approved by the Texas A&M University Institutional Review Board (IRB2014-0238D). The

dataset included all Medicare patients who received care in 2012 and 2013; the final sample consisted of 718 unique individuals. Age, encounter, and setting were exclusionary variables. Patients that were under 66 years of age in Year 0 were excluded to focus the analysis on traditionally qualifying Medicare patients; those 65 years of age would have only received care for a partial year (based on birth date), creating a difference in access to care for part of the calendar year. Also, patients that did not have at least one encounter in both 2012 and 2013 were excluded; to understand any difference in patients' outcomes, data from each year is required. Finally, patients whose primary location was a nursing home facility were also excluded, leaving six different locations at which care was provided during the set time period. Medical records in the nursing home settings did not utilize an electronic health record excluding these patients from the benefit of the above described intervention. Figure 2 shows how the described exclusion criteria affected the total number of the population for Specific Aim 1; subpopulations were defined for Specific Aims 2 and 3 (and for tests of each individual measure; see Appendix A) based on qualifying for respective measures. The main study population is defined in Figure 3.

Figure 3. Exclusion Criteria

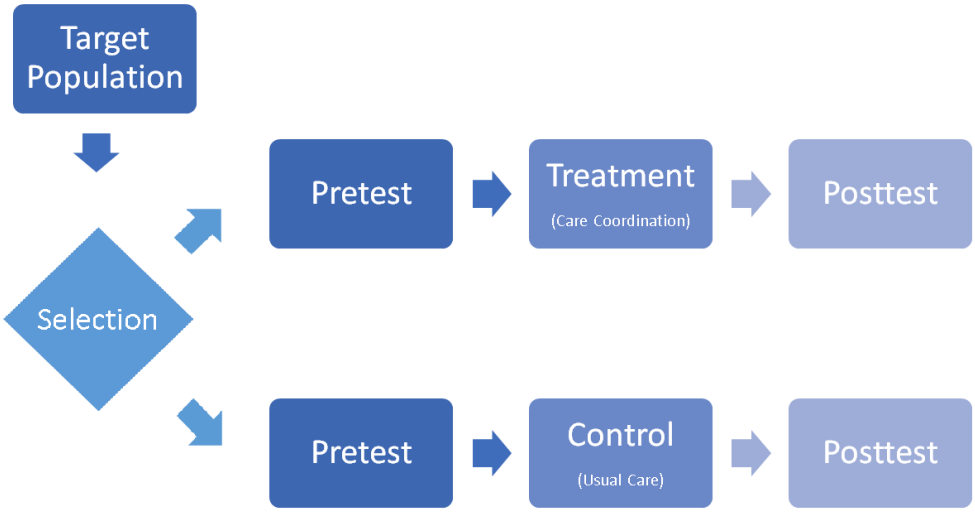


3.1.3 Data

Data for this dissertation was provided by the organization for analysis, and included the Medicare population. Patients have a calendar to year to meet the defined metrics; data from calendar years 2012 and 2013 were used for this study. The unit of analysis is the individual. Figure 3 depicts the pre post with non-equivalent research design. CMS looks at performance measures at the organizational level as the

percentage of patients that met the defined measures; this study did not aggregate patient level data to control for individual level, observable differences between the treatment and control groups.

Figure 4. Research Design



3.1.4 Key Variables

The background section of this dissertation introduces the dependent variables used in this study, and the history of process and outcome measures. There are no known studies that have used similar data to measure the success a care coordination intervention. A recent study assessing the difference of Pioneer ACOs in both quality and cost used difference in differences analyses utilizing only the performance measures that were captured through claims data; this was a longitudinal analysis and not all of the 33 measures were reported before 2012 (McWilliams et al., 2015). Similar to a study on

the implications of a policy change, Blue Cross and Blue Shield's introduction of Alternative Quality Contracts, quality measures were binary with some measures being restricted to members with a specified disease; measures were pooled for aggregate quality analysis (Song et al., 2011). Prior studies support the use of payer's quality metrics to be used to assess quality improvement; additionally, it seems appropriate to measure the success of this intervention against the criterion upon which it was devised.

For the intervention year (2013), there were 33 measures defined by CMS, and this study utilizes 20 of those measures relevant to ambulatory care settings. The aim of performance measures 1 to 13 is improved care; the aim of performance measures 14 to 33 is improved health (Donald M Berwick, 2011). Availability and applicability of 12 of the unused measures explain their exclusions (i.e., CAHPS (measures 1-7) and patient safety (measures 8-12)); patient safety measures largely focus on inpatient facilities and are not applicable to the study setting. Measure 13 is a binary measure of whether a screening for future fall risk was conducted within the calendar year. This measure was excluded for two reasons: 1) to be conservative in estimating the effects of this intervention; documentation of this screening was not done in Year 0, and 2) to focus on two complete categories of measures (i.e., preventive care (measures 14-21) and at risk populations (measures 22-33)). The future fall risk measure is the only measure in the patient safety category available in the data used for this study. The 20 performance measures (i.e., 14 to 33) used in this dissertation as / or to create dependent variables encompass the measures in the preventive care and at risk population domains.

For each of the two years, binary data was provided describing which of the 20 measures patients qualified for, and of those, which measures were met. A summary of the study's dependent variables is provided in Table 3, specifying the variable's definition, the unit of analysis, and the relevant specific aim.

Table 4 provides a summary and description of the independent variables used for covariate adjustment of observable differences. This includes age, sex, race, ethnicity, known disease states, and primary location of encounter. The data only included the five disease states relevant to the defined performance measures: diabetes, ischemic vascular disease, coronary artery disease, hypertension, and heart failure. Dummy variables were created to indicate the presence of each disease; these data are a substitute for a traditional comorbidity index. For primary encounter location, the location serving the largest number of patients was set as the reference group.

Table 3. Dependent Variables

Variables	Categories	Description	Unit of Analysis	Specific Aim
Number of Successes	1. All 20 measures 2. Only process measures 3. Only outcomes measures	Count of the number of performance measures for which each patient met	Individual	1, 3
Number of Attempts	1. All 20 measures 2. Only process measures 3. Only outcomes measures	Count of the number of performance measures for which each patient qualified	Individual	1, 3
Proportion	1. All 20 measures 2. Only process measures 3. Only outcomes measures	A number between zero and one representing the number of successes divided by the number of attempts.	Individual	Figures 8, 9, 10
Individual Performance Measures	20 different measures (see Chapter II)	Twenty dummy-coded variables representing individuals that succeeded in meeting each measure individually	Individual	Appendix
Adherence 22		Dummy-coded variable representing individuals that succeeded in adhering to recommended test	Individual	2
Intervention (Care Coordination)		Dummy-coded variable representing individuals that received the intervention	Individual	1,2,3
Time		Dummy-coded variable representing the pre-intervention or intervention year	Individual	1,2,3

Table 4. Independent Variables

Variables	Description	Unit of Analysis	Specific Aim
Age 75 and older	Binary Measure of patients' age; 66-74=0 / 75 and older=1	Individual	1, 3
Diabetes	Binary Measure of the presence of Diabetes	Individual	1, 3
Hypertension	Binary Measure of the presence of Hypertension	Individual	1, 3
Ischemic Vascular Disease	Binary Measure of the presence of IVD	Individual	1, 3
Heart Failure	Binary Measure of the presence of HF	Individual	1, 3
Coronary Artery Disease	Binary Measure of the presence of CAD	Individual	1, 3
Male	Binary variable representing patients' gender	Individual	1, 3
Race	Categorical variable representing patients' race	Individual	1, 3
Ethnicity	Categorical variable representing patients' ethnicity	Individual	1, 3
Primary Encounter Location	Categorical variable representing primary location of patients' encounters	Individual	1, 3

3.1.5 Hypotheses

Hypothesis 1: Care coordination is associated with a significant increase in patients meeting set performance measures.

Hypothesis 2: Care coordination is associated with a significant increase in diabetic patients' compliance to obtaining recommended lab work to measure blood glucose levels.

Hypothesis 3: Care coordination is more strongly associated with patients' success in meeting process measures compared to outcome measures.

3.2 Empirical Models

For each of the main hypotheses tested, either grouped logistic regression or logistic regression was conducted using Stata 12 (i.e., blogit for grouped data and xtlogit to account for repeated measures within panel data); the data used in this study are longitudinal (i.e., two data points, one in each calendar year); "the dependency, or correlation, among responses measured in the same individual is the defining feature of a repeated-measures design" (Larson & Sullivan, 2006, p. 238). "Blogit is the maximum likelihood estimator (the same as logit or logistic) but applied on data organized in a different way. Rather than having individual observations, [the] data are organized so that each observation records the number of observed successes and failures" (Stata, , p.6). In both cases, the dependent variable(s) is/are binary, coded as 1 indicating the

desired outcome, because it is assumed that the probability of an event occurring is P(Y=1).

Using a proportion as a dependent variable requires specific methods to account for the data's bounded nature to produce interpretable results (Baum, 2008); grouped logit takes into account the number of successes and number of attempts obtained by maximizing a weighted logit-likelihood function (StataCorp, 2012). Blogit reports estimated coefficients transformed to odds ratios in addition to transforming both standard errors and confidence intervals (StataCorp, 2012). Since care coordination is a shared intervention among treatment group members, and because the success of the intervention is being measured by patients' achieving up to 20 performance measures, it is appropriate to look at the data as a blocked/grouped data (for hypotheses 1 and 3), giving equal weight to each measure in measuring the success of the intervention.

Figures 5 – 7 depict hypothetical data of two different patients for each of the three different categories of grouped dependent variables used in the analyses for hypotheses one and three (all measures, process measures, and outcome measures). An analysis using the proportion as the dependent variable would treat the example data as equal because they have the same proportion despite that those proportions are based on a different number of measures. The blocked approach accounts for differences in the number of measures included in each block.

Figure 5. Dependent Variables – All Measures

	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Dependent Variables
# Met	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
# Eligible	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	4

	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Dependent Variables
# Met	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	3
# Eligible	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	6

Figure 6. Dependent Variables – Outcome Measures

	22	23	24	25	27	28	29	Dependent Variables
# Met	0	0	0	0	0	1	0	1
# Eligible	0	0	1	0	0	1	0	2

	22	23	24	25	27	28	29	Dependent Variables
# Met	0	0	1	0	0	0	0	1
# Eligible	0	1	1	0	0	0	0	2

Figure 7. Dependent Variables – Process Measures

	14	15	16	17	18	19	20	21	26	30	31	32	33	Dependent Variables
# Met	0	0	0	0	0	0	1	0	0	0	0	0	0	1
# Eligible	0	0	0	0	0	0	1	0	0	0	0	0	1	2

	14	15	16	17	18	19	20	21	26	30	31	32	33	Dependent Variables
# Met	0	0	0	0	1	0	0	0	0	1	0	0	0	2
# Eligible	0	0	0	1	1	0	0	0	0	1	0	1	0	4

3.3 Limitations of Methodology

Random assignment is often labeled the gold standard of research designs, but is often not possible in health services research given ethical questions and other difficulties that can arise. Randomization does ensure that differences between the treatment and control groups among study participants are a result of chance, controlling for extraneous differences, insuring internal validity (Radosevich, 2006). "The central concern of internal validity is whether the relationship between the treatment and the outcome is causal in the population under study" (West & Thoemmes, 2010, p. 19). In order to draw a causal inference, one must be able to rule out the threats to the internal validity. The untreated control group design with a pretest and posttest typically controls for all but four threats to internal validity; they include: selection-maturation, instrumentation, differential statistical regression, and local history (i.e., interaction of selection and history) (Cook et al., 1979). Chapter IV reports the results of tests to determine group equivalency.

The intervention group was not selected by clinic location or by provider, and may have modified providers practice in treating all patients. In this case, there could have been a spillover effect in which the control group could have received additional care from their provider. This limitation would underestimate the effectiveness of the intervention in comparison to usual care. Additionally, ICD-9 codes were not included in the data which did not allow for severity adjustment. Dual status is also unknown though nursing homes settings were excluded which may have partially excluded patients qualifying for Medicare due to disability.

CHAPTER IV

RESULTS

The data used for this dissertation includes the quality performance measures (see Chapter II) achieved in 2012 and 2013 by Medicare patients receiving care in a federally qualified health center in Texas. The final sample size includes 718 unique individuals, using subpopulations of that sample to test hypotheses two and three. Appendix A houses descriptive statistics for the subpopulations that qualify for each individual performance measure in addition to individual difference in differences analyses testing the impact of care coordination on meeting each measure.

4.1 Descriptive Statistics

The main study population is approximately one third male, three quarters white, and nearly 40% Hispanic, with a mean age of 74 (see Table 5). Approximately forty-five percent of the population has 2 or more comorbidities (diabetes, heart failure, hypertension, or ischemic vascular disease; see table 4). Patients included in this sample had an average of 3.68 visits in 2013, with a range of one to 14 visits. The mean number of providers seen by each patient in 2013 was 1.66 providers, with a range of one to six providers. The data used for this study contained treatment, time, primary location of treatment, patients' comorbidities, and demographic information in addition to performance measures (i.e., attempts and successes) for each patient. Missing values existed for some of the demographic information (i.e., marital status, race, and

ethnicity); in these instances missing demographic data was coded as a separate category for these variables (e.g., Married=39%, Single=50%, and Missing=11%).

Table 5. Number of Known Comorbidities in 2013

Number of Diseases	Frequency	Percent	Cumulative Percent
0	113	15.74	15.74
1	276	38.44	54.18
2	205	28.55	82.73
3	76	10.58	93.31
4	40	5.57	98.89
5	8	1.11	100

According to the Centers for Medicare and Medicaid Services, the prevalence of diabetes in adults age 65 or older living in Texas in 2013 was 29 percent; the prevalence of diabetes in the study population in the same year was 39 percent. (Centers for Medicare and Medicaid Services, 2016). Sixty-one percent of the individuals 65 or older in Texas had Hypertension in 2013, compared to 82 percent in the study sample; seventeen percent of Texans, age 65 and older, had experienced heart failure in 2013, ten percent more than the prevalence found in the study population (Centers for Medicare and Medicaid Services, 2016). It is not possible to accurately compare the study population's prevalence of Ischemic Vascular Disease nor Coronary Artery Disease to the State's prevalence because CMS uses "Ischemic Heart Disease" as their category, which is both a broader than Coronary Artery Disease and also more narrow than Ischemic Vascular Disease.

Table 6. Demographics Characteristics of the Study Population

	Total	Treatment Group	Control Group
N	718	276	442
Male (%)	34%	39%	31%
Age 75 plus (%)	41%	35%	45%
Age Mean	74	73	74
White (%)	73%	75%	71%
Black (%)	8%	6%	10%
Other Race (%)	5%	4%	5%
Hispanic (%)	38%	41%	37%
Non-Hispanic (%)	41%	33%	46%
Married (%)	36%	40%	33%
Single (%)	49%	49%	49%
Diabetic (%)	39%	40%	38%
Hypertensive (%)	82%	80%	83%
IVD (%)	20%	19%	21%
Heart Failure (%)	7%	7%	7%
CAD (%)	17%	17%	17%

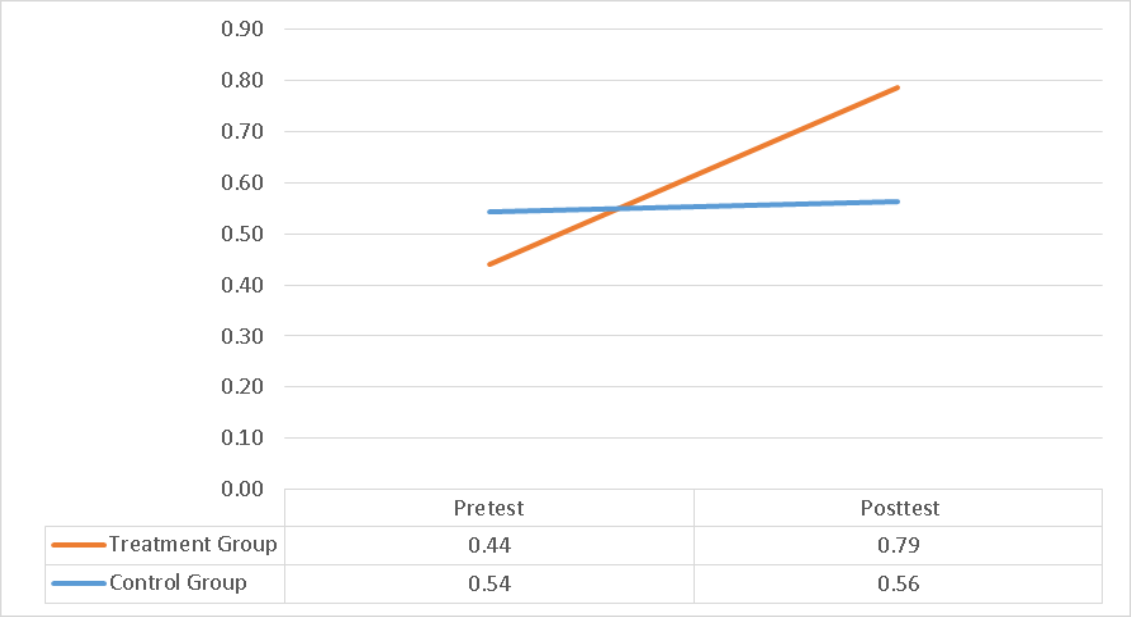
4.2 Group Non-Equivalence

Through an examination and comparison of the group's demographics (see Table 6), and confirmed by chi-squared tests, significant differences exist between the treatment and control groups in age, sex, marital status, race and ethnicity; the groups were determined to be non-equivalent. The variables race, ethnicity, and marital status did include missing data, so a missing category was created for each. Chi-squared tests were run on the data both including the missing data category and after listwise deletion; marital status was not statistically significant once patients with missing data had been dropped. The decision to run the models on all patients (including missing categories) was made to more accurately estimate the impact of the intervention on the target

population; listwise deletion omitted just over forty percent of the patient population (N=295).

To better understand group differences, the pretest numerators (i.e., measures met), pretest denominators (i.e., measures qualified for), and the resulting proportion were reviewed. The chi-squared test showed significant differences between the treatment and control groups for the numerator and for the proportion; the difference between groups in the denominator was null, suggesting that between group differences were not based on number of comorbidities, but were potentially related to severity. "When pretest differences do exist, the possibility increases that selection will combine with other threats additively and interactively" (Shadish et al., 2001, p. 138). Non-equivalence presumes selection bias; the existence of pretests scores by group allows for exploration of threats to validity (Shadish et al., 2001). Figure 8 shows that the means of the proportion of measures met by groups and time are reliably different as the initially lower scoring treatment group significantly surpassed the mean of the initially higher scoring control group. "Statistical regression cannot explain why low performers reliably surpassed the high performers at posttest, though regression may have inflated treatment estimates" (Shadish et al., 2001, p. 143).

Figure 8. Proportion of Performance Measures Met by Group and Time



4.2.1 Adjusting for Non-Equivalence between Groups

Quasi-randomization can be determined by comparing the differences between the two groups using propensity score matching or through use of an instrumental variables. “The propensity score, defined as the conditional probability of being treated given the covariates, can be used to balance the covariates in the two groups, and therefore reduce this bias” (d’Agostino, 1998, p. 2265). However, because unmeasured variables can actually be cofounders, increasing bias (Brooks & Ohsfeldt, 2013), the use of instrumental variables is likely preferable. A potential instrumental variable of “distance to primary treatment location” was identified and tested in an attempt to correct for between group differences; unfortunately “distance to primary treatment location” was not viable as it failed to meet a necessary assumption of appropriate

instrumental variables; the variable was not associated with treatment (Morshed et al., 2009). The decided method to correct for between group differences used in this study is covariate adjustment.

4.3 Multiple Hypothesis Testing

Multiple hypotheses testing increases the chance for Type 1 error; adjusting the significance level cut-off using the Bonferoni approach is an accepted, though conservative, method for accounting for multiple hypotheses testing. In the course of this dissertation, 24 dependent variables were tested (i.e., each of the 20 performance measures, individually, patient compliance to A1c testing, and summary DVs of the successes and attempts for 1) all measures, 2) all process measures, and 3) all outcome measures. Given the 24 models run, there is ~71 percent chance of coming up with significant findings that are not truly significant [$1 - (1 - 0.05)^{24} \approx 0.708$]. Using the Bonferoni correction (α/n), the significance cut-off for this study is set at 0.002 (.05/24).

4.4 Validity of Key Measures

A substantial section of Chapter II was dedicated to not only discussing the connection of the performance measures to Donebidian's Structure, Process, and Outcomes model, but also to providing documentation from the literature to compare to the support provided by the Centers of Medicaid and Medicare and the National Quality Forum for the performance measures used as the dependent variables for this study.

4.5 Findings from Empirical Models

4.5.1 Hypothesis 1 Results

The analysis of hypothesis one (see Table 5) supports that care coordination is associated with an increase in patients meeting overall performance measures (OR= 4.072, p=0.0000). The log likelihood for this model was -7778.365 (Wald chi2=780.70, p=0.0000). A visual depiction in the change experienced in meeting defined performance measures is depicted in Figure 7 and can be compared to Figure 8, showing consistent performance among the control group. There is a positive protective association between the interaction of the care coordination intervention and time with patients meeting defined performance measures (OR= 4.0716, p=0.0000). Care coordination was negatively associated with meeting defined performance measures (OR=0.6312, p=0.0000), a likely result of the difference in pretest scores between groups. Results from the grouped logit model are presented in Table 6. Other factors that were found to be significantly associated to patients meeting defined performance measures include the presence of diabetes, being of Hispanic ethnicity, and receiving care from Location C.

Table 7. Grouped Logistic Regression Model Results for All Performance Measures

	Odds Ratio	Standard Error	z	P>z	95% Confidence Interval		
Care Coordination	0.631	0.033	-8.820	0.000	0.570	-	0.699
Time	1.044	0.055	0.820	0.412	0.942	-	1.158
Care Coordination*Time	4.072	0.327	17.460	0.000	3.478	-	4.767
Age 75 plus	1.044	0.040	1.120	0.263	0.968	-	1.125
Diabetes	1.325	0.074	5.060	0.000	1.188	-	1.477
Hypertension	1.164	0.066	2.650	0.008	1.040	-	1.301
Ischemic Vascular Disease	1.304	0.163	2.130	0.034	1.021	-	1.666
Heart Failure	0.985	0.111	-0.130	0.896	0.789	-	1.230
Coronary Artery Disease	1.048	0.138	0.360	0.720	0.810	-	1.357
Male	1.009	0.051	0.180	0.858	0.914	-	1.114
Marital Status							
Single	1.029	0.049	0.590	0.552	0.938	-	1.128
Unknown	0.959	0.060	-0.680	0.496	0.849	-	1.083
Race							
Black	0.973	0.081	-0.330	0.742	0.826	-	1.146
Other	0.877	0.074	-1.540	0.123	0.743	-	1.036
Unknown	1.039	0.065	0.600	0.545	0.919	-	1.174
Ethnicity							
Hispanic	1.199	0.059	3.670	0.000	1.088	-	1.321
Unknown	1.088	0.056	1.660	0.098	0.985	-	1.203
Primary Treatment Location							
Location B	0.858	0.089	-1.470	0.140	0.701	-	1.052
Location C	1.665	0.195	4.360	0.000	1.324	-	2.093
Location D	1.238	0.115	2.300	0.021	1.032	-	1.484
Location E	1.151	0.105	1.540	0.124	0.962	-	1.376
Location F	1.030	0.119	0.250	0.801	0.820	-	1.293

4.5.2 Hypothesis 2 Results

In examining the demographic differences between groups, it is clear that this diabetic subpopulation differs between groups in race and marital status in addition to incidence of Hypertension and CAD (see Table 7).

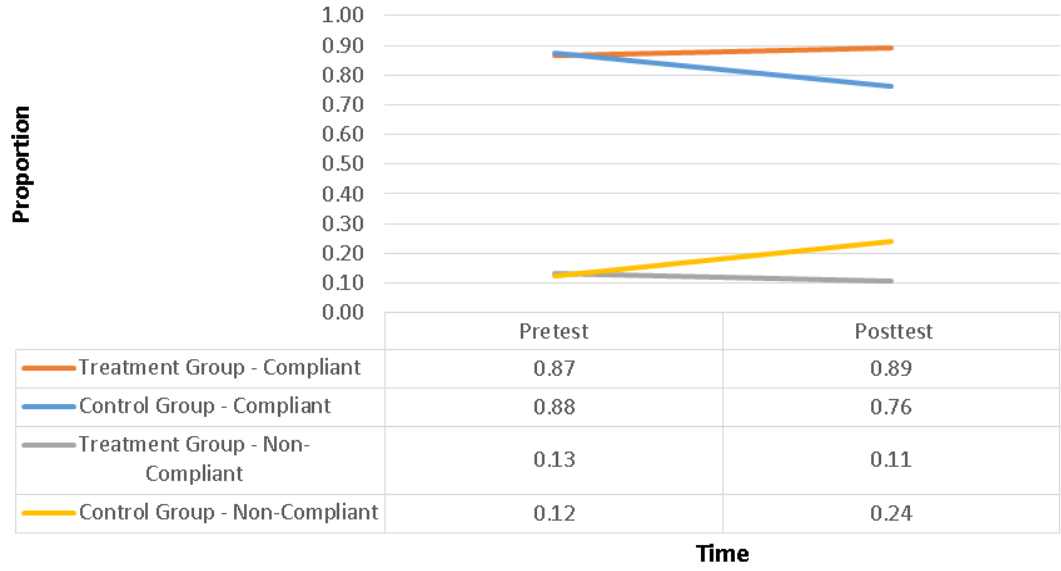
Table 8. Demographic Characteristics of the Diabetic Population

	Total	Treatment Group	Control Group
N	196	83	113
Male (%)	35%	40%	31%
Age 75 plus (%)	14%	11%	16%
Age Mean	71	70	71
White (%)	69%	81%	60%
Black (%)	9%	5%	12%
Other Race (%)	4%	1%	5%
Hispanic (%)	57%	58%	57%
Non-Hispanic (%)	29%	28%	30%
Married (%)	41%	46%	38%
Single (%)	45%	46%	45%
Diabetic (%)	96%	96%	96%
Hypertensive (%)	93%	89%	96%
IVD (%)	25%	28%	23%
Heart Failure (%)	7%	7%	6%
CAD (%)	19%	24%	15%

The mean of the binary measure of adherence in year 0 for the diabetic population (n=196) represents the proportion of the population to comply with the recommended blood glucose test. To determine potential difference in mean pretest scores between groups, the means of the two groups were examined; 88% of the control group and 87% of the treatment complied with the recommended blood glucose test. A

chi-squared test confirmed that there was no significant difference between the two groups in pretest scores. Examining the posttest scores, it is clear that the treatment group experienced an increase in compliance in year 1, exceeding prettest scores, while the control group experienced a decrease from baseline. In looking at the change in patient compliance and non-compliance between groups between year 0 and year 1 (see Figure 9), it is notable that the control group experienced an overall decrease in the intervention year (11 percent) while the treatment group experienced a slight increase (2.4 percent).

Figure 9. Proportion of Compliance to Blood Glucose Testing by Group and Year



	Pretest	Posttest
Treatment Group - Compliant	0.87	0.89
Control Group - Compliant	0.88	0.76
Treatment Group - Non-Compliant	0.13	0.11
Control Group - Non-Compliant	0.12	0.24

The analysis of hypothesis two (see Table 7) does not show an association between care coordination and diabetic patient compliance in completing the recommended lab test to measure blood glucose levels. Only the main effects model would converge, given the smaller size of this subpopulation (N=196; see Table 8). Time was shown to be significant at 0.019, but, due to the multiple hypotheses tested in this study, the Bonferroni correction was calculated, redefining the significance level to be 0.002. The strength of the relationship between time and outcome is likely a result of the decreased compliance demonstrated by the control group in year 1. The log likelihood for this model was -163.671 (Wald chi2=8.19, p= 0.0422). Given the model results, we must accept the null hypothesis that there is no difference between the treatment and control groups in complying with the recommended blood glucose lab test.

Table 9. Logistic Regression Model Results of Patient Compliance

	Odds Ratio	Standard Error	z	P>z	95% Confidence Interval
Care Coordination	0.934	0.467	-0.140	0.891	0.350 - 2.490
Time	0.390	0.157	-2.340	0.019	0.178 - 0.857
Care Coordination*Time	3.340	2.198	1.830	0.067	0.920 - 12.129

4.5.3 Hypothesis 3 Results

The analyses for hypothesis three (see Tables 11 and 12) supports that care coordination is associated with an increase in patients meeting both process and outcome performance measures. A visual depiction in the change experienced in meeting defined performance measures is shown in Figure 10. The sample qualifying for process measures does not

differ from the sample reviewed for all measures under hypothesis 1 as many process measures are preventive in nature and intended for the entire population. Qualifying for outcome measures is disease specific, thus the sample of patients subject to outcome measures is smaller (n=573). In looking at the group characteristics of the population qualifying for outcome measures, gender, age, marital status, race, and ethnicity are significantly different between groups in this subpopulation (see table 9).

Table 10. A Comparison of the Patients Demographics by Measure Type

	Process Measures				Outcome Measures		
	Total	Treatment Group	Control Group		Total	Treatment Group	Control Group
N	718	276	442		573	218	355
Male (%)	34%	39%	31%		34%	38%	31%
Age 75 plus (%)	41%	35%	45%		38%	31%	43%
Age Mean	74	73	74		74	73	74
White (%)	73%	75%	71%		73%	78%	70%
Black (%)	8%	6%	10%		8%	5%	10%
Other Race (%)	5%	4%	5%		4%	3%	5%
Hispanic (%)	38%	41%	37%		42%	44%	40%
Non-Hispanic (%)	41%	33%	46%		38%	31%	42%
Married (%)	36%	40%	33%		35%	41%	32%
Single (%)	49%	49%	49%		49%	48%	50%
Diabetic (%)	39%	40%	38%		46%	47%	45%
Hypertensive (%)	82%	80%	83%		95%	93%	96%
IVD (%)	20%	19%	21%		24%	23%	25%
Heart Failure (%)	7%	7%	7%		7%	7%	7%
CAD (%)	17%	17%	17%		21%	21%	21%

For both process measures and outcome measures, there is a positive protective association between the care coordination intervention and patients meeting the defined performance measures; the intervention (treatment*time) did have a stronger positive association with patients meeting process measures (OR=4.796, p=0.000) compared to outcome measures (OR= 2.849, p=0.000). Care coordination had a negative association with meeting process measures (OR=0.535, p=0.000), a likely result of the difference in pretest results experienced by the treatment group for this category of measures.

Table 11. Process Measures - Grouped Logistic Regression

	Odds Ratio	Standard Error	z	P>z	95% Confidence Interval
Care Coordination	0.535	0.031	-10.710	0.000	0.477 - 0.600
Time	1.049	0.052	0.950	0.341	0.951 - 1.157
Care Coordination*Time	4.796	0.434	17.320	0.000	4.016 - 5.727
Age 75 plus	1.224	0.067	3.710	0.000	1.100 - 1.361
Diabetes	1.115	0.055	2.210	0.027	1.012 - 1.227
Hypertension	1.104	0.053	2.070	0.038	1.005 - 1.212
Ischemic Vascular Disease	1.400	0.143	3.300	0.001	1.147 - 1.710
Heart Failure	1.096	0.084	1.190	0.234	0.943 - 1.273
Coronary Artery Disease	1.121	0.112	1.140	0.253	0.922 - 1.364
Male	0.970	0.037	-0.800	0.426	0.900 - 1.046
Marital Status					
Single	1.017	0.055	0.310	0.757	0.915 - 1.130
Unknown	0.950	0.063	-0.770	0.439	0.835 - 1.081
Race					
Black	0.926	0.074	-0.960	0.339	0.792 - 1.084
Other	0.877	0.090	-1.280	0.201	0.716 - 1.073
Unknown	0.995	0.064	-0.080	0.936	0.877 - 1.129
Ethnicity					
Hispanic	1.190	0.064	3.200	0.001	1.070 - 1.323
Unknown	1.109	0.068	1.690	0.091	0.984 - 1.250
Primary Treatment Location					
Location B	0.729	0.055	-4.200	0.000	0.629 - 0.845
Location C	1.689	0.199	4.440	0.000	1.340 - 2.129
Location D	1.084	0.097	0.890	0.372	0.909 - 1.292
Location E	0.962	0.076	-0.500	0.620	0.823 - 1.123
Location F	1.005	0.115	0.040	0.967	0.803 - 1.257

Other factors significantly positively associated to achieving defined process measures include: age (OR=1.224, p=0.000), IVD (OR=1.400, p=0.001), Hispanic (OR=1.190, p=0.001), and location C (OR=1.689, p=0.000). Receipt of care from

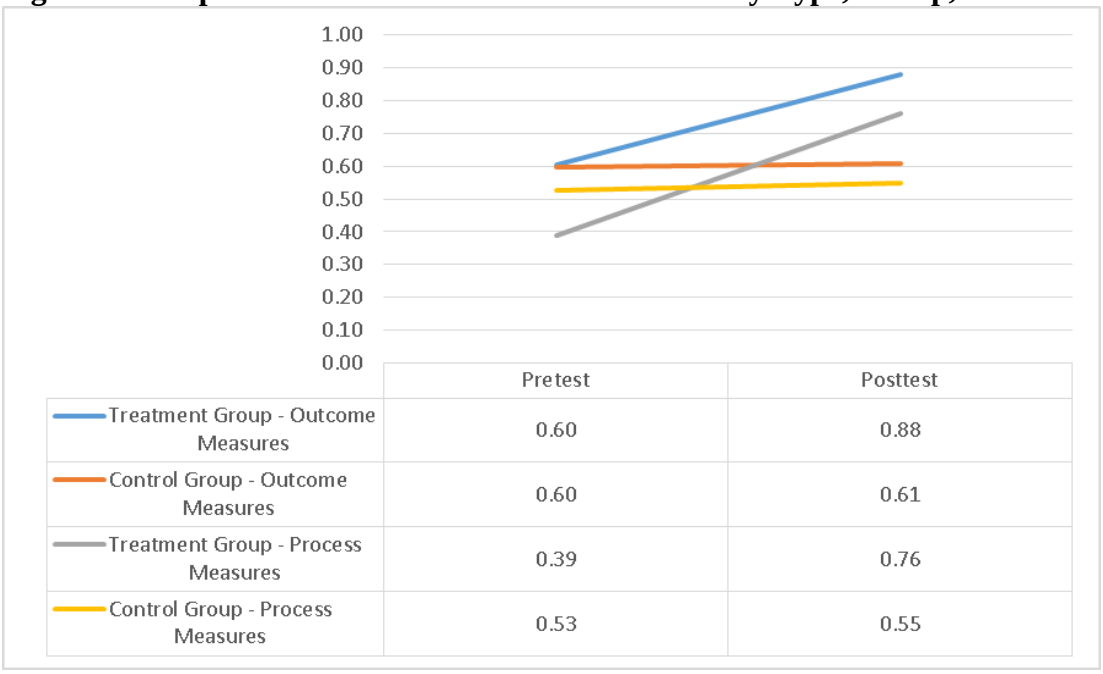
location B was negatively associated with meeting process measures (OR=0.729). Being 75 years or older had a positive association, contrary the effect on outcome measures.

Table 12. Outcome Measures – Grouped Logistic Regression

	Odds Ratio	Standard Error	z	P>z	95% Confidence Interval
Care Coordination	1.042	0.130	0.330	0.743	0.816 - 1.329
Time	1.078	0.148	0.550	0.585	0.824 - 1.411
Care Coordination*Time	2.849	0.638	4.670	0.000	1.836 - 4.419
Age 75 plus	0.656	0.075	-3.680	0.000	0.524 - 0.821
Diabetes	1.042	0.145	0.300	0.766	0.793 - 1.369
Hypertension	0.950	0.171	-0.290	0.773	0.668 - 1.350
Ischemic Vascular Disease	1.140	0.240	0.620	0.534	0.754 - 1.724
Heart Failure	0.671	0.157	-1.700	0.089	0.424 - 1.063
Coronary Artery Disease	0.830	0.193	-0.800	0.422	0.526 - 1.308
Male	1.080	0.123	0.670	0.501	0.864 - 1.350
Marital Status					
Single	1.082	0.135	0.630	0.527	0.848 - 1.382
Unknown	0.995	0.159	-0.030	0.973	0.727 - 1.360
Race					
Black	1.357	0.268	1.550	0.121	0.922 - 1.998
Other	1.006	0.284	0.020	0.983	0.578 - 1.751
Unknown	1.239	0.188	1.410	0.158	0.920 - 1.669
Ethnicity					
Hispanic	1.370	0.180	2.390	0.017	1.059 - 1.774
Unknown	1.082	0.164	0.520	0.604	0.803 - 1.457
Primary Treatment Location					
Location B	1.362	0.291	1.450	0.148	0.896 - 2.071
Location C	1.649	0.439	1.880	0.061	0.978 - 2.779
Location D	1.835	0.385	2.890	0.004	1.216 - 2.770
Location E	2.061	0.401	3.720	0.000	1.408 - 3.016
Location F	1.086	0.261	0.340	0.730	0.678 - 1.740

There are two other factors with a significant association to meeting outcome measures: age (OR= 0.656, p=0.000) and location E (OR=2.061, 0.000). Being 75 years or older had a negative association with achieving outcome measures, while having location E increased the likelihood of patients meeting defined outcome measures.

Figure 10. Proportion of Performance Measures Met by Type, Group, and Time



	Pretest	Posttest
Treatment Group - Outcome Measures	0.60	0.88
Control Group - Outcome Measures	0.60	0.61
Treatment Group - Process Measures	0.39	0.76
Control Group - Process Measures	0.53	0.55

4.5.4 Summary of Empirical Results

A simple means of examining how care coordination affected patient success in meeting 1) all measures, 2) process measures, and 3) outcome measure is to compare the mean proportion by group and time. Looking at the difference between the years 0 and 1 for each group individually, it is clear that for all three measure categories the treatment group realized a much larger increase in proportion of success in meeting defined

measures. Confirmatory analyses of the main effects, using difference in differences, for hypotheses 1 and 3 were conducted. Table 13 shows the proportion of measures met by group, pre and post measurement, by measure type. These data confirm that the treatment group, despite the lower pretest score means, surpassed the control group in Year 1 in each of the three categories, and that there was no substantial change in mean scores for the control group. A summary of results from all difference in differences analyses is listed in table 14; results for all measures, process measures, and outcome measures all show a statistically significant difference between groups by year (p=0.000).

Table 13. Mean Proportion of Performance Measures by Group and Year

	All measures		Process Measures		Outcome Measures	
Treatment * Time	Treatment Group	Control Group	Treatment Group	Control Group	Treatment Group	Control Group
T0 (2012)	44%	54%	39%	53%	60%	60%
T1 (2013)	79%	56%	76%	55%	88%	60%
Difference	35%	2%	37%	2%	28%	0%

Table 14. Statistical Significance of Time*Treatment by Individual PM Measure

Performance Measure(s)	Measure Description	Difference in Differences	P>t	Measure Type
All Measures	Performance Measures: 14-33	0.329	0.000**	Both
Process Measures	Performance Measures: 14, 15, 16, 17, 18, 19, 20, 21, 22, 26, 30, 31, 32, and 33	0.353	0.000**	Process
Outcome Measures	Performance Measures: 23, 24, 25, 27, 28, and 29	0.268	0.000**	Outcome
PM 14	Influenza Immunization	0.145	0.021*	Process
PM 15	Pneumococcal Vaccination	-0.088	0.098	Process
PM 16	Adult Weight Screening and Follow-up	0.352	0.000**	Process
PM 17	Tobacco Use Assessment and Cessation Intervention	0.973	0.000**	Process
PM 18	Depression Screening	0.737	0.000**	Process
PM 19	Colorectal Cancer Screening	-0.092	0.101	Process
PM 20	Mammography Screening	-0.180	0.083	Process
PM 21	Adults who had blood pressure screened in past 2 years	0.428	0.000**	Process
PM 22	Hemoglobin A1c Control (HbA1c) (<8 percent)	0.077	0.415	Outcome
PM 23	Low Density Lipoprotein (LDL) (<100 mg/dL)	0.174	0.086	Outcome
PM 24	Blood Pressure (BP) < 140/90	0.254	0.009*	Outcome
PM 25	Tobacco Non Use	0.028	0.698	Outcome
PM 26	Aspirin Use	-0.020	0.932	Process
PM 27	Beneficiaries with diabetes whose HbA1c is <9 percent	0.064	0.453	Outcome
PM 28	Beneficiaries with hypertension whose BP < 140/90	0.353	0.000**	Outcome
PM 29	Beneficiaries with IVD with complete lipid profile and LDL control < 100mg/dl	0.049	0.698	Outcome
PM 30	Beneficiaries with IVD who use Aspirin or other antithrombotic	-0.018	0.838	Process
PM 31	Beta-Blocker Therapy for LVSD CAD	0.080	0.698	Process
PM 32	Drug Therapy for Lowering LDL Cholesterol	0.174	0.153	Process
PM 33	ACE Inhibitor or ARB Therapy for Patients with CAD and Diabetes and/or LVSD	-0.067	0.663	Process

The difference in differences analyses for each performance measure allows for an examination of the individual effect of care coordination. Table 14 details the difference in differences (between groups and years), indicating significance at $p<.05$ and $p<.002$; the latter is used as the significance cutoff for this study, but the change in each of these performance measures is examined. There was an increase in meeting performance measure 14 (i.e., influenza vaccine) of more than five percent among treatment group members, while the control group experienced a decrease of nearly ten percent. Baseline pretests were equal between groups for performance measure 16 (i.e., BMI screening and documented follow-up), but the treatment group improved by over 30 percent while the control group remained nearly consistent. There was a striking distance between pretest scores for performance measure 17; this measure relates to tobacco use and cessation treatment and zero members of the treatment group met this measure in year 0 while 97 percent of the control group were either tobacco non-users or had been offered cessation counseling. In year 1, the control group realized a slight increase, but 100 percent of the treatment group then met this measure. Performance measure 18 focuses on clinical depression screenings. Over fourteen percent of the control group met this measure in year 0, compared to seven percent of the treatment group; in year 1, the treatment group had increased their success by 70 percent while the control group realized a slight decrease in depression screenings. Performance measure 21 calls for blood pressure screening and documented follow-up for results of high blood pressure. The treatment group's pretest mean was higher than that of the control group (41 percent and 28 percent, respectively), but the treatment group nearly doubled their

success in year 1 compared to a slight decrease of success by the control group. The pretest results for performance measure 24 were equitable; this measure focused on blood pressure results of the diabetic subpopulation. The treatment group increased their success by 25 percent while the control group realized a nearly 10 percent decrease. Performance measure 28 focuses on the blood pressure results of the diabetic, hypertensive population; differences between groups in pretest results were minimal. The treatment group in year 1 increased success in meeting this measure by over 20 percent, while the control group remained largely unchanged. When looking at the difference between the two groups by year, six individual measures realized a minimal decrease; it is notable that none of those decreases were statistically significant. Seven measures showed positive significant changes; only two of those were outcome measures and both were related to blood pressure results.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The main goal of this study was accomplished in assessing the effects that a care coordination intervention had on patients' likelihood to meet defined performance measures. Though both process and outcome measures of patients in the treatment group showed a statistically significant increase, the results suggest that efforts to coordinate care are more effective on performance measures in which providers have a higher degree of control (i.e., process measures). Increased outcome measures may result from higher quality of care, but level of patient activation and patient adherence to medical advice likely mediates that relationship.

In designing this study, the measures used to gauge quality became a subject of investigation. It was necessary to consider if the defined CMS measures were appropriate metrics by which to judge the success of this intervention. Given that these measures guided the care coordination intervention, it seemed reasonable to measure its success in this manner. It does, however, also seem appropriate to discuss the potential fallacies/issues associated with this type of measurement. This includes an examination of performance measures utilizing established management literature and concerns spelled out in recent literature.

5.1 Examining Performance Measures: A Performance Management Perspective

Performance is difficult to accurately assess in the health care environment because there is a poor correlation between outcome and quality due to the low signal to noise ratio (i.e., factors other than quality of care affect outcomes) and case mix bias (i.e., some patients are sicker than others) (Lilford et al., 2007). While it is difficult to define absolute best practices of performance management, given the context specific nature of performance management systems, the literature does offer broad suggestions to guide effective performance management. Aguinas describes the ideal performance management system as including the following characteristics (2009):

1. Strategic congruence
2. Thoroughness
3. Practicality
4. Meaningfulness
5. Specificity
6. Effective/ineffective
`performance
7. Reliability
8. Validity
9. Acceptability/fairness
10. Inclusiveness
11. Openness
12. Correctability
13. Standardization
14. Ethicality

What follows is a discussion of recommended performance management practices and how they align with the current healthcare environment based using the above identified characteristics as guidance.

A basic premise of setting performance management evaluative criteria is to align individual goals with unit and organizational goals (i.e., *strategic congruence*; Aguinas, 2009). Having payers set performance goals complicates aligning strategy and individual goals. If we look at CMS or other payers as the organization and the ACO as the individual, we can largely assume alignment because participation in these networks is voluntary. Given the expansive networks of healthcare organizations participating in ACOs, finding alignment between all these organizations and attempting to continue that alignment to include individual practitioners adds immense complexity, highlighting the importance of provider buy-in.

The performance measures are thorough for the purpose of improving population health; they are not thorough as proxies for performance of the quality of care provided by an organization or by an individual physicians; all major job responsibilities should be evaluated. A particular approach to performance management may be effective for a particular purpose, but what works in one context may not prove effective in another. DeNisi and Smith suggest that employees should be able to see how to achieve personal goals that are aligned with strategic goals (2014), and since quality care does not always lead to quality outcomes, being judged by these performance measurements may have unintended consequences (e.g., decreased job satisfaction and motivation, decreased perceived fairness/justice, and increased incidence of burnout). Patient adherence can

affect performance measures that providers are striving to help patients achieve, making the achievement a joint effort. The level of patient outcomes depends on a number of factors, only some of which are provider controlled. Adherence to recommended medical advice varies because patients' understanding of and willingness to manage their health varies by individual; the former has the potential to make vulnerable populations less desirable patients. If the purpose in using these measures was more strictly focused on increasing population health, there would be little argument to the extent to which they are thorough. But since these measures are now also tied to payment, the organization is being judged on criteria not wholly within its control which tends to impact providers' pay structures. "When used for multiple purposes, [performance appraisal] systems should be designed for those purposes, e.g. separate objectives, measurement criteria, etc., for career development and for the work activity" (Banner & Graber, 1985, p. 31). This is a crucial disconnect between the performance management literature and accepted performance management practices in the healthcare industry.

Regarding *practicality*, time is required to collect and report the defined performance measures; in some cases, new technology, procedures, and/or staff may be needed to aid in accurate documentation and coordination of care. And there has been some criticism of excessive reporting requirements. A recent qualitative study of health care executives and physicians noted two disadvantages of ACOs directly tied to performance measures:

1) “Increased bureaucracy – in the form of committee meetings, quality measure reporting, patient-centered medical home documentation, etc.” and

2) “Loss of autonomy due to expected adherence to clinical guidelines and performance on quality measures” (Berenson, Burton, & McGrath, 2016, p. 3).

Meaningfulness and *validity* refer to the evaluative criteria used in assessing performance; in this context, there is a degree of overlap between the two concepts as both relate to measure relevance. Chapter II assessed the performance measures based on the current literature and the rationale for them; CMS does communicate and clarify providers’ responsibilities as the performance management literature suggests (Pulakos & O’Leary, 2011) and they are based on best practices of care, despite that some of the enumerated targets are beyond provider control. The rationale for the performance measures provided by NQF and CMS are based on setting criteria that is beneficial to population health, which is only one purpose for which these measures are used. Providers and health systems need to understand in what ways and to what degrees a patient population is lacking in order to best address those concerns. Those same standards are arguably not readily transferrable as evaluative criteria for organizations or providers, but the structure of accountable care organizations do/encourage just that. “Performance assessment must emphasise only those functions under the control of the employee” (Aguinis, 2009, p.1/15). Judging a widget maker’s work quality and productivity based solely on the functionality and number of widgets produced is logical. This simple means of assessment does not readily translate to the health care environment due to the variability in patient activation (i.e., knowledge, skills, and willingness).

The *specificity* of CMS' performance measures are evident by the 73 page document used to describe the details of the 2013 measures. A three year ethnographic study of four organizations in the United Kingdom's National Health Service found that the "inflexible application of metrics-based target systems to clinical and administrative tasks...can result in dysfunctional outcomes for patient care and workforce morale" stemming from a dissatisfaction with the targets culture (McCann et al., 2015, p. 773). Having detailed guidance regarding performance expectations can allow employees to have a true understanding between *effective and ineffective performance* (Aguinas, 2009). This is not necessarily true when measures lack meaningfulness and validity, and herein lies the problem.

What remains in question is to what degree these measures readily identify high performing organizations and providers. "Outcomes synthesise all of the processes received by the patient and therefore reflect the activities of many clinicians and support services (Lilford et al., 2007, p. 649)". A focus on behaviors that are under the control of employees is appropriate (Aguinas, 2009; DeNisi & Smith, 2014) so as not to create unintended consequences. *Acceptability and fairness* of defined measures system is achieved when participants in the performance management system find it to be fair and appropriate.

The *reliability* of these performance measures should be consistent as data can readily be collected through use of an electronic health record at time of patient visit. Standardized systems should be used to evaluate consistently across people and time, (Aguinas, 2009), and in this way ACO performance measures comply. The reporting

process is highly *standardized*, allowing for comparison of results across various ACO networks. *Correctability* encompasses the idea of minimizing subjectivity, which these performance measures also do.

The *inclusiveness* of these measures could be argued largely based on the dual role that these measure play in performance management (i.e., population health improvement and administrative purposes). An inclusive evaluation process "must represent the concerns of all the people who will be affected by the outcome" (Aguinis, 2009, p. 1/16). CMS demonstrated inclusivity by convening an expert panel in the creation of these performance measures and by soliciting public comment (CMS).

5.2 Conclusions

The results of this study support prior research showing that care coordination efforts can improve patients' health. Care coordination interventions seem to be more effective on increasing the likelihood of meeting process measures compared to outcome measures where patient adherence is required to realize change in outcomes. Having nationally established standards of care quality will allow for ready comparison across care settings, but the existence of such standards incentivizes treating to the test. As such, the performance measures used to judge quality of care by accountable care organizations need to be continually updated to reflect medical advances and current best practices as these measures are likely to be a focus of care. The National Quality Forum is the basis for nearly all performance measures; their purpose is to improve population health. These same measures are doubling as performance targets through

organizational incentives offered by payers for increased quality of care and cost neutrality, conflicting with established performance management guidelines.

5.3 Future Research

In order to best realize improvements in population health, future research should test the strength of interventions implemented by ACOs to learn what changes to work processes have shown to be effective in helping patients meet defined performance measures. Also paramount is a better understanding of costs associated with interventions targeted at improving population health in ACOs. Continuing to validate and improve upon defined performance measures is also necessary to maintain the most appropriate care focus. Research efforts should also consider health care providers perceptions of the quality performance measures to understand potential implications that may result on levels of job satisfaction, burnout, and perceived fairness. Studies of performance management and their association to procedural and distributive justice seem appropriate at a time when pay for performance is increasing. Care provided to patients is becoming increasingly collaborative through models of care that encourage collaboration between the care team (e.g., patient centered medical homes and ACOs). The changing nature of the delivery of health care services calls for research on how best to assess individual level performance in team settings.

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APPENDIX A

Table 15. Patient Characteristics Qualifying for Performance Measure 14

	Total	Treatment Group	Control Group
N	494	240	254
Male (%)	34%	38%	31%
Age 75 plus (%)	38%	34%	41%
Age Mean	74	73	74
White (%)	74%	76%	72%
Black (%)	8%	6%	10%
Other Race (%)	5%	3%	6%
Hispanic (%)	42%	41%	43%
Non-Hispanic (%)	38%	34%	41%
Married (%)	39%	42%	37%
Single (%)	50%	47%	52%
Diabetic (%)	42%	41%	43%
Hypertensive (%)	84%	81%	87%
IVD (%)	20%	21%	19%
Heart Failure (%)	6%	5%	7%
CAD (%)	17%	18%	15%

Table 16. Difference in Differences for Performance Measure 14

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 14	0.449	0.404	-0.045	0.358	0.458	0.100	0.145
Std. Error	0.031	0.032	0.044	0.031	0.032	0.044	0.063
t	14.530	12.720	-1.010	11.600	14.420	2.260	2.310
P>t	0.000	0.000	0.314	0.000	0.000	0.024	0.021

Table 17. Patient Characteristics Qualifying for Performance Measure 15

	Total	Treatment Group	Control Group
N	716	274	442
Male (%)	34%	39%	31%
Age 75 plus (%)	41%	35%	45%
Age Mean	74	73	74
White (%)	73%	75%	71%
Black (%)	8%	6%	10%
Other Race (%)	5%	4%	5%
Hispanic (%)	38%	41%	37%
Non-Hispanic (%)	41%	33%	46%
Married (%)	36%	39%	33%
Single (%)	49%	49%	49%
Diabetic (%)	39%	40%	38%
Hypertensive (%)	82%	80%	83%
IVD (%)	20%	19%	21%
Heart Failure (%)	7%	7%	7%
CAD (%)	17%	17%	17%

Table 18. Difference in Differences for Performance Measure 15

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 15	0.507	0.697	0.190	0.572	0.675	0.103	-0.088
Std. Error	0.023	0.029	0.037	0.023	0.029	0.037	0.053
t	21.950	23.770	5.100	24.790	23.020	2.750	-1.660
P>t	0.000	0.000	0.000	0.000	0.000	0.006	0.098

Table 19. Patient Characteristics Qualifying for Performance Measure 16

	Total	Treatment Group	Control Group
N	714	272	442
Male (%)	34%	39%	31%
Age 75 plus (%)	41%	35%	45%
Age Mean	74	73	74
White (%)	73%	75%	71%
Black (%)	8%	6%	10%
Other Race (%)	5%	4%	5%
Hispanic (%)	39%	42%	37%
Non-Hispanic (%)	41%	33%	46%
Married (%)	36%	39%	33%
Single (%)	49%	49%	49%
Diabetic (%)	39%	40%	38%
Hypertensive (%)	82%	80%	83%
IVD (%)	20%	19%	21%
Heart Failure (%)	7%	7%	7%
CAD (%)	17%	17%	17%

Table 20. Difference in Differences for Performance Measure 16

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 16	0.629	0.622	-0.007	0.597	0.943	0.345	0.352
Std. Error	0.021	0.028	0.035	0.021	0.028	0.035	0.050
t	29.340	22.340	-0.190	27.860	33.860	9.830	7.090
P>t	0.000	0.000	0.846	0.000	0.000	0.000	0.000

Table 21. Patient Characteristics Qualifying for Performance Measure 17

	Total	Treatment Group	Control Group
N	718	276	442
Male (%)	34%	39%	31%
Age 75 plus (%)	41%	35%	45%
Age Mean	74	73	74
White (%)	73%	75%	71%
Black (%)	8%	6%	10%
Other Race (%)	5%	4%	5%
Hispanic (%)	38%	41%	37%
Non-Hispanic (%)	41%	33%	46%
Married (%)	36%	40%	33%
Single (%)	49%	49%	49%
Diabetic (%)	39%	40%	38%
Hypertensive (%)	82%	80%	83%
IVD (%)	20%	19%	21%
Heart Failure (%)	7%	7%	7%
CAD (%)	17%	17%	17%

Table 22. Difference in Differences for Performance Measure 17

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 17	0.971	0.000	-0.971	0.998	1.000	0.002	0.973
Std. Error	0.005	0.006	0.007	0.005	0.006	0.007	0.011
t	209.27	0.000	-129.750	215.12	170.38	0.300	91.960
P>t	0.000	1.000	0.000	0.000	0.000	0.762	0.000

Table 23. Patient Characteristics Qualifying for Performance Measure 18

	Total	Treatment Group	Control Group
N	714	272	442
Male (%)	34%	39%	31%
Age 75 plus (%)	41%	35%	45%
Age Mean	74	73	74
White (%)	73%	75%	71%
Black (%)	8%	6%	10%
Other Race (%)	5%	4%	5%
Hispanic (%)	39%	42%	37%
Non-Hispanic (%)	41%	33%	46%
Married (%)	36%	39%	33%
Single (%)	49%	49%	49%
Diabetic (%)	39%	40%	38%
Hypertensive (%)	82%	80%	83%
IVD (%)	20%	19%	21%
Heart Failure (%)	7%	7%	7%
CAD (%)	17%	17%	17%

Table 24. Difference in Differences for Performance Measure 18

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 18	0.145	0.070	-0.075	0.118	0.779	0.662	0.737
Std. Error	0.016	0.021	0.026	0.016	0.021	0.026	0.037
t	8.940	3.380	-2.860	7.270	37.760	25.220	19.860
P>t	0.000	0.001	0.004	0.000	0.000	0.000	0.000

Table 25. Patient Characteristics Qualifying for Performance Measure 19

	Total	Treatment Group	Control Group
N	497	203	294
Male (%)	33%	36%	31%
Age 75 plus (%)	14%	11%	17%
Age Mean	71	71	71
White (%)	71%	75%	69%
Black (%)	9%	6%	11%
Other Race (%)	5%	4%	5%
Hispanic (%)	40%	44%	37%
Non-Hispanic (%)	40%	32%	46%
Married (%)	39%	43%	36%
Single (%)	46%	45%	48%
Diabetic (%)	40%	40%	39%
Hypertensive (%)	82%	80%	84%
IVD (%)	19%	19%	18%
Heart Failure (%)	4%	4%	4%
CAD (%)	15%	16%	14%

Table 26. Difference in Differences for Performance Measure 19

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 19	0.248	0.296	0.047	0.262	0.217	-0.045	-0.092
Std. Error	0.025	0.031	0.040	0.025	0.031	0.040	0.056
t	9.760	9.650	1.190	10.290	7.080	-1.130	-1.640
P>t	0.000	0.000	0.235	0.000	0.000	0.257	0.101

Table 27. Patient Characteristics Qualifying for Performance Measure 20

	Total	Treatment Group	Control Group
N	174	70	104
Male (%)	0%	0%	0%
Age 75 plus (%)	0%	0%	0%
Age Mean	68	68	68
White (%)	74%	81%	68%
Black (%)	9%	7%	11%
Other Race (%)	5%	1%	8%
Hispanic (%)	41%	46%	38%
Non-Hispanic (%)	39%	29%	46%
Married (%)	29%	31%	27%
Single (%)	61%	60%	62%
Diabetic (%)	39%	44%	36%
Hypertensive (%)	83%	81%	84%
IVD (%)	14%	17%	12%
Heart Failure (%)	5%	3%	6%
CAD (%)	10%	11%	10%

Table 28. Difference in Differences for Performance Measure 20

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 20	0.375	0.471	0.096	0.327	0.243	-0.084	-0.180
Std. Error	0.047	0.057	0.073	0.047	0.057	0.073	0.104
t	8.050	8.310	1.310	7.020	4.280	-1.150	-1.740
P>t	0.000	0.000	0.190	0.000	0.000	0.253	0.083

Table 29. Patient Characteristics Qualifying for Performance Measure 21

	Total	Treatment Group	Control Group
N	153	58	95
Male (%)	44%	50%	40%
Age 75 plus (%)	42%	33%	47%
Age Mean	74	73	75
White (%)	76%	72%	79%
Black (%)	5%	3%	5%
Other Race (%)	6%	5%	6%
Hispanic (%)	27%	33%	24%
Non-Hispanic (%)	56%	45%	63%
Married (%)	43%	45%	42%
Single (%)	42%	41%	42%
Diabetic (%)	20%	26%	17%
Hypertensive (%)	22%	17%	24%
IVD (%)	14%	14%	15%
Heart Failure (%)	5%	3%	5%
CAD (%)	12%	10%	14%

Table 30. Difference in Differences for Performance Measure 21

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 21	0.284	0.414	0.130	0.253	0.810	0.558	0.428
Std. Error	0.046	0.059	0.074	0.046	0.059	0.074	0.105
t	6.200	7.060	1.740	5.510	13.820	7.490	4.070
P>t	0.000	0.000	0.083	0.000	0.000	0.000	0.000

Table 31. Patient Characteristics Qualifying for Diabetes Performances Measures (22, 23, 24, 25, and 27)

	Total	Treatment Group	Control Group
N	196	83	113
Male (%)	35%	40%	31%
Age 75 plus (%)	14%	11%	16%
Age Mean	71	70	71
White (%)	69%	81%	60%
Black (%)	9%	5%	12%
Other Race (%)	4%	1%	5%
Hispanic (%)	57%	58%	57%
Non-Hispanic (%)	29%	28%	30%
Married (%)	41%	46%	38%
Single (%)	45%	46%	45%
Diabetic (%)	96%	96%	96%
Hypertensive (%)	93%	89%	96%
IVD (%)	25%	28%	23%
Heart Failure (%)	7%	7%	6%
CAD (%)	19%	24%	15%

Table 32. Difference in Differences for Performance Measure 22

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 22	0.655	0.747	0.092	0.602	0.771	0.169	0.077
Std. Error	0.043	0.051	0.067	0.043	0.051	0.067	0.095
t	15.060	14.720	1.380	13.830	15.190	2.530	0.820
P>t	0.000	0.000	0.169	0.000	0.000	0.012	0.415

Table 33. Difference in Differences for Performance Measure 23

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 23	0.478	0.518	0.040	0.460	0.675	0.215	0.174
Std. Error	0.047	0.054	0.072	0.047	0.054	0.072	0.101
t	10.260	9.530	0.560	9.880	12.410	3.000	1.720
P>t	0.000	0.000	0.575	0.000	0.000	0.003	0.086

Table 34. Difference in Differences for Performance Measure 24

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 24	0.628	0.651	0.022	0.531	0.807	0.276	0.254
Std. Error	0.044	0.052	0.068	0.044	0.052	0.068	0.096
t	14.160	12.570	0.330	11.970	15.590	4.050	2.630
P>t	0.000	0.000	0.744	0.000	0.000	0.000	0.009

Table 35. Difference in Differences for Performance Measure 25

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 25	0.903	0.928	0.025	0.779	0.831	0.053	0.028
Std. Error	0.033	0.038	0.050	0.033	0.038	0.050	0.071
t	27.690	24.390	0.500	23.890	21.850	1.050	0.390
P>t	0.000	0.000	0.617	0.000	0.000	0.295	0.698

Table 36. Difference in Differences for Performance Measure 27

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 27	0.779	0.831	0.053	0.69	0.807	0.117	0.064
Std. Error	0.039	0.046	0.061	0.039	0.046	0.061	0.086
t	19.75	18.07	0.87	17.5	17.54	1.93	0.75
P>t	0	0	0.386	0	0	0.054	0.453

Table 37. Patient Characteristics Qualifying for Performance Measure 26

	Total	Treatment Group	Control Group
N	20	9	11
Male (%)	40%	33%	45%
Age 75 plus (%)	25%	22%	27%
Age Mean	71	71	71
White (%)	60%	67%	55%
Black (%)	15%	0%	27%
Other Race (%)	5%	0%	9%
Hispanic (%)	60%	67%	55%
Non-Hispanic (%)	20%	11%	27%
Married (%)	40%	33%	45%
Single (%)	45%	56%	36%
Diabetic (%)	0%	0%	0%
Hypertensive (%)	95%	89%	100%
IVD (%)	100%	100%	100%
Heart Failure (%)	10%	11%	9%
CAD (%)	50%	56%	45%

Table 38. Difference in Differences for Performance Measure 26

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 26	0.909	0.889	-0.020	0.818	0.778	-0.040	-0.020
Std. Error	0.112	0.124	0.167	0.112	0.124	0.167	0.237
t	8.100	7.160	-0.120	7.290	6.270	-0.240	-0.090
P>t	0.000	0.000	0.905	0.000	0.000	0.811	0.932

Table 39. Patient Characteristics Qualifying for Performance Measure 28

	Total	Treatment Group	Control Group
N	531	200	331
Male (%)	32%	36%	29%
Age 75 plus (%)	38%	33%	41%
Age Mean	73	73	74
White (%)	72%	78%	69%
Black (%)	9%	6%	11%
Other Race (%)	4%	3%	5%
Hispanic (%)	43%	45%	41%
Non-Hispanic (%)	36%	29%	41%
Married (%)	35%	40%	32%
Single (%)	50%	50%	50%
Diabetic (%)	45%	46%	45%
Hypertensive (%)	100%	100%	100%
IVD (%)	21%	20%	21%
Heart Failure (%)	7%	7%	7%
CAD (%)	18%	18%	18%

Table 40. Difference in Differences for Performance Measure 28

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 28	0.598	0.570	-0.028	0.580	0.905	0.325	0.353
Std. Error	0.025	0.033	0.041	0.025	0.033	0.041	0.059
t	23.530	17.430	-0.680	22.810	27.670	7.840	6.030
P>t	0.000	0.000	0.496	0.000	0.000	0.000	0.000

Table 41. Patient Characteristics Qualifying for Performance Measure 29

	Total	Treatment Group	Control Group
N	128	49	79
Male (%)	50%	59%	44%
Age 75 plus (%)	48%	37%	56%
Age Mean	75	73	76
White (%)	77%	88%	70%
Black (%)	9%	4%	11%
Other Race (%)	3%	0%	5%
Hispanic (%)	34%	33%	34%
Non-Hispanic (%)	47%	41%	51%
Married (%)	34%	47%	27%
Single (%)	52%	39%	59%
Diabetic (%)	50%	53%	48%
Hypertensive (%)	86%	84%	87%
IVD (%)	99%	98%	100%
Heart Failure (%)	19%	16%	20%
CAD (%)	80%	80%	81%

Table 42. Difference in Differences for Performance Measure 29

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 29	0.443	0.531	0.088	0.557	0.694	0.137	0.049
Std. Error	0.056	0.071	0.090	0.056	0.071	0.090	0.127
t	7.960	7.510	0.970	10.010	9.820	1.520	0.390
P>t	0.000	0.000	0.331	0.000	0.000	0.129	0.698

Table 43. Patient Characteristics Qualifying for Performance Measure 30

	Total	Treatment Group	Control Group
N	128	49	79
Male (%)	50%	59%	44%
Age 75 plus (%)	49%	39%	56%
Age Mean	75	74	76
White (%)	77%	88%	70%
Black (%)	9%	4%	11%
Other Race (%)	3%	0%	5%
Hispanic (%)	34%	33%	34%
Non-Hispanic (%)	46%	39%	51%
Married (%)	34%	47%	27%
Single (%)	52%	39%	59%
Diabetic (%)	50%	53%	48%
Hypertensive (%)	86%	84%	87%
IVD (%)	99%	98%	100%
Heart Failure (%)	19%	16%	20%
CAD (%)	80%	80%	81%

Table 44. Difference in Differences for Performance Measure 30

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 30	0.848	0.878	0.029	0.886	0.898	0.012	-0.018
Std. Error	0.037	0.048	0.061	0.037	0.048	0.061	0.086
t	22.650	18.460	0.490	23.670	18.890	0.200	-0.210
P>t	0.000	0.000	0.627	0.000	0.000	0.844	0.838

Table 45. Patient Characteristics Qualifying for Performance Measure 31

	Total	Treatment Group	Control Group
N	42	17	25
Male (%)	29%	35%	24%
Age 75 plus (%)	57%	53%	60%
Age Mean	77	76	77
White (%)	76%	71%	80%
Black (%)	12%	12%	12%
Other Race (%)	5%	0%	8%
Hispanic (%)	24%	29%	20%
Non-Hispanic (%)	45%	29%	56%
Married (%)	26%	24%	28%
Single (%)	55%	53%	56%
Diabetic (%)	48%	59%	40%
Hypertensive (%)	90%	88%	92%
IVD (%)	55%	53%	56%
Heart Failure (%)	93%	88%	96%
CAD (%)	48%	47%	48%

Table 46. Difference in Differences for Performance Measure 31

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 31	0.760	0.706	-0.054	0.680	0.706	0.026	0.080
Std. Error	0.092	0.112	0.145	0.092	0.112	0.145	0.205
t	8.230	6.300	-0.370	7.360	6.300	0.180	0.390
P>t	0.000	0.000	0.710	0.000	0.000	0.859	0.698

Table 47. Patient Characteristics Qualifying for Performance Measure 32

	Total	Treatment Group	Control Group
N	112	46	66
Male (%)	50%	61%	42%
Age 75 plus (%)	49%	37%	58%
Age Mean	75	74	76
White (%)	76%	89%	67%
Black (%)	8%	4%	11%
Other Race (%)	4%	0%	6%
Hispanic (%)	29%	26%	32%
Non-Hispanic (%)	48%	48%	48%
Married (%)	30%	46%	20%
Single (%)	56%	39%	68%
Diabetic (%)	46%	54%	39%
Hypertensive (%)	84%	83%	85%
IVD (%)	93%	89%	95%
Heart Failure (%)	20%	22%	18%
CAD (%)	97%	93%	100%

Table 48. Difference in Differences for Performance Measure 32

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 32	0.697	0.674	-0.023	0.697	0.848	0.151	0.174
Std. Error	0.055	0.066	0.086	0.055	0.066	0.086	0.121
t	12.670	10.230	-0.270	12.670	12.870	1.760	1.430
P>t	0.000	0.000	0.788	0.000	0.000	0.080	0.153

Table 49. Patient Characteristics Qualifying for Performance Measure 33

	Total	Treatment Group	Control Group
N	60	28	32
Male (%)	45%	50%	41%
Age 75 plus (%)	42%	29%	53%
Age Mean	74	73	75
White (%)	73%	86%	63%
Black (%)	12%	4%	19%
Other Race (%)	5%	0%	9%
Hispanic (%)	35%	39%	31%
Non-Hispanic (%)	40%	32%	47%
Married (%)	27%	39%	16%
Single (%)	57%	43%	69%
Diabetic (%)	82%	89%	75%
Hypertensive (%)	87%	82%	91%
IVD (%)	92%	86%	97%
Heart Failure (%)	33%	32%	34%
CAD (%)	95%	89%	100%

Table 50. Difference in Differences for Performance Measure 33

Outcome Variable	Time 0 Control	Time 0 Treated	Baseline Difference	Time 1 Control	Time 2 Treated	Follow-up Difference	Difference in Differences
Performance Measure 33	0.750	0.821	0.071	0.781	0.786	0.004	-0.067
Std. Error	0.074	0.079	0.108	0.074	0.079	0.108	0.153
t	10.140	10.390	0.660	10.570	9.940	0.040	-0.440
P>t	0.000	0.000	0.511	0.000	0.000	0.967	0.663