ABSTRACT

Title of Dissertation:	MDPCP PRIMARY CARE PRACTICE CAPABILITIES AND CARE MANAGEMENT DELIVERY AMONG MARYLAND MEDICARE BENEFICIARIES
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Care management is one of the core components of comprehensive primary care, which represents the future direction of primary care in the United States. Nearly twenty percent of Medicare beneficiaries experience 30-day readmissions. While primary care is uniquely positioned to provide care management services associated with reducing readmissions, only 50 percent of older adults who have experienced 30-day hospital readmissions receive outpatient care.

The goal of this dissertation was to identify structural and process components associated with the delivery of care management services to Maryland fee-for-service (FFS) Medicare beneficiaries, to examine geographic variation in the delivery of care management services, and to examine the association between the provision of care management services and patient health outcomes.

This dissertation explores the relationship between structural and process components of care delivery and the delivery of care management services with three aims: (1) examine the association between primary care practice structural and process capabilities and the delivery of care management to Medicare beneficiaries and whether this association is altered by primary care practice medically underserved area (MUA) designation, (2) examine the association between Health Equity Advancement Resource and Transformation (HEART) payments and care management comprehensiveness and whether this association is altered by primary care practice care management delivery option, and (3) identify unique trajectories of comprehensive care management performance and examine the association between care management trajectories and readmission rates.

Several key findings and implications are identified through the exploration of these aims. Increased primary care practice-level capabilities were associated with increased care management comprehensiveness. There was geographic variation in the provision of care management services among Maryland FFS Medicare beneficiaries. Next, prospective HEART payments were associated with increased care management comprehensiveness, and this association varied according to MUA designation and care management delivery options. Additionally, intensive partnerships between care transformation organizations (CTOs) and primary care practices improved access to comprehensive care management services. Finally, four unique classes of comprehensive care management performance were identified, and these care management performance classes had distinct patient characteristics and geographic locations. Among the low care management performance class, increased comprehensiveness among care management services was associated with decreased unplanned readmissions over time.

This dissertation provides evidence that geographic variation in the provision of care management exists and includes guidance on how to assess geographic variation in care management services across the United States. These results also provide valuable evidence about how prospective equity-based payments can transform care delivery in primary care settings. Lastly, this dissertation presents a novel method of program performance evaluation that can be applied to all evaluations of Medicare demonstrations.

MDPCP PRIMARY CARE PRACTICE CAPABILITIES AND CARE MANAGEMENT DELIVERY AMONG MARYLAND MEDICARE BENEFICIARIES

by

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2024

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Dedication

This dissertation is lovingly dedicated to my late grandparents, JoAnn Stewart Robinson and Ronald Edward Robinson. You both inspired me to pursue a career in public health and will continue to inspire my future work. Your dedication to learning, strong work ethic, and sense of humor have been the foundation of my journey. This work is a tribute to your memory.

Acknowledgements

This dissertation would not be possible without the mentorship and support I received from the Department of Health Policy and Management, my peers, family, and friends. I am profoundly grateful to all who contributed to this significant milestone. First and foremost, I would like to thank my mentor and advisor, Dr. Neil Sehgal, for his unwavering belief in my potential and continuous support. I am incredibly grateful for the time and effort he dedicated to helping me succeed over these last five years. My sincere thanks also go to my dissertation committee members, Drs. Dushanka V. Kleinman, Rozalina G. McCoy, Kellee White Whilby, and Dahai Yue. Your expert advice, insightful feedback, and encouragement challenged me to improve my dissertation and prepared me for a future in scholarly and applied research. I am immensely grateful to my peers within the Department of Health Policy and Management and my cohort. Your friendship and support were a lifeline throughout this journey.

I am deeply grateful to the Maryland Primary Care Program team, including Dr. Howard Haft, Chad Perman, Candice Morrison, and Raghavi Anand. Your approval and support were crucial in making this dissertation a reality. I am immensely thankful for the opportunity to contribute to a program that directly impacts the health and well-being of Maryland residents.

My journey through this doctoral program would have been significantly more challenging without my family and friends' unwavering support and love. To my husband, Norris Phillip, I find it difficult to articulate my gratitude because it is limitless. Thank you for your constant support, for your understanding, for being my peace throughout this process, for being my editor, and most of all, for being my best friend. I could not have undertaken this journey without

you. I am equally grateful to my family—my sister Kayla Robinson-Ector, mother Kimberly Robinson, and aunt Karen Robinson for your endless emotional support and encouragement. To my friends and Spelman sisters, your consistent encouragement and belief in my potential motivated me to push through even the most challenging periods. Lastly, I must thank my beloved family pets, Oliver, Azriel, and Comet, for their constant companionship.

Table of Contents

Dedication ii
Acknowledgements iii
Table of Contents v
List of Tables ii
List of Figures ii
List of Abbreviations iii
Chapter 1: Introduction 1
  Introduction 1
  Theoretical Framework 4
  Literature Review 7
  Overview 26
Chapter 2: Primary Care Practice Capabilities 27
  Background 27
  Methods 29
  Results 39
  Discussion 57
  Conclusion 60
Chapter 3: HEART Payments and Comprehensive Care Management 61
  Background 61
  Methods 63
  Results 74
  Discussion 99
  Conclusion 103
Chapter 4: Comprehensive Care Management and Primary Care Practice-Level Readmission Rates 104
  Background 104
  Methods 106
  Results 112
  Discussion 123
  Conclusion 125
Chapter 5: Conclusion and Future Direction 126
  Summary 126
  Policy Implications and Future Research 127
Appendix A: Chapter 2 130
Appendix B: Chapter 4 138
Bibliography 141

List of Tables

Table 2.1: Characteristics of MDPCP Primary Care Practices by MUA Designation, 2021 39
Table 2.2: Care Management Characteristics of MDPCP Primary Care Practices by MUA Designation, 2021 40
Table 2.3: Principal Component Analysis Descriptive Statistics after Scaling 41
Table 2.4: Hypothesized Variables and Care Transformation Categories 42
Table 2.5: Principal Component Analysis of Primary Care Structural and Process Capability Variables 43
Table 2.6: Variables Loadings after Promax Rotations 44
Table 2.7: Kaiser-Meyer-Olkin Measure of Sampling Adequacy 45
Table 2.8: Variables and Care Transformation Categories based on Principal Component Analysis Results. 48
Table 2.9: MDPCP primary care practice principal component capabilities associated with care management, Poisson regression models 50
Table 2.10: The impact of the interaction between MDPCP Primary care practice principal component capabilities and primary care practice MUA status on care management, Poisson regression models 52
Table 2.11: The number of MDPCP primary care practice capabilities and care management, Poisson regression models 55
Table 2.12: The impact of the interaction between the number of MDPCP primary care practice capabilities and primary care practice MUA status on care management, Poisson regression models 55
Table 3.1: MDPCP Care Management Services by Care Management Delivery Agreement Option 68
Table 3.2: Characteristics of MDPCP Primary Care Practices by Level of HEART Payments, January 1, 2022 – March 31, 2023 74
Table 3.3: Characteristics of MDPCP Primary Care Practices by Care Management Delivery Options, January 1, 2022 – March 31, 2023 76
Table 3.4: Care Management Characteristics of MDPCP Primary Care Practices by HEART Payment Level, January 1, 2022 – March 31, 2023 77
Table 3.5: Care Management Characteristics of MDPCP Primary Care Practices by Care Management Delivery Options, January 1, 2022 – March 31, 2023 79
Table 3.6: Comprehensive Care Management, Poisson mixed-effects models, 2022 – 2023 84
Table 3.7: Comprehensive Care Management, Poisson mixed-effects MUA Designation Stratified Models, 2022 – 2023 86
Table 3.8: Social Needs Management, Poisson mixed-effects models, 2022 – 2023 88
Table 3.9: Social Needs Management, Poisson mixed-effects models, 2022 – 2023 89
Table 4.1: Comprehensive Care Management Performance Trajectory Post Estimation Model Fit Assessment and Group Assessment 113
Table 4.2: Two-way Analysis of Comprehensive Care Management Score and Time by Care Management Performance Trajectory, July 1, 2020 – March 31, 2023, N=475 115
Table 4.3: Baseline Characteristics of MDPCP Primary Care Practices by Care Management Performance Trajectories, 2020 116

Table 4.4: Baseline Care Management Characteristics of MDPCP Primary Care Practices by HEART Payment Level, January 1, 2020 117
Table 4.5: Comprehensive Care Management Performance Trajectories, Negative Binomial Mixed-Effects Regression Models, July 1, 2020 – March 31, 2023 120
Appendix Table 2.13: Individual MDPCP primary care practice capabilities associated with comprehensive care management, Poisson regression models 130
Appendix Table 2.14: MDPCP primary care practice principal component capabilities with MDPCP practice provision of comprehensive care management, Poisson regression models .. 132
Appendix Table 2.15: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of risk-stratified care management, Poisson regression models 133
Appendix Table 2.16: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of self-management and support, Poisson regression models 134
Appendix Table 2.17: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of transitional care management, Poisson regression models 135
Appendix Table 2.18: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of medication management, Poisson regression models 136
Appendix Table 2.19: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of social needs management, Poisson regression models 137
Appendix Table 4.6: Comprehensive Care Management, Negative Binomial Mixed-Effects Regression Models, , July 1, 2022 – March 31, 2023 138
Appendix Table 4.7: Risk-stratified care management, Negative Binomial mixed-effects regression models, July 1, 2020 – March 31, 2023 138
Appendix Table 4.8: Self- management and support, Negative Binomial mixed-effects regression Models , July 1, 2020 – March 31, 2023 139
Appendix Table 4.9: Social needs management, Negative Binomial mixed-effects regression Models, July 1, 2020 – March 31, 2023 139
Appendix Table 4.10: Comprehensive medication management, Negative Binomial mixed-effects regression Models, July 1, 2020 – March 31, 2023 140
Appendix Table 4.11: Transitional care management, Negative Binomial mixed-effects regression Models, July 1, 2020 – March 31, 2023 140

List of Figures

Figure 1.1. MDPCP – Comprehensive Care Management Framework..... 7
Figure 2.1: Scree plot of eigenvalues after Principal Component Analysis 44
Figure 3.1: MDPCP HEART Payments by Care Management Delivery Options among All Practices, MUA-designated Practices, and Non-MUA-designated Practices, 2022 – 2023..... 81
Figure 3.2: Comprehensive Care Management Score by Care Delivery Management Options among All Practices, MUA-designated Practices, and Non-MUA-designated Practices, 2022 – 2023..... 82
Figure 3.3: Social Needs Management Score by Care Delivery Management Options among All Practices, MUA-designated Practices, and Non-MUA-designated Practices, 2022 – 2023..... 83
Figure 3.4: Marginal Probabilities of Comprehensive Care Management, January 1, 2022 – March 31, 2023 92
Figure 3.5: Marginal Probabilities of Comprehensive Care Management among MUA-designated Practices, January 1, 2022 – March 31, 2023 93
Figure 3.6: Marginal Probabilities of Comprehensive Care Management among Non-MUA-designated Practices, January 1, 2022 – March 31, 2023 94
Figure 3.7: Marginal probabilities of social needs management, January 1, 2022 – March 31, 2023..... 95
Figure 3.8: Marginal probabilities of social needs management among MUA-designated practices, January 1, 2022 – March 31, 2023 97
Figure 3.9: Marginal probabilities of social needs management among non-MUA-designated practices, January 1, 2022 – March 31, 2023 98
Table 4.1: Comprehensive Care Management Performance Trajectory Post Estimation Model Fit Assessment and Group Assessment..... 113
Figure 4.1: Comprehensive Care Management Performance Trajectories, July 1, 2020 – March 1, 2023..... 114
Figure 4.2: Marginal Probabilities Comprehensive Care Management Performance Trajectories Interacted with Time, July 1, 2020 – March 31, 2023 - N: 475; Observations: 2,596 122

List of Abbreviations

AARP	American Association of Retired Persons
ACO	Accountable Care Organization
ADI	Area Deprivation Index
APP	Average posterior probabilities
BIC	Bayesian information criterion
CCLF	Claim Line Feed data
CFIR	The Consolidated Framework for Implementation Research
CHCS	The Center for Health Care Strategies Care Management Framework
CI	Confidence Intervals
CIN	Clinically Integrated Networks
CMM	Comprehensive medication management
CMMI	The Center for Medicare and Medicaid Innovation
CMS	The Centers for Medicare & Medicaid Services
COPD	Chronic Obstructive Pulmonary Disease
CPC	The Comprehensive Primary Care Initiative
CPC+	The Comprehensive Primary Care Plus Program
CRISP	Chesapeake Regional Information System for our Patients
CTOs	Care Transformation Organizations
EHR	Electronic Health Record
FFS	Fee-for-service

FQHC	Federally qualified health centers
GBTM	Group-based trajectory modeling
HCC	CMS-Hierarchical Condition Category
HEART	Health Equity Advancement Resource and Transformation payments
HIT	Health information technology
HPSA	Primary Care Health Professional Shortage Areas
IRR	Incidence rate ratio
IOM	Institute of Medicine
KMO	The Kaiser-Meyer-Olkin measure
MDPCP	The Maryland Primary Care Program
MSO	Managed service organization
MUA	Medically underserved area
OCC	The odds of correct classification
OR	Odds Ratios
SDOH	Social determinants of health
SMS	Self-management and support
SNM	Social needs management
TCM	Transitional care management
PBIP	Performance-Based Incentive Payments
PCA	Principal Component Analysis

Chapter 1: Introduction

Introduction

Almost 20 percent of Medicare beneficiaries experience 30-day hospital readmissions (Jencks, Williams & Coleman,2009; Karrison et al., 2011; Graham et al., 2017) costing Medicare nearly $26 billion annually (National Opinion Research Center (NORC), 2018). Hospital readmissions among older adults are associated with negative health outcomes, such as increased risk of mortality after initial hospital discharge (Lum et al.,2012). Though primary care is uniquely positioned to provide care management services associated with reducing readmissions, many older adults fail to receive outpatient care after their initial hospital discharge (Jencks, Williams & Coleman, 2009; Rodriguez-Gutierrez et al., 2019). In a statewide primary care assessment, the Maryland Department of Health recognized that the limited use of care management services among high-risk and rising-risk patients was a serious health care issue (Maryland Primary Care Program, 2019).

Care management encompasses a wide range of services; however, these services generally include activities focused on improving health outcomes and decreasing unnecessary use of health care, such as avoidable readmissions (Peikes et al., 2021). Care management activities such as care plans (Spivack et al., 2021), transitional care management (Spivack et al., 2021; Latifi et al., 2021; Moneme et al., 2023; Toth et al., 2017; Ballard et al., 2018; Termnan et al., 2018; Tak et al., 2019; Tak et al., 2021; Brooke et al., 2014; Anderson et al., 2015) comprehensive medication management (Spivack et al., 2021), and social needs management (Spivack et al., 2021; Devoe et al., 2016; LaForge et al., 2018; Frehn et al., 2022), have all been associated a reduction in readmission rates. Primary care practice-based care management

interventions that apply multi-process approaches have demonstrated greater reductions in readmission rates when compared to primary care practice-based care management interventions that include less comprehensive care management processes (Spivack et al., 2021). Due to the complex nature of care management interventions and the diverse patient populations they target, it is difficult to separate which intervention components contribute to improved health outcomes. This complexity also makes it challenging to identify which resources or services to prioritize when care management services are being implemented in primary care practices with limited (Spivack et al., 2021).

The evidence about whether primary care-based care management interventions reduce hospital readmissions is mixed. In some instances, care management interventions were associated with a reduction in readmissions among rural patients and patients initially admitted for emergency general surgery (Burdick, 2022; Moneme, 2023); however, an intensive care management intervention targeting older adults was unsuccessful in reducing readmission (Nelson, 2012). National comprehensive primary care demonstrations such as the CPC+ and the CMS State Innovation Models Initiative did not reduce hospital readmissions (Dale et al., 2016; Singh et al., 2024; Rodríguez, 2020). Additionally, an assessment of the CMS State Innovation Models Initiative found that the demonstration did not improve practice-level care management capabilities.

The Maryland Primary Care Program (MDPCP) is a voluntary Medicare demonstration modeled after the national Medicare demonstration Comprehensive Primary Care Plus (CPC+). The MDPCP is designed to transform primary care practices to provide comprehensive primary care (Machta et al., 2021). Care management services represent one of the five core components of comprehensive primary care (Machta et al., 2021). While national, state, and site-specific care

management assessments have been conducted, there is little information about the types of care management Maryland Medicare FFS beneficiaries receive, and there is little information about whether primary care practices in Maryland have the structural and process capabilities to provide care management services.

Medically underserved areas (MUAs) are federally assigned locations with a shortage of primary care providers, high infant mortality, high poverty, or a high elderly population *(Health Resource & Services Administration, 2023)*. These locations can include entire counties or areas as small as census tracks *(Health Resource & Services Administration, 2023).* Currently, 1,023,454 (16.9%) Maryland residents live in Maryland's 42 MUAs (Primary Care Office, 2021).

Racial and ethnic minorities and rural communities are overrepresented in these areas. As a result, they are more likely to experience disparities in access to care and their quality of care (Kim, 2020). Geographic location affects health care infrastructure by limiting access to quality health providers, financial resources, and technical resources (Kind, 2014; Hu, 2018; Johnson., 2021). For example, Black communities are more likely to be medically under-resourced, and primary care practices in these communities have difficulties hiring high-quality providers and have difficulties referring patients to quality specialists (Friedberg, 2010). Individuals living in MUAs often have fewer post-discharge treatment options, which might cause people to return to the emergency department or hospital (Kim, 2020).

The goal of this dissertation was to identify structural and process components associated with the delivery of care management services to Maryland FFS Medicare beneficiaries, examine geographic variation in the delivery of care management services, and examine the association between the provision of care management services and patient health outcomes.

Theoretical Framework

This research will be guided by the Donabedian Model, the Center for Health Care Strategies (CHCS) Care Management Framework, and the Consolidated Framework for Implementation Research (CFIR). The Donabedian Model provides a framework that enables the evaluation of health care quality (Donabedian, 1988). Within this model, three care quality categories, structure, process, and outcome, explain how health care impacts health outcomes (Donabedian, 1988). The *structure* category includes characteristics about where patients receive their health care (Donabedian, 1988). For instance, structural factors can consist of staff type, electronic medical systems, and funding. These structural factors impact the processes of care that are accomplished. The *processes* category represents actions or the care provided to patients (Donabedian, 1988). Process measures enable the evaluation of whether excellent or appropriate health has been provided (Donabedian, 1988). For this analysis, the processes being measured are care management services. The patient health outcome being assessed is 30-day unplanned hospital readmissions (Donabedian, 1988). This framework will be used to guide understanding of how specific structures and processes facilitate care management delivery.

The CHCS Care Management Framework outlines core care management components and services (CHCS, 2007). The CHCS developed this framework in collaboration with states (California, Indiana, Nevada, New York, Pennsylvania, and Washington) participating in the Managed Care for People with Disabilities Purchasing Institute (CHCS, 2007). This collaboration sought to improve Medicaid's managed care programs. This collaboration developed a core definition of care management, a framework that outlines core components of care management and effective management tools and strategies (Center for Health Care Strategies, 2007). This Framework also includes a list of resources and office structures

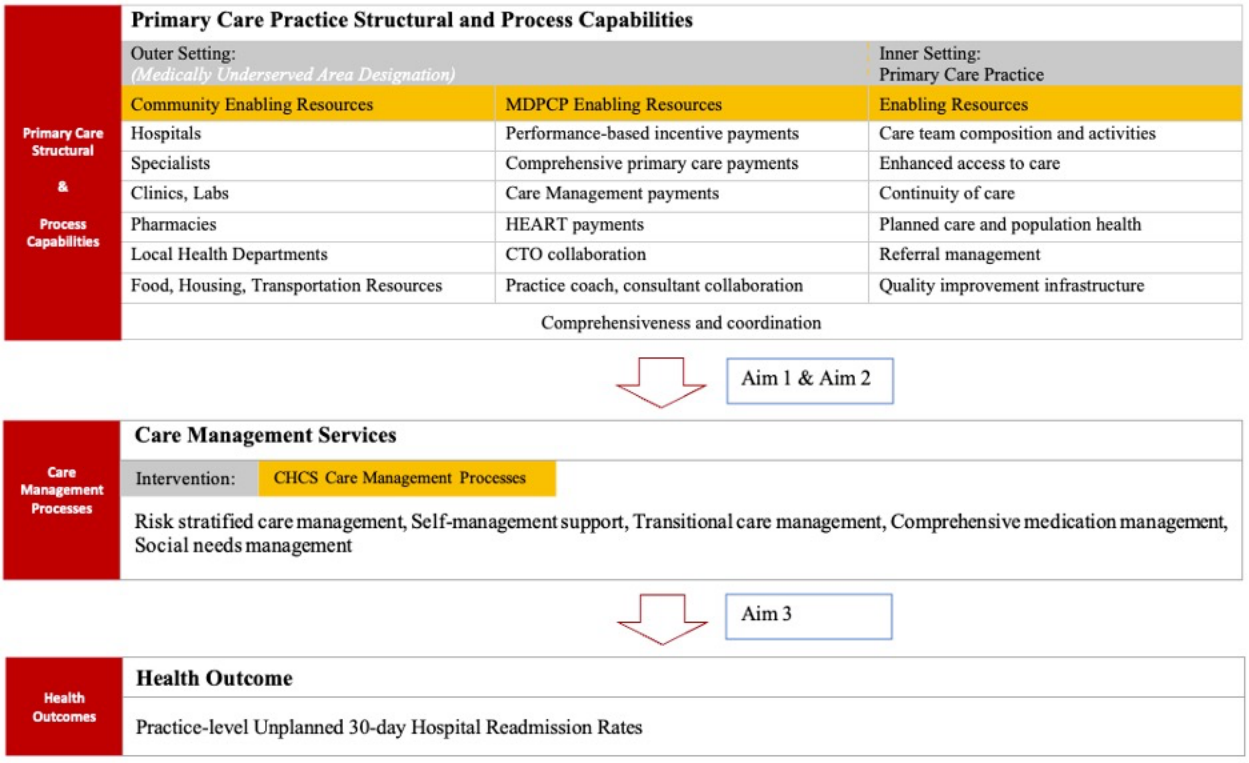
associated with facilitating care management (Center for Health Care Strategies, 2007). The framework's processes of care management were used to identify, in conjunction with the literature, care management services. The CHCS Care Management Framework contains four core components: (1) member identification, population stratification and prioritization, (2) care management intervention, (3) evaluation, and (4) payment and financing. In this model, *member identification, population stratification and prioritization* explain that clinical and non-clinical sources should be used to identify high-risk patients who will most benefit from care management. The *care management intervention* component of the model states that care management interventions should be patient-centered, multi-faceted, improve patients' quality of care, and include care coordination. Care management interventions should also be tailored to meet the unique needs of patients. The *evaluation* component assesses whether the intervention results in improved quality of care (CHCS, 2007). Lastly, the model states that payment and financing should be organized to support care management improvement efforts, quality, and patient and provider participation rewards. The framework's outlined tools and strategies were used to identify structural components associated with successfully providing care management.

The CFIR was developed in 2019 by implementation researchers affiliated with the Veterans Affairs Diabetes Quality Enhancement Research Initiative. The CFIR assesses the barriers and facilitators associated with implementing interventions. The CFIR contains five domains and 26 subdomains of implementation factors. The *intervention characteristics* domain assesses aspects of interventions that facilitate or impede the implementation of that specific intervention (Damschroder et al., 2009). The *outer setting* domain assesses outside factors that influence implementation (Damschroder et al., 2009). The third domain, inner setting, assesses factors within the intervention setting that are proven to impact implementation (Boccuti &

Casillas, 2017). Domain four assesses the characteristics of the individuals involved with the intervention implementation. Domain five assesses intervention processes (Damschroder et al., 2009). Primary care practice resources and capabilities will be mapped to this model to understand how these factors contribute to an office's ability to provide care management. This framework will be used to inform how specific structures and processes facilitate the implementation of care management.

When paired with the Donabedian Model, the CHCS Care Management Framework provides scientifically proven 'structures' and 'processes of care' associated with the ability to provide care management services, while the CFIR explains how specific primary care office resources and capabilities impact the ability to provide care management.

Figure 1.1: MDPCP – Comprehensive Care Management Framework



Legend	
	The Donabedian Model
	The Consolidated Framework for Implementation Research (CFIR)
	The Center for Health Care Strategies (CHCS) Care Management Framework

Literature Review

Readmissions:

Readmissions occur when patients discharged from hospital care are readmitted to the hospital within a specific period (Boccuti & Casillas, 2017). Readmissions are often measured by 30, 90, and 180 days. Medicare uses a 30-day readmission period to measure the quality of care provided to patients (Boccuti & Casillas, 2017). This measure defines a 30-day readmission as a hospital stay within 30 days of an initial hospital stay (Boccuti & Casillas, 2017)

30-Day Readmissions:

Among Medicare beneficiaries, 18 percent of those discharged from hospitals are readmitted to a hospital again within 30 days (Hochman & Asch, 2017). The Patient Protection and Affordable Care Act enacted incentives to reduce hospital 30-day readmission (Grabowski et al., 2012). Centers for Medicare & Medicaid Services (CMS) Hospital Readmissions Reduction Program allows CMS to reduce hospital payments with excessive readmissions. The program targets and penalizes hospitals with higher-than-expected 30-day readmission rates for specific clinical conditions (Grabowski et al., 2012; Kripalani et al., 2014; Zuckerman et al., 2016; Rocca et al., 2020).

CMS uses 30-day all-cause readmissions as a quality measure of care offered in hospital settings, transitional care, and coordination (Zuckerman et al., 2016). There is disagreement around which type of readmission and which readmission period best measures health care deficiencies. Some believe that 30-day readmissions are generally attributable to insufficient hospital care and poor discharge process, while others point to additional factors outside of hospitals' control and reason that The Hospital Readmissions Reduction Program is flawed because it assumes that 30-day all-cause readmissions solely reflect the quality of care hospitals provide (Zuckerman et al., 2016). Opponents of the measure reason that readmissions after seven days post-discharge might be more reflective of patient-level management, quality of ambulatory care, access to community resources, or the development of new complications (Kripalani et al., 2014). There is an existing debate about whether readmissions can be prevented. It is also difficult to know what portion of readmissions are preventable with estimates ranging from five percent to 79 percent (Kripalani et al., 2014; Auerbach et al., 2016). One study found that among the five most common primary diagnoses, infection, neoplasm, heart failure, gastrointestinal

disorder, and liver disorder, associated with potentially avoidable 30-day readmissions, all were exacerbated by the presence of underlying chronic conditions (Donzé et al., 2013).

Chronic conditions and health disparities:

Racial disparities in hospital readmissions are well-documented (Tsai, Orav, & Joynt, 2014; Chaiyachati, Qi, & Werner, 2018; Kaplan, Thompson, & Waters, 2019). Healthy People 2020 defined a health disparity as a health difference linked to economic, social, or environmental disadvantage (Healthy People 2020, n.d.). Health disparities disproportionately impact those who systematically experienced greater obstacles to health based on characteristics historically linked to discrimination or exclusion and include racial/ethnic minorities, amongst others (Braveman, 2014).

While there is some debate about whether racial and ethnic disparities in hospital readmissions among Medicare beneficiaries with multimorbidity exist (Yancy et al., 2008), research finds that black and Hispanic Medicare beneficiaries with multimorbidity were more likely to be readmitted to the hospital post-discharge than white Medicare beneficiaries (McHugh, Carthon, & Kang, 2010). Those who experience both 30-day and 90-day readmissions are more likely to be racial and ethnic minorities (Kim et al., 2010; Rodriguez-Gutierrez et al., 2019). Racial and ethnic disparities in hospital readmissions also exist among Medicare beneficiaries with specific chronic conditions. For instance, 23 percent of African Americans hospitalized with Chronic Obstructive Pulmonary Disease (COPD) experienced 30-day readmissions compared to 20 percent of white patients (Elixhauser, Au & Podulka, 2006; Prieto-Centurion et al., 2013).

African Americans with end-stage renal disease, as well as African Americans with chronic kidney disease, have a higher likelihood of experiencing 30-day readmissions at 38

percent than whites with end-stage renal disease (36 percent) (Saran et al., 2015). Similar readmission disparities among racial and ethnic minorities exist for Medicare beneficiaries with acute myocardial infarction, congestive heart failure, chronic kidney disease, and pneumonia (Saran et al., 2015; Joynt, Orav, & Jha, 2011a; Joynt, Orav, & Jha, 2011b). Older adults with multiple chronic conditions have a greater risk of experiencing all-cause 30-day readmissions post-hospital discharge (Joynt, Orav, & Jha, 2011a; Joynt, Orav, & Jha, 2011b; Coleman et al., 2004; Basu, Hanchate & Koroukian, 2018; Facchinetti et al., 2020).

Complex Care Management:

Care management programs generally target high-needs, high-risk, and high-use patients who usually have multiple chronic conditions; however, there are also care management interventions that target individuals based on medication use (Hong, Siegel & Ferris, 2014). While each intervention's definition of these terms may vary, they all share common goals and intervention components: the use of multi-disciplinary care teams that seek to improve patient health outcomes and minimize unnecessary health care use. These interventions all (1) identify and engage patients at risk for adverse health outcomes and unnecessary health care use; (2) conduct health assessments in order to identify issues, that once addressed via intervention, will improve health outcomes and minimize unnecessary health care use; (3) collaborate with care team, patients and caregivers to delivery necessary interventions; and (4) respond dynamically to patient's needs and changes in patients' conditions in order to provide appropriate care (Hong, Siegel & Ferris, 2014).

Complex Care Management Intervention Setting:

According to CMS, providing care management to high-risk and high-cost patients is the gold standard of comprehensive primary care. Generally, care management is described as organized interventions that seek to improve health outcomes and diminish unnecessary health care use (CMMI, 2020). Complex care management programs vary not only by target population and intervention components but also by setting. Vendor-supported complex care management programs are usually conducted by nurses who interact with patients remotely via telephone and have minimal face-to-face interaction with patients or providers (Bodenheimer & Berry-Millett, 2009). Under the commercial disease management model, nurses provide care management remotely via telephone. This can be challenging, however, because the nurses do not have face-to-face encounters with their patients (Bodenheimer & Berry-Millett, 2009). Integrated multispecialty group complex care management programs usually have a separate department responsible for care management and coordinating with patients and their providers (Bodenheimer & Berry-Millett, 2009). Hospital-based care management begins in the hospital setting and is limited to complex patients being discharged from the hospital. In these programs, care managers usually meet with patients prior to being discharged and follow up with patients via telephone post-discharge(Bodenheimer & Berry-Millett, 2009). Home-based care management programs provide all care management services in peoples' homes, and the target population is usually restricted to those who are home-bound (Bodenheimer & Berry-Millett, 2009). Lastly, primary care complex care management interventions either provide care at the primary care practices or, more often, are provided by a care manager who is embedded within patients' primary care providers' offices and works closely with primary care providers in order

to deliver care management services (Bodenheimer & Berry-Millett, 2009). The rest of this literature review will focus exclusively on primary care-based care management interventions.

Primary Care-Based Care Management and Readmissions:

The literature demonstrates that the most successful complex care management programs are embedded within providers' offices (Powers, Chaguturu & Ferris, 2015). This is largely because this intervention location enables care managers to build strong relationships with patients and enables better care coordination (Powers, Chaguturu & Ferris, 2015). While primary care physicians are uniquely positioned to provide comprehensive and long-term care management to Medicare beneficiaries at risk for hospital readmissions, in some instances, only 50 percent of older adults who experienced 30-day hospital readmissions had received outpatient care within those 30 days (Jencks, Williams & Coleman, 2009). The evidence on whether primary care-based care management interventions reduce hospital readmissions is mixed. Generally, complex care management interventions have little to no effect on hospital admissions and readmissions (Nelson, 2012). The following sections will discuss distinct care management intervention characteristics and their association with hospital admissions and readmissions.

Care Managers:

While the presence of care managers alone within complex care management interventions was not associated with decreased hospital use, interventions where care managers had intensive face-to-face interactions with patients successfully reduced hospital admissions and readmissions among participants (Nelson, 2012; McCall, Cromwell & Urato, 2010; Brown et al., 2012; Hayes & McCarthy, 2016; McCall et al., 2010; Peikes et al., 2009; Maeng et al., 2012a;

Maeng et al., 2012b; Chu & O'Brien, 2013; Klein & McCarthy, 2010; Claffey et al., 2012; Peikes et al., 2012; McCarthy, Waugh & Paige Nong, 2021; Boult et al., 2013; Hostetter et al., 2016; California Improvement Network. Inc, 2018).

In interventions where care managers had intensive face-to-face interactions with patients, care managers were often physically located in physicians' offices or near physician offices, which enabled care managers to frequently accompany patients to provider visits (Nelson, 2012; McCall, Cromwell & Urato, 2010; Brown et al., 2012; Maeng et al., 2012a; Maeng et al., 2012b; Chu & O'Brien, 2013). Interventions where care managers had extensive face-to-face interaction and intensive interaction with providers were even more successful at reducing hospital admissions and readmissions (Nelson, 2012; McCall, Cromwell & Urato, 2010; Brown et al., 2012; Peikes et al., 2009; Maeng et al., 2012a; Maeng et al., 2012b; Chu & O'Brien, 2013; Klein & McCarthy, 2010; Claffey et al., 2012; Peikes et al., 2012; McCarthy, Waugh & Paige Nong, 2021; Boult et al., 2013; Hostetter et al., 2016; California Improvement Network. Inc, 2018). While the inclusion criteria for these interventions varied, all successful interventions specifically targeted patients with multimorbidity and a high risk of hospital overuse. The most common targeted conditions included but were not limited to congestive heart failure, COPD, diabetes, and hypertension (Nelson, 2012).

Intensive care manager face-to-face interaction is not always associated with decreased hospital use. Two interventions with this characteristic were associated with increasing patient hospital admissions by 10% or more (Nelson, 2012). Both interventions had patient populations that were older than most of the interventions included in this analysis, with one intervention having almost 45 percent of its participants 85 years old or older. The two programs that

increased hospital admissions by at least 10 percent are Charlestown and Jewish Home and Hospital (both from the Coordinated Care Demonstration) (Nelson, 2012).

Many complex care management interventions did not have integrated care managers who interacted face-to-face with patients. Also, many of these interventions rarely facilitated communication and coordination between care managers and providers. The majority of interventions employed offsite care managers who primarily contacted patients by telephone (McCall et al., 2010; McCall et al., 2011; Esposito et al., 2008).

Interventions where care managers had extensive remote interaction via telephones did not successfully reduce hospital admissions and readmissions among participants (Nelson, 2012). The literature demonstrates that among both privately and publicly funded programs, complex care management interventions were more successful in reducing hospital admissions and readmissions when care managers were embedded in physician offices and had extensive face-to-face interaction with patients (Bodenheimer & Berry-Millett, 2009).

The overwhelming majority of successful interventions provided the following services: patient risk stratification, care plans, self-management support, comprehensive medication management, social needs management, and transitional care. The following sections will detail how these interventions used these services.

Risk stratification:

Risk stratification is a method used by CMS and providers to identify patients with complex medical conditions and a history or risk of being high-use or high-cost. This method is used to segment patient populations into groups with similar medical complexities and care needs, enabling providers to direct resources, such as care management, toward those who would benefit most from them (National Association of Community Health Centers, 2019). MDPCP

applies the CMS risk categories: low-risk (01-24 percentile), medium-low risk (25-49 percentile), medium-high risk (50-74 percentile), high-risk beneficiaries (75-89 percentile), and complex risk (90+ percentile). A regional pool of Medicare FFS beneficiaries is used to identify risk categories. This quarterly prospective process applies beneficiaries' demographics, diagnoses, and medical expenditures from the previous year to generate current scores (CMMI, 2018). Patient risk stratification is a known readmission reduction activity (Spivack et al., 2021). Successful complex care management interventions where care managers engaged in comprehensive interaction with patients and at times providers, risk stratification based on diagnoses, medications, and utilization data to identify, support and reduce hospital admissions and readmissions among complex patients (Nelson, 2012; Hayes & McCarthy, 2016; Peikes et al., 2009; Maeng et al., 2012a; Maeng et al., 2012b; Chu & O-Brien, 2013; Claffey et al., 2012; Peikes et al., 2012; McCarthy, Waugh & Nong, 2021; Boult et al., 2013; Hostetter et al., 2016; California Improvement Network, 2018).

Care Plans:

Care plans document mutually agreed-upon care instructions and guidance detailing patients' health care goals, their health needs, self-management activities, and beneficial health interventions. Care plans should be made accessible to the patient and the entire care team.[93] The use of care plans in complex care management has also been identified as a readmission reduction activity (Spivack et al., 2021). In successful interventions where care managers engaged in comprehensive interaction with patients and, at times providers, individual care plans that contained patient needs assessments, goals, and treatment preferences were used to provide care management (Nelson, 2012; Peikes et al., 2009; Maeng et al., 2012a; Maeng et al., 2012b; Chu

& O-Brien, 2013; Peikes et al., 2012; McCarthy, Waugh & Nong, 2021, Boult et a., 2013; California Improvement Network, 2018).

Self-management and Support:

The Institute of Medicine (IOM) defines self-management support as staff-led organized interventions that seek to improve patients' ability to manage their own health (Pearson et al., 2020). These interventions include structured goal setting, trouble shooting, and progress evaluations (Pearson et al., 2020). Ultimately, self-management and support interventions seek to change patient behavior by improving their self-efficacy and knowledge, which is expected to improve their ability to manage health conditions (Pearson et al., 2020). Interventions that successfully reduced hospital admissions or readmissions among Medicare beneficiaries used self-management and support programs and interventions to promote positive behavioral changes such as healthy eating or smoking cessation and for disease management of conditions such as congestive health failure and diabetes (Nelson, 2012; Peikes et al., 2009; Klein & McCarthy, 2010; Claffey et al., 2012; McCarthy et al., 2021, Boult et a., 2013; Hostetter et al., 2016; California Improvement Network, 2018).

Comprehensive medication management:

Medicare beneficiaries with multiple chronic illnesses see an average of 13 different physicians, have 50 different prescriptions filled per year, account for 76 percent of all hospital admissions, and are 100 times more likely to have a preventable hospitalization than those with no chronic conditions (McInnis, Strand & Pharm, 2012). During comprehensive medication management, patients' medications are assessed to ensure each is appropriate for the patient, for the medical condition the medication is prescribed for and is safe. Comprehensive medication

management is usually supported with an individualized care plan that is reviewed during scheduled follow-ups to assess mediation use and health outcomes (McInnis, Strand & Pharm, 2012). here are four general steps that take place during comprehensive medication management. During step one, patients' medication needs are assessed. Providers or care managers review existing medications and assess patients' beliefs and attitudes about their medications (McInnis, Strand & Pharm, 2012). During step two, any existing problems that might impede patients' ability to take their medications successfully are discussed. The following criteria are discussed for each medication: appropriateness, effectiveness, safety, and adherence (McInnis, Strand & Pharm, 2012). Next, care plans are developed, and therapy goals for each medication are outlined, as well as appropriate follow-up time frames (McInnis, Strand & Pharm, 2012). Last, an evaluation of comprehensive medication management takes place (McInnis, Strand & Pharm, 2012). Comprehensive medication management in complex care management has also been identified as a readmission-reduction activity (McInnis, Strand & Pharm, 2012). Interventions that successfully reduced hospital admissions or readmissions among Medicare beneficiaries used comprehensive medication management. In many instances, care managers had direct access to patients' electronic health records and, while less common, also coordinated with patients' pharmacists (Nelson, 2012; McCall, Cromwell & Urato, 2010; Brown et al., 2012; Peikes et al., 2009; Maeng et al., 2012a; Maeng et al., 2012b; Chu & O'Brien, 2013; Klein & McCarthy, 2010; Claffey et al., 2012; Peikes et al., 2012; McCarthy, Waugh & Nong, 2021; California Improvement Network, 2017; Liu et al., 2019).

Social needs management:

It is well known that over 40 percent of health outcomes can be attributed to social determinants of health, behavioral factors, and economic factors, which are not usually addressed

within traditional healthcare systems (Kim et al., 2021). Research demonstrates that addressing factors such as access to housing, transportation and food can significantly improve older adult health outcomes and prevent avoidable hospital admissions (Kim et al., 2021). An American Association of Retired Persons (AARP) Foundation survey found that 34% of older adults lived in low-income households and that nearly 22% of respondents reported having difficulties affording their monthly expenses(Kim et al., 2021). Another analysis found that social needs, such as lack of transportation or financial challenges, were increased among older adults with multiple chronic conditions (Valaitis et al., 2020). Partnerships between health care providers, social services, and community resources have resulted in successfully decreasing readmissions among older adults (Kim et al., 2021; Szanton et al., 2011; Bradley et al., 2016; Brewster et al., 2016; Mays, Mamaril & Timsina, 2016). Social needs management has also been identified as a readmission reduction activity (Spivack et al., 2021; Devoe et al., 2016; LaForge et al., 2018; Frehan et al., 2022). A large portion of successful complex care interventions went beyond simply addressing Medicare beneficiary health needs but also coordinated social needs management by connecting patients to community programs and resources and by addressing transportation, social support, and financial challenges (Hayes & McCarthy, 2016; Peikes et al., 2009; Maeng et al., 2012a; Maeng et al., 2012b; Chu & O'Brien, 2013; Peikes et al., 2012; McCarthy, Waugh, Nong, 2021; Boult et al., 2012; Hostetter et al., 2016).

Transitional care management – Intervention:

Transitional care management has been associated with a lowered risk of hospital readmissions. CMS defines transitional care management as the coordination of a Medicare patient's transition to a community setting after discharge from an acute care setting such as a hospital or an emergency department visit (Toth et al., 2017; Ballard et al., 2018; Terman et al.,

2018; Tak et al., 2019; Latifi et al., 2020; Spivack et al., 2021; Tak et al., 2021; Brooke et al., 2014; Anderson et al., 2015). Transitional care management is a specific type of episodic care management where practitioners manage and coordinate patients' health care and daily living needs following hospital or skilled nursing facility discharge. Transitional care management has three distinct components: interactive contact, face-to-face visits, and non-face-to-face services. For the interactive contact component, primary care providers are required to contact the patient within seven days of their health care encounter or discharge. Next, for the interactive contact component, providers are required to meet with patients in person. During this face-to-face visit, the following services take place:

1. Review the discharge information: Providers must obtain and review patient discharge information, including instructions on necessary follow-up, test results and treatment plans.
2. Medication reconciliation: Providers also Conduct medication reconciliation or medication management,
3. Patient Education: Providers are responsible for educating patients and caregivers on current or updated health status and health management needs.
4. Screening for community resources: Providers must also screen for and make referrals to community resources.
5. Referrals: Lastly, providers are required to facilitate referrals for necessary medical services.

Within the MDPCP, transitional care management is required for beneficiaries discharged from the hospital, emergency department, or skilled nursing facility.

These interventions successfully decreased readmissions within various timeframes; however, the most common readmission timeframe was 30-day readmissions (Toth et al., 2017; Ballard et al., 2018; Tak et al., 2019; Latifi et al., 2020; Spivack et al., 2021; Takahashiet al., 2016; Nall et al., 2020). Some primary care interventions did not reduce hospital readmissions among general Medicare beneficiaries during these six years. These interventions used methods such as primary care follow-up, comprehensive primary care initiatives, and interdisciplinary care teams and were unable to statistically significantly reduce 30-day readmissions (Nall et al., 2020; Noel et al., 2020; Bailey et al., 2019; Peikes et al., 2018; Gaskin et al., 2018). Two primary care interventions resulted in an increase in 30-day hospital remissions among Medicare beneficiaries within the experimental arm of the studies and call into question whether all readmissions are unnecessary (Huckfeldt et al., 2019; Lalani et al., 2019).

Transitional care management – readmissions:

Current evidence on the impact of outpatient visits post-hospital discharge on hospital readmissions among Medicare beneficiaries is mixed. In many instances, primary care follow-up visits post-hospital discharge have been associated with decreased readmissions (Latifi et al., 2020; Anderson et al., 2015). Primary care interventions where patients received outpatient visits within seven days, 14 days, and 30 days post-hospital discharge were associated with a decrease in 30-day and 60-day readmissions (Tak et al., 2021; Toth et al., 2017; Latifi et al., 2020; Terman et al., 2018; Tak et al., 2019).

In some instances, outpatient visits post-hospital discharge have not been associated with decreased hospital readmissions among Medicare beneficiaries (Nall et al., 2020). Outpatient follow-up visits in urban settings had little impact on hospital readmissions (Sinha, Seirup & Carmel, 2017). Care management interventions have successfully reduced readmissions in urban

and rural settings (Toth et al., 2017). Among Medicare beneficiaries initially admitted to the hospital due to ischemic strokes also did not benefit from outpatient follow-up visits (Leppert et al., 2020). When evaluating the impact of patient follow-up conducted via telehealth the evidence shows that telehealth did not decrease readmissions among Medicare beneficiaries (Leppert et al., 2020; Noel et al., 2020). Unfortunately, many studies evaluating outpatient visit follow up use secondary-level data such as claims data and are unable to capture specific details about the care being received.

Primary care based multicomponent care management:

As previously discussed, in some instances, primary care use is associated with a decrease in hospital readmissions among Medicare beneficiaries. This section will take a closer look at the various methods used to successfully reduce hospital readmissions. Research demonstrates that the more readmission reduction activities practices engage in the more likely they are to successfully reduce readmissions. The literature identified core activities that if conducted in conjunction with each other, increase the likelihood of successfully reducing readmissions;[10,] however, when these activities are conducted independently, they do not have any effect on hospital readmissions on Medicare beneficiaries (Patel et al., 2021; Spivack et al., 2021; Ballard et al., 2018; Russo et al., 2017). These activities include but are not limited to:

- Routinely screening for social needs such as food insecurity, housing and/or transportation needs,
- Stratifying patients into different subgroups for targeted interventions, identifying complex patients and providing them with care managers or care coordinators, and/or conducting medication adherence,
- Notifying physicians when complex patients are admitted to the hospital,

- Conducting the following for complex patients when they are discharged from the hospital: referrals to community health-related social services, follow-up with patients within 72 hours of discharge, conduct home visits, provide primary care clinicians discharge summaries and have procedures in place to reconcile medications,
- Collecting patient-reported measures, conducting shared decision making, and/or providing culturally tailored interventions, and
- Conducting practice level quality improvement efforts.

As a result of reducing access to care barriers, multicomponent primary care interventions that conduct home visits have generally been successful in reducing readmissions among older adults with multimorbidity and or functional limitations;[120] however, this same effect was not seen among Medicare beneficiaries initially admitted to the hospital for heart failure (Warren, Lemieux & Phoenix Bittner, 2019; Schamess et al., 2017; Murtaugh et al., 2017; Takahashi et al., 2016 .

Even when primary care interventions apply the previously mentioned intervention components, there is still a possibility that the intervention will fail to successfully decrease readmissions. While some interventions assessed the impact of 12 or more primary care intervention components associated decreasing interventions national interventions only required the implementation of five components. The Comprehensive Primary Care Initiative (CPC) was initiated by CMS in 2012 (Peikes et al., 2018). The program sought to evaluate alternative approaches to delivering primary care (Peikes et al., 2018). As of 2018, this program was unsuccessful in decreasing readmissions among Medicare beneficiaries (Peikes et al., 2018). Multicomponent primary care interventions conducted in communities with high ADI scores

unsuccessfully reduced readmissions (Gaskin et al., 2018). As previously discussed, the built environment has unique avenues that impact patient outcomes independent of individual-level SDOH. Primary care interventions seeking to decrease readmissions within community with high levels of resource deprivation might need to increase the intensity or number of primary care intervention components associated decreasing interventions. Conducting multicomponent primary care readmissions interventions among adults 75 years of age and older have also been unsuccessful in reducing readmissions and in some instances, has increased readmissions among those receiving the intervention (Huckfeldt et al., 2019).

Social determinants of health:

Evidence suggests that that nearly 80 percent of patient health outcomes can be attributed to social, behavioral, and economic factors and the other 20 percent can be attributed to health care (Murray et al., 2021). Social determinants of health (SDOH) are the conditions in which people are born into, grow up in, live, work and age, and the systems which shape these circumstances, including economics, social policies, and politics (WHO, 2010). SDOH are associated with higher rates of hospital readmissions(Murray et al., 2021). Low health literacy and the inability to maintain self-care needs are also associated with increased hospital readmissions (Murray et al., 2021; Joynt Maddox et al., 2019). In some studies, having low income was associated with increased readmissions, while in others there was no significant relationship between earning low income and readmissions (Murray et al., 2021; Joynt Maddox et al., 2019; Arbaje et al., 2008).

While there is evidence that patient-level socioeconomic status impact hospital readmission rates, there is research that also demonstrates the opposite. An evaluation of hospitals that treat large percentages of patients with low socioeconomic status, found that

controlling for patient-level socioeconomic status did not significantly impact readmission rates at these hospitals and found little difference in readmission rates between hospitals serving populations with lower socioeconomic status compared to hospitals serving populations with higher socioeconomic status (Bernheim et al., 2016). These differences were attributed to patients with lower socioeconomic status being more likely to have greater clinical severity (Bernheim et al., 2016). Even when these conditions are not associated with the primary reason for admissions, research demonstrates that the presence of multimorbidity leads to post-discharge complications (Kwok et al., 2019). Low levels of education, housing instability and homelessness are also associated with higher rates of readmissions (Joynt Maddox et al., 2019; Arbaje et al., 2008). Research demonstrates that increased social risk is associated with increased hospital readmissions due to increased difficulties with post-discharge care (Murray et al., 2021; Joynt Maddox et al., 2019). These difficulties include, but are not limited to, accessing primary care, affordability of prescriptions, accessing transportation for follow-up care, adhering to care regimens, which is exacerbated by increase social risk (Murray et al., 2021; Joynt Maddox et al., 2019).

The built environment greatly impacts hospital readmissions. One study found that 58 percent of variation in hospital readmissions was explained by the specific county hospitals were located in (Herrin et al., 2015). More specifically, county-level demographics such as increased concentration of Medicare beneficiaries, low county-level rates of education and low employment rates were all associated with increased readmission rates(Herrin et al., 2015). These findings are consistent with the literature which also demonstrates the association of increased unemployment rates and county-level income with increased hospital readmissions (Joynt Maddox et al., 2019; Joynt, Orav & Jha, 2011a; Joynt, Orav & Jha, 2011b). It is well

documented that health care affordability is a barrier to those who are unemployed or have limited incomes. There is also proof of an association between low neighborhood-level access to public transportation, grocery stores and pharmacies and increased hospital readmissions and that individuals living in high-poverty neighborhoods had higher rates of readmissions than those living in lower-poverty neighborhoods (Hu, Gonsahn & Nerenz, 2014).

Factors such as increased access to general practitioners and more nursing homes per capita are associated with lower hospital readmissions, while increased access to specialists and hospital beds per capita are associated with increased hospital readmissions (Kim, 2020). Patients living in communities with a limited number of general practitioners have access fewer post-discharge treatment options and might return to the emergency department or hospital in the event of a post-discharge event, rather than general practitioners (Kim, 2020). A non-linear relationship was identified while assessing the how the ratio of general practitioners to specialists impacts hospital readmissions. The middle quintile ratio was associated with decreased readmission rates comparable to the lowest quintile (Kim, 2020).

Many MUAs are located in rural areas for instance, nearly 66 percent of all Primary Care Health Professional Shortage Areas (HPSAs) are present within rural locations and only 12 percent of all health care providers within the United States practices in rural areas (Rural Health Information Hub, 2024; Seshamani et al., 2023). Often individuals living in rural locations with limited access to primary care services substitute these services with specialists or emergency use (Bolin et al., 2015). For instance, 34 percent of adults in urban areas used the emergency department while nearly 44 percent of adults in rural settings used emergency department services and many believe the increased use of emergency department services among rural adults is an indicator or limited access to primary care services (Bolin et al., 2015). Even

instances where rural adults are accessing primary care services their health outcomes are worse than adults in non-rural settings. When compared to urban practices, rural practices providing care to Medicare beneficiaries had similar care delivery, capabitilities, their patients still had higher hospital readmissions rates (Fraze et al., 2022).

Overview

Chapter 2, Primary Care Practice Capabilities, examines the association between primary care capabilities and the delivery of care management services and whether this association is altered by primary care practice medically underserved area (MUA) designation.

Chapter 3, HEART Payments and Comprehensive Care Management, examines the association between HEART payments and care management services and whether this association is altered by primary care practice care management delivery option. Additionally, this aim seeks to assess the association between HEART payments and care management services among practices within and outside of medically underserved areas (MUA).

Chapter 4, Comprehensive Care Management and Primary Care Practice-Level Readmission Rates, identifies unique trajectories of comprehensive care management performance among MDPCP primary care practices and to examine the association between comprehensive care management performance trajectories and practice-level unplanned readmission rates.

Chapter 5, Conclusion and Future Direction, provides an overview of the results found in chapters 2, 3, and 4 and explores policy implications and suggestions for future research.

Chapter 2: Primary Care Practice Capabilities

Background

The Maryland Primary Care Program (MDPCP) is a voluntary Medicare demonstration, modeled after the Comprehensive Primary Care Plus (CPC+) program. The MDPCP is designed to facilitate the delivery of comprehensive primary care which includes care management (Machta et al., 2021). Care management is a patient-centered approach, used in various health care settings, that seeks to help patients better manage their health (Center for Health Care Strategies Inc, 2007). Previous scholarship identifies primary care office-led care management as an avenue to reduce readmissions; however, there is a gap in understanding how primary care office structural and process capabilities impact the capacity to provide care management, specifically within Maryland.

Care management is generally described as activities that seek to improve patient 'quality of life and health outcomes and to reduce high utilization' (Peikes, Swankoski, O'Malley, and Timmins, 2021). Practices employing a multi-process care management approach have demonstrated greater readmission reductions than those using a single care management process (Spivack, DeWalt, Oberlander et al., 2021). Findings such as these make it difficult to understand how these care management processes interact and make it difficult for primary care offices with limited resources to prioritize the implementation of specific management services (Spivack, DeWalt, Oberlander et al., 2021). Little information exists about whether Maryland Medicare beneficiaries receive care management services or the types of care management they receive. Furthermore, little is known about whether Maryland primary care offices have the structural and process capabilities to provide these services or what capabilities Maryland primary care offices use to provide care management to Medicare beneficiaries.

While several studies document the association between community-level resources and hospital quality, little is understood about how community-level resources impact primary care quality. Geographic location and the built environment greatly impact health care infrastructure and access to human capital, financial resources, and technical resources (White et al., 2021; Jung et al., 2018; Landon et al., 2021). It is important to understand how health care disparities are mediated or moderated through place of care. For instance, primary care offices with higher shares of vulnerable patients are more likely to receive lower performance-based payments (Friedberg et al., 2010). Another study highlights that primary care offices in primarily black communities might struggle to attract high-quality providers and found that black patients generally saw providers who were less likely to be board-certified. These providers were more likely to have difficulty referring patients to quality specialists (Bach et al., 2004). While it is generally accepted that limited access to resources, such as high-quality providers and funding, contribute to safety-net hospitals providing lower quality of care (Kaplan et al., 2019; Hasnain-Wynia et al., 2007) further research is needed to assess how the built environment moderates primary office infrastructure and the ability to provide quality care such as care management. Lastly, research is needed to evaluate geographic variation in care management provided to Medicare beneficiaries.

This analysis examines the association between primary care capabilities and the delivery of care management services and whether this association is altered by primary care practice MUA designation. We hypothesize that controlling for practice-level characteristics, certain primary care practice process and structural capabilities will be associated with the provision of care management, that practices with increased structural and process capabilities will provide more comprehensive care management services, and that practices with an MUA designation

will have less structural and process capabilities and as a result will provide less comprehensive care management services.

Methods

Data

Several secondary data sources are utilized in this analysis: Maryland Primary Care Program data, Chesapeake Regional Information System for our Patients (CRISP) data, and hMetrix data. All data are aggregated at the primary care practice level. Data from 2021 is used for this analysis. MDPCP data provides rosters of participating practices and rosters of participating Care Transformation Organizations (CTOs). MDPCP Care Transformation Reports provide practice-level care delivery transformation data and practice structural and process capabilities. These reports provide practice-level data on care delivery changes made in order to address the five Comprehensive Primary Care Functions: (1) Access and Continuity, (2) Care Management, (3) Comprehensiveness and Coordination, (4) Patient and Caregiver Engagement, and (5) Planned Care and Population Health. The reports also include practice-level care management implementation, the type of care management provided, and the types of care management processes used. MDPCP data provide practice ownership in formation, federally qualified health centers (FQHC) status, size, and practice MDPCP participation track status. MDPCP data also provide practice-level provider and staff demographic information. CRISP data provide beneficiary demographics and data. CPRISP uses Medicare Fee-For-Service claims and Claim Line Feed (CCLF) data to provide MDPCP primacy care offices health information technology tools that capture attributed Medicare beneficiary patient summaries and reports. CRISP data provide beneficiary demographic information such as age, race and ethnicity, hierarchical condition category (HCC) risk tier, chronic conditions, preferred language, Medicare

eligibility, and enrollment characteristics. CRISP data also provide beneficiary-level claim payments, and service use such as hospital admissions and readmissions. HMetrix data provide practice-level per beneficiary per month MDPCP Care Management payment, Comprehensive Primary payment, and Performance Based Incentive payment information.

Study Sample

MDPCP eligible primary care practices must have a minimum of 150 attributed Medicare beneficiaries and must fall under the following provider categories: General Practice, Family Medicine, Internal Medicine, Obstetrics and Gynecology, Pediatric Medicine, Geriatric Medicine, and co-located Psychiatry. This analysis only includes MDPCP Medicare fee-for-service (FFS) attributed beneficiaries. Attribution is a process that assigns beneficiaries to specific providers who are then held accountable for the assigned beneficiaries' care and health outcomes (Fiesinger, 2016). This analysis includes primary care practices participating in the MDPCP in 2021 and those who participated in the MDPCP 12 months prior and 12 months after the implementation of the HEART payments on January 1, 2022. The final sample in this analysis is 490 of the total 608 primary care practices that participated in the MDPCP between January 1, 2019 to March 31, 2023

Dependent Variables

The dependent variable is a composite measure assessing the comprehensiveness of primary care practice-level care management. The measure captures five care management categories and is standardized to range between 0-5. Each care management category was also standardized to range from 0-1:

(1) Risk-stratified care management: (0 – 1 Points)
- Risk stratification – Methods

    - (1) Intuition only; (2) Data-driven algorithm only; (3) Two-step
- Risk stratification – Factor complexity
    - (1) Claims variables; (2) Clinical variables from the EHR; (3) Computed risk scores; (4) Pre-AH Tool (Likelihood for Avoidable Hospital Events report); (5) Other methods
- Risk stratification – The percent of beneficiaries risk stratified out of the total empaneled patient population
    - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Lead Care Manager
    - (1) Yes; (0) No
- Longitudinal Care Management – The percent of beneficiaries under care management out of total empaneled
    - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Care Plan – The percent of beneficiaries under longitudinal care management with care plans
    - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Care Plan – Document & storage
    - (0) No; (1) Care plans are stored but not health IT integrated; (2) Care plans are EHR or HIT integrated)

(2) Self-management and support (SMS): (0 – 1 Points)

- Populations that receive SMS
    - (1) All beneficiaries with targeted conditions; (2) Risk status; (3) Poorly controlled disease; (4) Data from a formal self-management assessment tool; (5) Beneficiary interest; (6) Clinician referral/identification; (7) Other
- Self-management support activities
    - (1) No activities; (2) encourage beneficiaries to choose goals that are meaningful to them; include family/caregivers in goal setting and care plan development; (3) Connect or provide beneficiaries and caregivers with formal self-management support services at our practice or in the community; (4) measure beneficiaries' skills and progress; (5) Staff are trained in self-management support techniques

(3) Transitional care management (TCM): (0 – 1 Points)

- The percent of patient follow-up within one week post emergency department discharge
    - (0) None (0%); (1) Some (Up to 50%); (2 Most (51-95%); (3) All (96-100%)
- The percent of patient follow-up within 72 hours post-hospital discharge
    - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Admission/discharge/transfer information EHR/HIT system integration
    - (1) Yes; (2) No

(4) Comprehensive medication management (CMM): (0 – 1 Points)

- Delivery of CMM
    - (1) Yes; (0) No
- Populations that receive CMM

    - (1) Active medication issues (e.g., adverse reactions, adherence, not reaching intended treatment outcomes); (2) Potential therapy issues (e.g., high-risk medications, polypharmacy, multi-therapy drug interactions, high-cost medications); (3) Referred by practitioner or care team

(5) Social needs management (SNM): (0 – 1 Points)

- Populations that receive SNM
    - (0) Do not screen beneficiaries; (1) Targeted subpopulation; (2) All beneficiaries
- Types of social needs screened for
    - (1) Food insecurity; (2) Housing instability; (3) Utility needs; (4) Financial resource strain; (5) Transportation; (6) Social isolation; (7) Safety or interpersonal violence; (8) Other
- Inventory of social service resources
    - (1) Yes; (0) No
- Established relationship with social resources
    - (1) Food insecurity; (2) Housing instability; (3) Utility needs; (4) Financial resource strain; (5) Transportation; (6) Employment; (7) Social isolation; (8) Safety or interpersonal violence

Independent Variable

In this analysis, the primary independent variables represent primary care practices' structural and process care management capabilities. The literature identified each capability as a facilitator of care management delivery (Ryvicker, 2018; Lee et al., 2019; Jang et al., 2021). Participating MDPCP practices are required to report care delivery transformation efforts and practice structural and process characteristics biannually. Primary care office structural care management capabilities are captured via seventeen variables in the following categories (1) programmatic payments, (2) care team activities, (3) enhanced access to care, (4) continuity of care, (5) planned care and population health, (6) referral management, and (7) quality improvement infrastructure. The seventeen variables are as follows:

1. Comprehensive Primary Care (Average Per Beneficiary Per Month) Payments,
2. Care Management (Average Per Beneficiary Per Month) fees,
3. Performance-Based Incentive Payments (PBIP),

4. Multidisciplinary care team composition,
5. Multidisciplinary care team activities,
6. Twenty-four-hour access to patient electronic records,
7. Twenty-four-hour coverage,
8. Enhanced appointment and communication capabilities,
9. Alternative approaches to care,
10. Patients are seen by the provider or care team they are empaneled to,
11. Offices use data to plan the care they provide,
12. How often offices use data to plan the care they provide,
13. Referral management arrangements with specialists,
14. Use of cost measures to engage in continuous quality improvement efforts,
15. Use of patient experience measures to engage in continuous quality improvement efforts,
16. Use of measures to engage in continuous quality improvement efforts,
17. Engagement in culture of improvement efforts.

Covariates in this analysis fall into two categories: practice-level beneficiary characteristics and practice organization-level characteristics. *Covariates: Practice-level beneficiary characteristics* covariates include beneficiary information: age (the percentage of patients that are 64, 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). *Practice organization-level characteristics* covariates include: total number of providers, percent of providers that are general practitioners and family, MDPCP participation track (I,II,III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick,

Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, and Worcester), and MUA status (yes; no).

Statistical Analysis

We employ Principal Component Analysis (PCA) to reduce the number of primary practice capabilities variables being used in the analysis by categorizing the 17 capabilities variables into latent themes. PCA is a linear dimensionality reduction and factor identification statistical procedure that reduces the dimensionality of datasets with large numbers of variables that are correlated by creating principal components which as linear combinations of the variables of interest that retain the majority of the variation found in the original variables (UCLA: Statistical Consulting Group, n.d.; Penn State, n.d.; Kripalani et al., 2014). The overall goal of PCA is to summarize the information within large datasets by creating a smaller set of summary indices or principal component variables (Sartorius, 2020). For PCA, a sample size of 100 is considered 'poor,' a sample size of 200 is considered 'fair,' a sample size of 300 is considered 'good,' a sample size of 500 is considered 'very good,' and a sample size of 1000 or more is considered 'excellent' (Tabachnick and Fidell, 2001). This analysis utilizes 490 primary care practices, which is considered appropriate based on these standards. We employ the following steps:

Step 1: Variable Standardization. The range of the initial variables must be standardized so that variables with larger ranges do not bias the results by representing greater variance than variables with smaller ranges. For this analysis each variable will be divided by its total so that the range of each variable will be transformed to span from zero to one (Sartorius, 2020).

Step 2: Correlation Analysis. PCA requires the presence of correlation among the initial variables (Mertler and Reinhart, 2017). This step identifies existing relationships between the variables such as whether an increase or decrease in variable A results in an increase or decrease in variable B. A covariance matrix of all the standardized variables will be calculated to assess the presence of pairwise correlation among variables of interest. Covariance ranges from zero which represents no relationship between two variables, to one or negative one, which represents strong correlation (Patil, 2020). The presence of variables with a score of .30 indicate that high enough pairwise correlation exists and that PCA can be conducted (Penn State, n.d; Sartorius, 2020; Jaadi, 2024).

Step 3a: Principal Component Identification. During this step we calculate the eigenvalues and eigenvectors of the covariance matrix are calculation to identify the principal components. Step 3a1. Generate matrix): First a matrix is constructed with dimensions equal to the number of variables in the model and each observation is placed within the dimensional space. For this analysis there are 17 variables so there will be 17 dimensions and the scaling criterion will be based on unit variance (Penn State, n.d; Sartorius, 2020; Jaadi, 2024).

Step 3a2. Mean centering: Next the average of each variable is generated and a vector of all the variables averages is generated. This vector or point in space is transformed into the center of variation among the data and now becomes the origin point (Penn State, n.d; Sartorius, 2020; Jaadi, 2024).

Step 3a3. Linear transformation: The data undergoes an orthogonal linear transformation which transforms the original data to lay on a new coordinate system (Yang, Teng & Chen, 2020). The eigenvectors represent the direction of the linear transformation and eigenvalues are

the coefficients of the linear transformation and represent the variance captured in each principal component (Khan Academy, n.d.). The number of eigenvectors and eigenvalues generated is always equal to the number of variables or dimensions included in the model. For example, this analysis includes 17 variables and each variable represents a dimension. Since there are 17 dimensions, the analysis will generate 17 pairs of eigenvectors and eigenvalues (Penn State, n.d; Sartorius, 2020; Jaadi, 2024).

Step 3b: When multiplied, eigenvectors and eigenvalues represent principal components. This also means that if there are 17 dimensions that 17 principal components will be generated. Principal components represent the new 'index' variable comprised of the linear combinations of the initial variables. The first principal component captures the most variance present in the data and the second principal component is orthogonal in relation to the first component and captures the remaining maximum variance among the data. This process continues so that the first principal component contains the most variance and the 17th principal component contains the least variance (Penn State, n.d; Sartorius, 2020; Jaadi, 2024).

Step 4: Create feature vector. During this step dimension reduction takes place when you decide which principal components to keep in the analysis. A feature vector is a matrix that contains the eigenvectors of the principal components that remain in the analysis. Organizing eigenvectors by their eigenvalues in descending order, organizes principal components by level of variance captured. (Sartorius, 2020; Jaadi, 2024). This is the initial dimensionality reduction process because the number of principal components that are retained represent the number of dimensions that remain as well Jaadi, 2024). Principal components will be kept in the analysis if their eigenvalues are above one, which is based on Kaiser's rule. According to this rule retaining

a factor that represents less variance that an initial variable is not a reasonable practice when developing instruments or assessment tool (Kaufman and Dunlap, 2000). Additionally, PCA scree plot of eigenvalues, confirmatory factor analysis, iterated principal component analysis, maximum likelihood principal component analysis, and parallel analysis will also be assessed to confirm the appropriate number of principal components to keep (Penn State, n.d; Sartorius, 2020; Jaadi, 2024).

Step 5: Transform the original matrix. It is expected that correlation will be present among the principal components so Promax, which is an oblique rotation method, will be applied to estimate rotated factor loadings (Brown, 2009; Rodriguez et al., 2016). This method will reorient the original standardized variables onto the retained principal components or dimensions. In order to complete the final data transformation, the original data is multiplied by the eigenvectors of the principal components that are retained in the analysis (Sartorius, 2020; Jaadi, 2024; DataCamp, 2023).

Regression analysis. Poisson regression models were employed to assess whether there are differences in the comprehensiveness of care management services primary care practices provide. Model 1 includes the outcome variable comprehensive primary care and the principal components of the primary care process and structural capabilities variables. Model 2 includes all the variables present in Model 1 as well as primary care practice patient-level characteristics: age, race, HCC risk scores, and dual eligibility status. Model 3 includes all the variables present in Model 2 as well as practice-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track, CTO collaboration, county, and MUA status. Lastly, Model 4 includes of the variables in Model 3 as well as interaction terms between each primary care practice process and structural capability principal

component analysis and MUA designation in order to assess whether primary care practice MUA designation impacts the association between the provision of comprehensive care management and primary care capabilities.

Model 1: Crude

$$log\big(E(y)\big) = log(\lambda) = \beta_0 + \beta_1 X_{1\ \text{(care management capabilities)t}}$$

Model 2: Patient level characteristics

$$\begin{aligned} log\big(E(y)\big) &= log(\lambda) \\ &= \beta_0 + \beta_1 X_{1\ \text{(care management capabilities)}} \\ &+ \beta_2 X_{2\text{(primary care practice}-\text{level patient characteristics)}} \end{aligned}$$

Model 3: Patient and practice level characteristics

$$\begin{aligned} log\big(E(y)\big) &= log(\lambda) \\ &= \beta_0 + \beta_1 X_{1\ \text{(care management capabilities)}} \\ &+ \beta_2 X_{2\text{(primary care practice}-\text{level patient characteristics)}} \\ &+ \beta_3 X_{3\text{(primary care practice characteristics)}} \end{aligned}$$

Model 4: Patient and practice level characteristics with interaction terms between primary care practice care management capabilities and MUA status.

$$\begin{aligned} log\big(E(y)\big) &= log(\lambda) \\ &= \beta_0 + \beta_1 X_{1\ \text{(care management capabilities)}} \\ &+ \beta_2 X_{2\text{(primary care practice}-\text{level patient characteristics)}} \\ &+ \beta_3 X_{3\text{(primary care practice characteristics)}} \\ &+ \beta_4 X_{4\text{(care management capabilities} * \text{primary care practice MUA status)}} \end{aligned}$$

Where the model terms represent the following: *log(E(y))* = comprehensive primary care practice care management services score. The Bonferroni correction, a multiple-comparison correction, will be used to account for multiple simultaneous tests. The correction which will lower alpha values in order to account for the number of performed comparisons and to avoid spurious positives (Weisstein, n.d.). Collinearity will be assessed and any variables with a score of five or more will not be included in the models. For all analyses, statistical significance will be set as $p < .05$ (2-sided) and will be performed using Stata version MP 17.0.

Results

Table 2.1. Assesses whether there were significant differences between MUA and non-MUA in primary care practice patient-level demographics, primary care practice-level MDPCP funding, and primary care practice-level geographic characteristics. During 2021, 27 percent (n=134) of MDPCP primary care practices operated in MUAs. MUA MDPCP primary care practices had a greater percentage of patients under 65 (13.7% vs. 9.3%, p<0.001), Dual-eligible patients (25.1% vs. 16.3%, p<0.001), black patients (30.1% vs. 23.5%, p<0.001), and MUA MDPCP primary care practices were more likely to practice in rural areas (54.5% vs. 25.4%, p<0.001), compared to non-MUA MDPCP primary care practices. Non-MUA MDPCP primary care practices, on average, had a greater number of attributed Medicare beneficiaries (766.4% vs. 725.8%, p<0.001), white patients (66.4% vs. 63.4%, p<0.001) and a higher percentage engaged in CTO partnerships (79.8% vs. 73.3%, p<0.001).

Table 2.1: Characteristics of MDPCP Primary Care Practices by MUA Designation, 2021

	Total Sample N=490	MUA n=134 27.3%	Non-MUA n=356 72.7%	*p-value*
Number of patients per practice, Avg	755.3	725.8	766.4	0.055
Patient age, %				
64	10.5	13.7	9.3	0.000
65-69	18.3	18.2	18.4	0.067
70-74	25.5	24.4	26.0	0.000
75-79	19.8	19.0	20.1	0.000
80-84	13.1	12.6	13.2	0.000
85 +	12.8	12.1	13.1	0.000
Patient race & ethnicity, %				
Black	25.3	30.3	23.5	0.000
Hispanic	1.5	1.7	1.5	0.000
White	65.6	63.4	66.4	0.000
Non-English patients, %	6.8	6.8	6.0	0.867
HCC, Avg	1.1	1.2	1.1	0.000
Dual-eligible patients, %	18.7	25.1	16.3	0.000
Comprehensive Primary Care Payment, Avg	$7,179	$4,797	$8,076	0.000
Care Management Fees, Avg	$65,536	$65,094	$65,702	0.761
Performance-Based Incentive Payments, Avg	$12,573	$9,515	$13,724	0.000
Percentage family and general providers, %	24.3	20.73	25.67	0.115

FQHC Status, %				
Yes	1.4	4.5	0.3	0.000
No	98.6	95.5	99.7	
CTO Partnership, %	78.0	73.3	79.8	0.000
Rural Status, %	33.4	54.5	25.4	0.000
Region, %				
Capital	30.4	11.9	37.3	0.000
Central	51.5	52.2	51.4	
Eastern	8.1	20.1	3.6	
Southern	5.7	6.7	5.3	
Western	4.8	8.9	2.2	

Table 2.2. Describes differences between MUA and non-MUA in care management services. MUA MDPCP primary care practices had a greater comprehensive care management composite score; however, this difference was not statistically significant (3.60 vs. 3.43, $p<0.001$). Non-MUA practices had higher risk-stratified care management scores (0.74 vs. 0.72, $p<0.001$). MUA practices had higher self-management support (0.67 vs. 0.66, $p<0.037$), comprehensive medication management (0.73 vs. 0.67, $p<0.016$), and social needs management (0.77 vs. 0.64, $p<0.012$) scores.

Table 2.2: Care Management Characteristics of MDPCP Primary Care Practices by MUA Designation, 2021

	Total Sample N=490	MUA n=134 (27.3%)	Non-MUA n=356 (72.7%)	*p-value*
Overall care management, Avg	3.48	3.60	3.43	0.603
(1) Risk-stratified care management, Avg	0.73	0.72	0.74	0.000
(2) Self-management and support, Avg	0.66	0.67	0.66	0.037
(3) Transitional care management, Avg	0.70	0.68	0.71	0.087
(4) Comprehensive medication management, Avg	0.69	0.73	0.67	0.016
(5) Social needs management, Avg	0.67	0.77	0.64	0.012

Table 2.3. shows descriptive statistics of the seventeen variables included in the Principal Component Analysis. Each variable was normalized by rescaling the range from zero to one. Standardizing the standard deviation of each variable and setting the means to zero was explored;

however, normalizing each variables' response range was a better fit for this analysis (UCLA: Statistical Consulting Group, n.d.).

Table 2.3: Principal Component Analysis Descriptive Statistics after Scaling

Variables	Minimum	Maximum	Mean	Std. Deviation
Team huddles focused on beneficiary care	0	1	0.69	0.280
Team meeting to discuss high-risk beneficiaries	0	1	0.54	0.25
Teams meeting to review quality improvement data	0	1	0. 72	0.20
24/7 access to patient electronic record	0	1	0.94	0.22
Practice site provides 24/7 coverage	0	1	0.94	0.23
Enhanced appointment and communication capabilities	0	1	0.74	0.25
Alternative approaches to care	0	1	0.29	0.33
Patients are seen by the provider or care team they are empaneled	0	1	0.92	0.26
How often offices use data to plan the care they provide	0	1	0.47	0.14
Whether offices use data to plan the care they provide	0.11	1	0.71	0.15
Referral management w/ specialists	0	1	0.60	0.31
Use of cost measures	0	1	0.48	0.23
Use of utilization measures	0	1	0.63	0.28
Use of patient experience measures	0	1	0.56	0.31
Care management fees	0.01	1	0.12	0.13
Performance-based incentive payments	0	1	0.09	0.11
Comprehensive primary care payment	0	1	0.03	0.07

Table 2.4. shows the hypothesized care transformation categories that each variable was expected to belong to. Fourteen of the variables included in the PCA represent survey questions that are currently categorized into the following categories: (1) care team composition and activities, (2) enhanced access to care, (3) continuity of care, (4) planned care and population health, (5) referral management, and (6) quality improvement infrastructure. The remaining three variables were placed into the MDPCP cost category and represent the three distinct funding streams each practice receives for participating in the MDPCP.

Table 2.4: Hypothesized Variables and Care Transformation Categories

Hypothesized care transformation categories	Variables	
Care team activities	1	Team huddles focused on beneficiary care
	2	Team meeting to discuss high-risk beneficiaries
	3	Teams meeting to review quality improvement data
Enhanced access to care	4	24/7 access to patient electronic record
	5	Practice site provides 24/7 coverage
	6	enhanced appointment and communication capabilities
	7	alternative approaches to care
Continuity of care	8	patients are seen by the provider or care team they are empaneled
Planned care and population health	9	How often offices use data to plan the care they provide
	10	Whether offices use data to plan the care they provide
Referral management	11	Referral management w/ specialists
Quality improvement infrastructure	12	Use of cost measures
	13	Use of utilization measures
	14	Use of patient experience measures
MDPCP Payments	15	Care management fees
	16	Performance-based incentive payments
	17	Comprehensive primary care payment

The six principal components extracted from the primary care structural and process capabilities variables are shown in **Table 2.5.** Each of the principal components extracted had eigenvalues greater than one. The first principal component explained 14.91% of the variance, the second principal component explained 14.25% of the variance, the third principal component explained 11.85% of the variance, the fourth principal component explained 11.61% of the variance, the fifth principal component explained 11.47 % of the variance, and the sixth principal component explained 8.58% of the variance. All six principal components collectively represented 72.7% of the variance within the primary care practices.

Table 2.5: Principal Component Analysis of Primary Care Structural and Process Capability Variables

	Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Eigenvalues	Variance %	Cumulative %	Eigenvalues	Variance %	Cumulative %	Eigenvalues	Variance %	Cumulative %
1	3.22	18.98	18.98	3.22	18.98	18.98	2.535	14.91	14.91
2	2.49	14.68	33.66	2.49	14.68	33.66	2.423	14.25	29.16
3	2.20	12.96	46.61	2.20	12.96	46.61	2.014	11.85	41.01
4	1.63	9.60	56.22	1.63	9.60	56.22	1.973	11.61	52.62
5	1.29	7.59	63.81	1.29	7.59	63.81	1.949	11.47	64.09
6	1.08	6.39	70.20	1.08	6.39	70.20	1.459	8.58	72.67
7	0.96	5.66	75.86						
8	0.74	4.41	80.27						
9	0.66	3.89	84.16						
10	0.53	3.12	87.28						
11	0.43	2.56	89.84						
12	0.41	2.44	92.28						
13	0.37	2.19	94.48						
14	0.31	1.87	96.35						
15	0.24	1.44	97.79						
16	0.20	1.21	99.00						
17	0.16	1.00	100.00						
Extraction Method: Principal Component Analysis; Rotation Method: Promax Rotation									

The scree plot, depicting each of the initial 17 principal components' eigenvalues, clearly visualizes the number of principal components with eigenvalues greater than one **(Figure 2.1)**.

Figure 2.1: Scree plot of eigenvalues after Principal Component Analysis

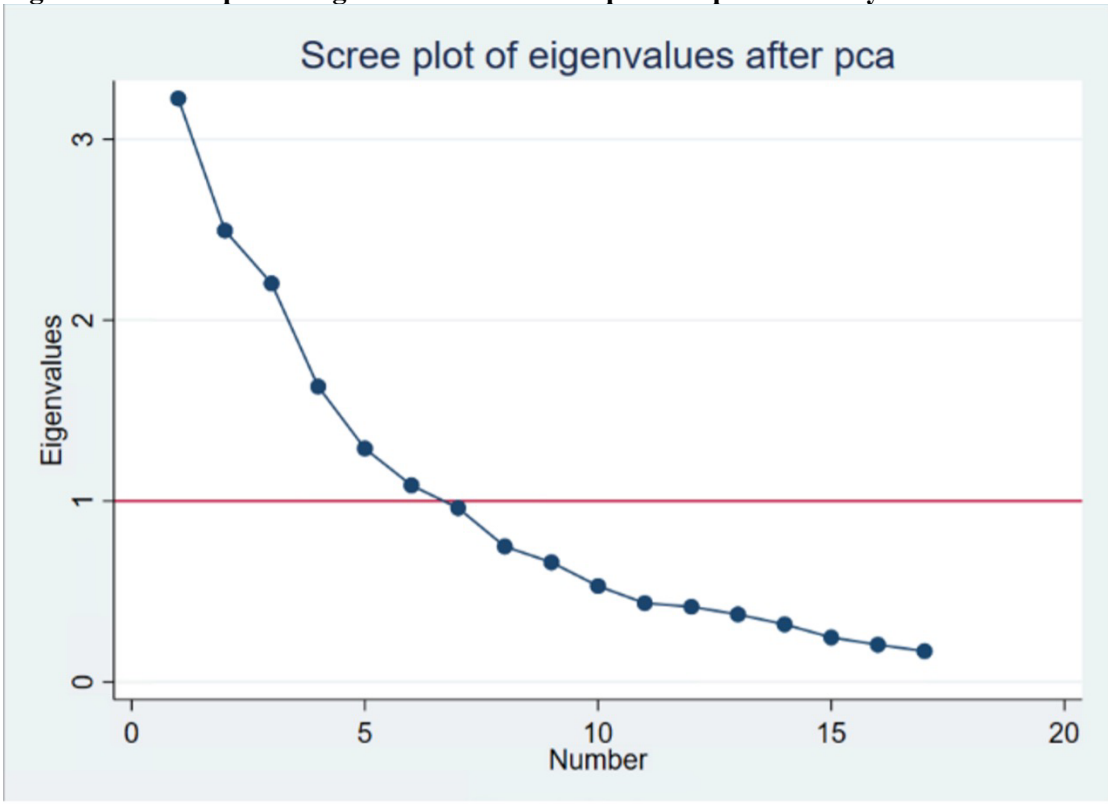


Table 2.6. shows the variable loadings for each primary care capability variable after Promax rotations were applied.

Table 2.6: Variables Loadings after Promax Rotations

Variables	**Rotated Component Matrix**					
	Principal Components					
	PC1	PC2	PC3	PC4	PC5	PC6
Team huddles focused on beneficiary care	.164	.057	.335	-.248	.360	.012
Team meeting to discuss high-risk beneficiaries	.164	.057	.335	-.248	.360	.012
Teams meeting to review quality improvement data	.218	-.101	.042	-.528	-.011	-.528
24/7 access to patient electronic record	.153	.288	.356	.167	-.104	-.349
Practice site provides 24/7 coverage	-.114	.013	.199	.146	.484	.403
Enhanced appointment and communication capabilities	.169	-.009	-.099	-.310	-.012	-.329
Alternative approaches to care	.079	.115	.084	.412	.479	-.167
Continuity of care where patients are seen by the provider or care team, they are empaneled to	.226	.221	.387	.136	-.176	-.348

How often offices use data to plan the care they provide	.364	-.057	.229	.116	-.333	.345
Whether offices use data to plan the care they provide	.344	-.133	.246	.070	-.179	.402
Referral management w/ specialists	.254	-.288	-.283	-.055	.080	-.228
Use of cost measures	.305	-.231	-.249	.256	.236	.069
Use of utilization measures	.361	-.212	-.178	.105	.108	-.230
Use of patient experience measures	.311	-.074	-.177	.308	-.148	.057
Care management fees	.192	.485	-.248	-.090	.073	.120
Performance-based incentive payments	.170	.453	-.259	-.107	-.029	.155
Comprehensive primary care payment	.152	.437	-.257	.022	.064	.112
Extraction Method: Principal Component Analysis; Rotation Method: Promax Rotation						

The Kaiser-Meyer-Olkin measure (KMO) of sampling adequacy **(Table 2.7.)** generated a statistic that estimated the correlation between the 17 variables included in the analysis (Kaiser, 1974). The KMO statistic ranges from zero to one, with greater values indicating that factor analysis is an appropriate method. High KMO statistics indicate that the correlation between variables is high enough to capture the common factors that influence them or the principal components. In this analysis, the KMO statistic was 65.2, which is above the accepted threshold of 50.0 (Kaiser, 1974).

Table 2.7: Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Variables	**KMO**
Team huddles focused on beneficiary care	0.6124
Team meeting to discuss high-risk beneficiaries	0.6387
Teams meeting to review quality improvement data	0.6779
24/7 access to patient electronic record	0.5847
Practice site provides 24/7 coverage	0.4768
Enhanced appointment and communication capabilities	0.6137
Alternative approaches to care	0.5236
Continuity of care where patients are seen by the provider or care team, they are empaneled to	0.6202
How often offices use data to plan the care they provide	0.6187
Whether offices use data to plan the care they provide	0.6178
Referral management w/ specialists	0.6795
Use of cost measures	0.7102
Use of utilization measures	0.7573
Use of patient experience measures	0.6993
Care management fees	0.6376
Performance-based incentive payments	0.6743
Comprehensive primary care payment	0.7455
Overall	0.6518

Table 2.8. depicts updated primary care capability categories based on the results of the PCA. This table also shows that each of the 17 variables included in the analysis contributed over 30% to the variance of each component and that all but two variables contributed to over 47% of component variance. While the variables included in the PCA were hypothesized to represent, the PCA identified six principal components. All but one variable, '24/7 access to patient electronic records,' remained in their original groupings. Additionally, PCA combined the 'referral management' and 'quality improvement infrastructure' categories into a single principal component.

The first principal component measures 'referral management + quality improvement infrastructure.' This component was positively and strongly associated with all three variables assessing whether primary care practices used cost, use, and patient experience measures to support quality improvement efforts, as well as the single referral management variable, which captured the number of specialist types a primary care practices have referral arrangements with. This principal component might capture primary care practice-level ability to organize information and then the ability to use this information to inform practice, whether it be quality improvement efforts or connecting patients with specialty providers.

The second principal component measures 'MDPCP payments' and was positively and strongly associated with all three variables assessing MDPCP related payments: (1) care management fees, (2) performance-based incentive payments, and (3) comprehensive primary care payments. The third principal component 'planned care and population health' was positively associated with both 'planned care and population health' variables. This principal component captures the types of data used to plan patient care and how often data are reviewed to provide informed care.

The fourth principal component measures ‘continuity of care + enhanced access to care’ and was positively and strongly associated with the single continuity of care variable that captures whether patients are consistently treated by the provider or care team that they are empaneled to, and an enhanced access to care variable that captures whether patients have 24/7 access to their electronic health records. While initially categorized in separate categories, these variables capture primary care practice-level ability to provide continuous access to consistent treatment and information. This principal component might also capture consistent communication between providers and patients since some electronic health record platforms facilitate emails between patients and providers. The fifth principal component measures ‘care team composition and activities’ and was positively and strongly associated with all three variables in this original category. This principal component captures whether primary care practices use team meetings to discuss patients, review quality improvement data, and plan actions of care. Lastly, the sixth principal component measures ‘enhanced access to care’ and was positively and negatively associated with three of the four variables originally in this category. Each variable captured patients’ ability to seek care outside of traditional office hours.

Table 2.8: Variables and Care Transformation Categories based on Principal Component Analysis Results.

Care transformation Principal Components	Contribution to Total Variance (%)	Variables		Variables Contributing to Over 30% of Components (%)
PC 5. Care team activities	11.47	1	Team huddles focused on beneficiary care	53.49
		2	Team meeting to discuss high-risk beneficiaries	59.25
		3	Teams meeting to review quality improvement data	47.22
PC 4. Continuity of care/ Enhanced access to care	11.61	4	24/7 access to patient electronic record	63.43
		8	Patients are seen by the provider or care team they are empaneled	65.31
PC 6. Enhanced access to care	8.58	5	Practice site provides 24/7 coverage	64.73
		6	Enhanced appointment and communication capabilities	-30.72
		7	Alternative approaches to care	52.89
PC 3. Planned care and population health	11.85	9	How often offices use data to plan the care they provide	65.82
		10	Whether offices use data to plan the care they provide	62.61
PC 1. Referral management/ Quality improvement infrastructure	14.91	11	Referral management w/ specialists	47.44
		12	Use of cost measures	53.18
		13	Use of utilization measures	51.72
		14	Use of patient experience measures	34.77
PC 2. MDPCP Payments	14.25	15	Care management fees	59.96
		16	Performance-based incentive payments	57.58
		17	Comprehensive primary care payment	53.79

Table 2.9 shows the results of six separate Poisson regression models that assessed whether the principal components of primary care capabilities were associated with providing comprehensive care management, risk-stratified care management, self-management and support, transitional care management, comprehensive medication management, and social needs management. PC 1. Referral management/Quality improvement infrastructure was positively associated with comprehensive care management (Incidence rate ratio [IRR] 1.03, p=0.000, 95% Confidence Intervals [CI] 1.02, 1.03), comprehensive medication management (IRR 1.07, p=0.000, 95% CI 1.05, 1.09) and social needs management (IRR 1.07, p=0.000, 95% CI 1.04, 1.09) and negatively associated with risk-stratified care management (IRR 0.99, p=0.000, 95% CI 0.98, 0.99). PC 3. Planned care and population health was positively associated with all care management categories except social needs management. PC 4. Continuity of care/ Enhanced access to care was positively associated with all care management categories except self-management and support. PC 5. Care team composition and activities was only associated with transitional care management (IRR 1.03, p=0.000, 95% CI 1.01, 1.05). PC 6. Enhanced access to care was negatively associated with comprehensive care management (IRR 0.98, p=0.000, 95% CI 0.97, 0.99), risk-stratified care management (IRR 0.98, p=0.000, 95% CI 0.97, 0.99), comprehensive medication management (IRR 0.92, p=0.000, 95% CI 0.90, 0.95), and social needs management (IRR 0.96, p=0.025, 95% CI 0.90, 0.95). MUA primary care practice designation was associated with a decrease in the comprehensiveness of the comprehensive care management composite score (IRR 0.94 p=0.046, 95% CI 0.89, 0.99) as well a decrease in the comprehensiveness of risk-stratified care management (IRR 0.94 p=0.032, 95% CI 0.89, 0.99).

Table 2.9: MDPCP primary care practice principal component capabilities associated with care management, Poisson regression models

	Comprehensive care management	Risk-stratified care management	Self-management and support	Transitional care management	Medication management	Social needs management
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
PC 1. Referral management/ Quality improvement infrastructure	1.03*** (1.02, 1.03)	0.99** (0.98, 0.99)	1.07*** (1.05, 1.09)	1.01 (0.99, 1.03)	0.98 (0.96, 1.00)	1.07*** (1.04, 1.09)
PC 2. MDPCP payments	0.99 (0.98, 1.01)	0.99 (0.99, 1.00)	0.97* (0.95, 0.99)	1.00 (0.98, 1.02)	1.02 (0.99, 1.04)	1.00 (0.97, 1.02)
PC 3. Planned care and population health	1.03*** (1.02, 1.04)	1.02*** (1.01, 1.03)	1.03*** (1.01, 1.05)	1.03** (1.00, 1.05)	1.08*** (1.05, 1.11)	1.02 (0.99, 1.05)
PC 4. Continuity of care/ Enhanced access to care	1.08*** (1.06, 1.09)	1.03*** (1.02, 1.03)	1.01 (0.99, 1.03) 0.146	1.04** (1.01, 1.07)	1.34 (1.26, 1.42) 0.000	1.16*** (1.11, 1.22)
PC 5. Care team composition and activities	0.98 (0.99, 1.01)	1.01* (1.00, 1.01)	1.01 (0.99, 1.03)	1.03** (1.01, 1.05)	0.98 (0.95, 1.01)	0.98 (0.95, 1.01)
PC 6. Enhanced access to care	0.98*** (0.97, 0.99)	0.98*** (0.97, 0.99)	1.00 (0.99, 1.02)	1.01 (0.99, 1.03)	0.92*** (0.90, 0.95)	0.96* (0.90, 0.95)
MUA Status						
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
Yes	0.94* (0.89, 0.99)	0.94* (0.89, 0.99)	0.90 (0.81, 0.99)	0.98 (0.86, 1.11)	0.97 (0.86, 1.09)	0.91 (0.79, 1.06)

*p< 0.05, **p<0.01, ***p<0.001. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, MUA., medically underserved area.
Models: Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Table 2.10 shows the results of six separate Poisson regression models that assessed the impact of the interaction between the principal components of primary care capabilities and primary care practice MUA status on comprehensive care management, risk-stratified care management, self-management and support, transitional care management, comprehensive medication management, and social needs management. Interaction terms between primary care practice MUA designation and PC 1. Referral management/Quality improvement infrastructure was statistically significantly associated with transitional care management (IRR 1.06, p=0.020, 95% CI 1.00, 1.11). Interaction terms between primary care practice MUA designation and PC 3. Planned care and population health was statistically significantly associated with comprehensive care management (IRR 0.97 p=0.032, 95% CI 0.94, 0.99), self-management and support (IRR 0.95 p=0.021, 95% CI 0.91, 0.99), comprehensive medication management (IRR 0.92 p=0.005, 95% CI 0.87, 0.97), and social needs management (IRR 0.94 p=0.037, 95% CI 0.89, 0.99).

Table 2.10: The impact of the interaction between MDPCP Primary care practice principal component capabilities and primary care practice MUA status on care management, Poisson regression models

	Comprehensive care management	Self-management and support	Transitional care management	Medication management	Social needs management
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
PC 1. Referral management/ Quality improvement infrastructure	1.03*** (1.02, 1.03)	1.07*** (1.05, 1.09)	1.00 (0.98, 1.02)	0.98 (0.96, 1.00)	1.07*** (1.04, 1.09)
PC 2. MDPCP payments	1.00 (0.98, 1.01)	0.97* (0.95, 0.99)	1.00 (0.98, 1.02)	1.02 (0.99, 1.05)	1.00 (0.97, 1.02)
PC 3. Planned care and population health	1.05*** (1.031, 1.060)	1.05*** (1.03, 1.07)	1.02* (1.00, 1.05)	1.11*** (1.07, 1.16)	1.04* (1.00, 1.08)
PC 4. Continuity of care/ Enhanced access to care	1.08*** (1.069, 1.099)	1.01 (0.99, 1.03)	1.04** (1.01, 1.07)	1.34*** (1.26,1.43)	1.16*** (1.11, 1.22)
PC 5. Care team composition and activities	1.004 (0.993, 1.014)	1.01 (0.99, 1.02)	1.03** (1.01, 1.05)	0.98 (0.95, 1.01)	0.98 (0.95, 1.00)
PC 6. Enhanced access to care	0.979*** (0.969, 0.989)	1.00 (0.98, 1.02)	1.01 (0.99, 1.03)	0.92*** (0.90, 0.94)	0.96* (0.94, 0.99)
MUA Status					
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
Yes	0.95 (0.89, 1.01)	0.91 (0.81, 1.01)	0.98 (0.86, 1.12)	1.00 (0.89, 1.13)	0.93 (0.80, 1.08)
MUA Status * PC 1. Referral management/ Quality improvement infrastructure					
MUA Status					
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
Yes	---	---	1.06* (1.00, 1.11)	---	---
MUA Status * PC 3. Planned care and population health					
MUA Status					
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]

Yes	0.97* (0.94, 0.99)	0.95* (0.91, 0.99)	---	0.92** (0.87, 0.97)	0.94* (0.89, 0.99)

*p< 0.05, **p<0.01, ***p<0.001. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, MUA., medically underserved area.
Models: Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Table 2.11 shows the results of six Poisson regression models that assessed whether the number of primary care capabilities was associated with the provision of care management. Increased primary care capabilities were positively associated with comprehensive care management, risk-stratified care management, self-management and support, transitional care management, comprehensive medication management, and social needs management. MUA primary care practice designation was associated with a decrease in the comprehensiveness of the risk-stratified care management score (IRR 0.94 p=0.047, 95% CI 0.88, 0.99).

Table 2.12 shows the results of six separate Poisson regression models that assessed whether primary care practice MUA designation changed the association between the number of primary care capabilities and care management comprehensiveness. The interaction between primary care practice MUA designation and the number of primary care capabilities was only significantly associated with risk-stratified care management (IRR 0.94, p=0.018, 95% CI 0.90, 0.99).

Table 2.11: The number of MDPCP primary care practice capabilities and care management, Poisson regression models

	Comprehensive care management	Risk-stratified care management	Self-management and support	Transitional care management	Medication management	Social needs management
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
Number of primary care practice capabilities	1.06*** (1.05, 1.07)	1.01*** (1.00, 1.02)	1.08*** (1.06, 1.10)	1.06*** (1.03, 1.08)	1.08*** (1.05, 1.11)	1.09*** (1.07, 1.12)
MUA Status						
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
Yes	0.94 (0.89, 1.00)	0.94* (0.88, 0.99)	0.92 (0.82, 1.02)	0.97 (0.85, 1.11)	0.96 (0.84, 1.10)	0.92 (0.80, 1.06)

*p< 0.05, ***p<0.001 Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, MUA., medically underserved area. **Models:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Table 2.12: The impact of the interaction between the number of MDPCP primary care practice capabilities and primary care practice MUA status on care management, Poisson regression models

	Comprehensive care management	Risk-stratified care management	Self-management and support	Transitional care management	Medication management	Social needs management
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
Number of primary care practice capabilities	1.06*** (1.05,1.07)	1.01*** (1.00, 1.02)	1.08*** (1.05, 1.09)	1.05*** (1.02, 1.07)	1.08*** (1.05, 1.11)	1.11*** (1.08, 1.14)
MUA Status						
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
Yes	0.84 (0.62, 1.13)	0.78* (0.63, 0.97)	0.70 (0.43, 1.13)	0.58 (0.31, 1.08)	0.95 (0.47, 1.93)	1.57 (0.97, 2.52)
Number of primary care practice capabilities * MUA Status						
No	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
Yes	1.01	1.01	1.02	1.05	1.00	0.94*

	(0.98, 1.04)	(1.00, 1.02)	(0.98, 1.07)	(0.99, 1.11)	(0.93, 1.06)	(0.90, 0.99)

*p< 0.05, ***p<0.001. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, MUA., medically underserved area. **Models:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I,II,III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Tables 2.13 – 2.19 are located in the appendix. These tables show results of the association between individual primary care practice capabilities and all six care management categories as well was crude, intermediate and full models for reach of the regression models.

Discussion

While the primary care structural and organizational capabilities variables were originally grouped based on widely known primary care delivery transformation areas, the PCA results demonstrate the importance of evaluating data for latent factors, especially when the sample is specialized and or not nationally representative. Four of the six principal components extracted were associated with the provision of care management. Principal component 1. Referral management + quality improvement infrastructures' positive association with the provision of care management is supported by existing literature. Practices' ability to organize information and the ability to use the information to care for patients is often associated with information technology capacity, which has also been associated with care management and more specifically, social needs screening (Frehn et al., 2022). Additionally having a strong quality improvement culture has also been identified as a facilitator of care management (Bodenheimeret et al., 2004).

The positive association between PC4. Continuity of care + Enhanced access to care and the provision of care management is also supported by the literature. This principal component captures primary care practice-level continuity of communication and treatment. While continuity of provider treatment has been identified as important function of quality care, this principal component might also capture the importance of patients being able to continue communication with their providers after and or between doctor's visits (Lustman, 2016).

While PC 5. Care team composition and activities was not statistically associated with increased comprehensiveness within the comprehensive care management composite variable but was associated with increased comprehensiveness among the risk-stratified care management and the transitional care management variables. These results are consistent with existing literature that states relational coordination and improved communication among care teams is associated with improved care management (Cramm & Nieboer, 2012). In this program, the ability to capture, monitor and share patient information might be a better indicator of a practices ability to provide care management. This might explain why PC 1. Referral management/Quality improvement infrastructure, PC 3. Planned care and population health, and PC 4. Continuity of care/ Enhanced access to care, were all associated with increased provision of care management. Patient characteristics and geographic location had greater associations with the provision of care management. High patient HCC average was associated with increased provision of care management than all six primary care practice capabilities variables. This could be an implication of practices prioritizing existing resources in order to provide patients with necessary care.

Traditionally, primary care practices operating in communities with lower resources are less likely to participate in quality improvement demonstrations Fraze et al., 2018; Lewis et al., 2012; Lewis et al., 2017; Rubin, 2018; Yasaitis et al., 2016). This analysis provides an opportunity to better understand how primary care practices operating in MUAs that have opted into the MDPCP, provide care management. While MDPCP MUA primary care practices are shown to provide more comprehensive care management in two-way analysis, once practice capabilities, patient, staff and geographic location are controlled for, non-MUA primary care

practices provided more comprehensive risk-stratified care management and social needs management.

Strength and Limitations

This analysis has several limitations. First, only MDPCP primary care practices are included in this analysis. While this may limit the generalizability of our findings, importantly these results may further the development of future state and national care management demonstrations by offering guidance on what resources might be needed to implement care management services.

Second, the MDPCP is a voluntary program and participants may not be representative of primary care offices across the state of Maryland or the nation. Of note, however, over 40 percent of all Maryland practices participated in the MDPCP in 2021 (Schrader et al., 2021). Though this program is voluntary, when compared to other Medicare demonstrations this analysis also includes an extremely diverse sample. This sample includes a larger percentage of small practices, which is more representative of the national distribution of primary care practice size (Rubio et al., 2023; Singh et al., 2020). Notably, these analyses also include one of the largest percentages of rural primary care practices in a state or national level Medicare demonstration to date (Singh et al., 2020). Additionally, the primary care practices in these analyses have higher percentages of black patients than previous state and national Medicare demonstrations (Rubio et al., 2023; Singh et al., 2020).

A third limitation is that the COVID-19 pandemic overlaps study period and most likely impacted care delivery and utilization. Lastly, this is a cross-sectional study and the results found in 2021 might be different from results found in a different year; however, the primary care capabilities there were associated with care management comprehensiveness were similar to

those in previous studies (Frehn et al., 2022; Spivack et al., 2022; Rodriguez et al., 2016; Murray, Rodriguez, & Lewis, 2020).

The strengths of this analysis outweigh the identified limitations. This analysis is extremely comprehensive in its assessment of which primary care practice capabilities are associated with care management comprehensiveness. Additionally, this is the only study to assess five different care management services and provides a comprehensive understanding of which care management capabilities are associated with each care management service. Lastly, this is the first study to identify that MUA-designated primary care practices might use resources differently than non-MUA practices when delivering care management in the state of Maryland. This is also the first study to demonstrate that disparities in access to comprehensive care management are present in the state of Maryland.

Conclusion

These results provide more evidence about differences in the primary care structural and process capabilities with specific care management services. PC 3. Planned care and population health, was the only capability that was positively associated with increased comprehensiveness in self-management and support, transitional care management, comprehensive medication management and social needs management. Additionally, this analysis demonstrates the existence of geographic variation in the provision of care management and that in certain instances non-MUA-designated primary care practices provide more comprehensive care management services.

Chapter 3: HEART Payments and Comprehensive Care Management

Background

Nearly 80 percent of patient health outcomes are attributed to social, behavioral, and economic factors, while the other 20 percent are a result of health care services (Murray et al., 2021). Social determinants of health (SDOH) are the conditions in which people are born into, grow up in, live, work and age, and the systems which shape these circumstances, including economics, social policies, and politics (WHO, 2010). SDOHs, such as low income, low education, low health literacy, unemployment and housing instability, and homelessness are also associated with increased hospital readmissions (Murray et al., 2021; Joynt et al., 2019; Joynt et al., 2011a; Joynt et al., 2011b; Arbaje et al., 2008). Difficulties with post-discharge care, such as accessing primary care, affordability of prescriptions, accessing transportation for follow-up care, and adhering to care regimens, are exacerbated by increased social risk and are associated with increased readmission rates (Murray et al., 2021; Joynt et al., 2019). Additionally, where one lives greatly impacts hospital readmissions. Neighborhood-level deprivation is also associated with health outcomes such as readmissions. Due to low neighborhood-level access to public transportation, grocery stores, and pharmacies, individuals living in high-poverty neighborhoods had higher readmission rates than those living in better-resource communities (Hu, Gonsahn, & Nerenz, 2014). Over 50 percent of hospital variation in readmissions can be attributed to the specific county hospitals are located in (Herrin et al., 2015). Difficulties with post-discharge care, such as accessing primary care, affordability of prescriptions, accessing transportation for follow-up care, and adhering to care regimens, are exacerbated by increased social risk and are associated with increased readmission rates (Murray et al., 2021; Joynt et al.,

2019). While it is widely accepted that SDOHs greatly impact health outcomes, there is uncertainty in health care's role in addressing them.

The Maryland Primary Care Program (MDPCP) is a voluntary Medicare demonstration modeled after the Comprehensive Primary Care Plus (CPC+) program. The MDPCP facilitates the delivery of the five comprehensive primary care, including access and continuity, care coordination, risk-stratified care management, planned care for population health and patient and caregiver engagement (Machta et al., 2021). Care management is comprised of activities that seek to improve patient health outcomes and reduce high health care utilization (Peikes, Swankoski, O'Malley, and Timmins, 2021). Multi-component primary care practice-based care management interventions have demonstrated greater reductions in readmissions (Spivack, DeWalt, Oberlander et al., 2021; Powers, Chaguturu, & Ferris, 2015). Little is known about the types of care management services provided to Maryland Medicare beneficiaries. Furthermore, little is known about what resources Maryland primary care practices need to comprehensive care management services to Medicare beneficiaries.

The MDPCP is at the forefront of supporting primary care practices in their efforts to address SDOH Primary care practices that receive value-based payments are more likely to screen for social needs than primary care practices that do not receive value-based payments (Horstman and Lewis, 2023). Prospective value-based payments give providers the flexibility to tailor the care they provide. In 2022 the MDPCP began distributing Health Equity Advancement Resource and Transformation (HEART) Payments to practices for each attributed patient in the 4th or 5th Hierarchical Condition Categories (HCC) risk tiers (Centers for Medicare & Medicaid Service (CMS), 2023; MDPCP, 2023). HEART payments are not tied to quality indicators and are more flexible in nature. Practices are encouraged to use these funds to improve their infrastructure

to better provide services that support the five components of comprehensive primary care. These funds can also be used to improve the ability to screen for social needs and provide social services. In some instances, these funds can be used to directly address patients' social needs. HEART payments are innovative because payments are based on the severity of patients' health burdens as well as neighborhood socioeconomic disadvantage (CMS, 2023; MDPCP, 2023). HEART payments push the needle in health care's ability to support providers that provide care to extremely burdened patients. To date, little is known about whether non-fee-for-service payment models, such as HEART payments, facilitate care management and social needs service delivery to Medicare beneficiaries.

This analysis examines the association between HEART payments and care management services and whether this association is altered by primary care practice care management delivery option. Additionally, this aim seeks to assess the association between HEART payments and care management services among practices within and outside of MUAs. We hypothesize that, controlling for practice-level characteristics, practices that receive higher levels of HEART payments will increase comprehensives of care management services provided and that the association between HEART payments and increased delivery of care management services will be reduced among MUA practices.

Methods

Data

This analysis uses several secondary data sources: Maryland Primary Care Program data, Chesapeake Regional Information System for our Patients (CRISP) data, and hMetrix data. In this analysis, all data are captured at the primary care practice level. MDPCP data include

participating practice rosters, CTO rosters, and Care Transformation Reports. Care Transformation reports provide practice-level structural and process capabilities and care management information. MDPCP data also include practice ownership in formation, FQHC status, size, practice participation track status, and practice-level provider information. CRISP data include beneficiary demographics and Medicare FFS Claim Line Feed (CCLF) data. CRISP data provide beneficiary demographic information such as age, race and ethnicity, HCC risk tier, chronic conditions, preferred language, Medicare eligibility, enrollment characteristics, and beneficiary-level service use such as hospital admissions and readmissions. hMetrix data provide practice-level average per beneficiary per month: MDPCP Care Management payment, Comprehensive Primary payment, Performance Based Incentive payment information, and quarterly HEART payments.

Study Sample

To participate in the MDPCP primary care practices need at least 150 attributed Medicare beneficiaries and must be in one of the following provider categories: General Practice, Family Medicine, Internal Medicine, Obstetrics and Gynecology, Pediatric Medicine, Geriatric Medicine, and co-located Psychiatry. Only Medicare FFS attributed beneficiaries can participate in the MDPCP. The final sample includes primary care practices that had at least 12 months of HEART payments between January 1, 2022, and March 31, 2023, as well as practices with no missingness among the variables included in the model. The final sample included in this analysis was 468 of the total 608 primary care practices that participated in the MDPCP.

Dependent Variables

The dependent variable is a composite measure assessing primary care practice-level care management comprehensiveness. The five types of care management included in this measure include: (1) Risk stratification care management, (2) Self-management and support, (3) Transitional care management, (4) Comprehensive medication management, and (5) Social needs management. Components of the comprehensive care management variable are as follows:

(1) Risk-stratified care management:
- Risk stratification – Methods
  - (1) Intuition only; (2) Data-driven algorithm only; (3) Two-step
- Risk stratification – Factor complexity
  - (1) Claims variables; (2) Clinical variables from the EHR; (3) Computed risk scores; (4) Pre-AH Tool (Likelihood for Avoidable Hospital Events report); (5) Other methods
- Risk stratification – The percent of beneficiaries risk stratified out of total empaneled
  - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Lead Care Manager
  - (1) Yes; (2) No
- Longitudinal Care Management – The percent of beneficiaries under care management out of total empaneled
  - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Care Plan – The percentage of beneficiaries under longitudinal care management with care plans
  - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Care Plan – Document & storage
  - (0) No; (1) Care plans are stored but not health IT integrated; (2) Care plans are EHR or HIT integrated)

(2) Self-management and support (SMS):
- Populations that receive SMS
  - (1) All beneficiaries with the targeted condition; (2) Risk status; (3) Poorly controlled disease; (4) Data from a formal self-management assessment tool; (5) Beneficiary interest; (6) Clinician referral/identification; (7) Other
- Self-management support activities
  - (1) No activities; (2) encourage beneficiaries to choose goals that are meaningful to them; include family/caregivers in goal setting and care plan development; (3) Connect or provide beneficiaries and caregivers with formal self-management support services at our practice or in the community; (4) measure beneficiaries' skills and progress; (5) Staff are trained in self-management support techniques

(3) Transitional care management (TCM):
- The percent of patient follow-up within one week post emergency department discharge
  - (1) None (0%); (2) Some (Up to 50%); (3) Most (51-95%); (4) All (96-100%)
- The percent of patient follow-up within 72 hours post hospital discharge
  - (1) None (0%); (2) Some (Up to 50%); (3) Most (51-95%); (4) All (96-100%)
- Admission/discharge/transfer information EHR/HIT system integration
  - (1) Yes; (2) No

(4) Comprehensive medication management (CMM):
- Delivery of CMM
  - (1) Yes; (2) No
- Populations that receive CMM
  - (1) Active medication issues (e.g., adverse reactions, adherence, not reaching intended treatment outcomes); (2) Potential therapy issues (e.g., high-risk medications, polypharmacy, multi-therapy drug interactions, high-cost medications); (3) Referred by practitioner or care team

(5) Social needs management (SNM):
- Populations that receive SNM
  - (1) Do not screen beneficiaries; (2) Targeted subpopulation; (3) All beneficiaries
- Types of social needs screened for
  - (1) Food insecurity; (2) Housing instability; (3) Utility needs; (4) Financial resource strain; (5) Transportation; (6) Social isolation; (7) Safety or interpersonal violence; (8) Other
- Inventory of social service resources
  - (1) Yes; (2) No
- Established relationship with social resources
  - (1) Food insecurity; (2) Housing instability; (3) Utility needs; (4) Financial resource strain; (5) Transportation; (6) Employment; (7) Social isolation; (8) Safety or interpersonal violence;

Independent Variables

MDPCP provides HEART payments to participating primary care practices based on the demographic characteristics of the patients served by the practices. Practices in MDPCP tracks I and II receive HEART payments as a part of their care management fees, and MDPCP practices in track III receive HEART payments separately. HEART payments are based on patients' CMS-Hierarchical Condition Category (HCC) score as well as their Area Deprivation Index (ADI)

scores (CMS, 2023; MDPCP, 2023). ADI is a validated measure describing census block-level neighborhood socioeconomic disadvantage (CMS, 2023; MDPCP, 2023). Practices receive HEART payments based on the number of attributed patients that are in the highest quintile of area deprivation index (ADI) and are also in the 4th HCC risk tier, which encompasses those in the 75th to 89th HCC risk score percentiles, or the 5th HCC risk tier, which encompasses those in the 90th to 99th HCC risk score percentiles (CMS, 2023; MDPCP, 2023). MDPCP practices receive $110 per eligible beneficiary per month (MDPCP, 2023). These payments are prospective and are distributed quarterly (MDPCP, 2023). Beneficiary eligibility status is evaluated quarterly and is adjusted as needed (MDPCP, 2023). HEART payments can be spent on both practice-level infrastructure and patient-level services.

Care Management Delivery Option:

Care Transformation Organizations (CTOs) are comprised of interdisciplinary care management teams equipped to provide comprehensive primary care services such as care management. CTOs provide the following services: pharmacist services, community health workers, health and nutrition counseling services, behavioral health specialist services, referrals and linkages to social services (MDPCP, n.d.). CTOs are generally owned by health insurance companies, Accountable Care Organizations (ACOs), managed service organizations (MSOs), or hospitals (MDPCP, n.d.).

Table 3.1 describes the care management services provided under each CTO option. Within the MDPCP, primary care practices have three main options in terms of how they deliver care management. In the first option, 100/0, primary care practices provide all care management services by themselves. With this option, primary care practices retain 100% of care management and HEART payments (MDPCP, 2020). In the second option, 70/30, primary care

practices provide full-time care managers and the CTOs provide care management services (CMS, 2023). This option allows primary care practices to retain 70% of care management and HEART payments while sharing 30% with the partnered CTOs (MDPCP, 2020). In the third option, 50/50, CTOs provide full-time care managers and provide care management services. Under this agreement, CTO care managers collaborate with primary care practice staff, and CTOs are required to provide additional care management professionals to provide prespecified services such as comprehensive medication management (CMS, 2023). With this option, primary care practices retain 50% of care management and HEART payments while sharing 50% with the partnered CTO (MDPCP, 2020).

Table 3.1: MDPCP Care Management Services by Care Management Delivery Agreement Option

Service Category	Description	Staff Type	Staff: Practice Ratio	50/50	70/30	100/0
Lead Care Manager				CTO: Provides	Practice: Provides	Practice: Provides
Social Determinants Screening & Referral	Access to One Call Care Management for social needs assessment; Identification and establishment of social service resources and ongoing updating of these resources	LCSW; Resource specialist	1:20 practices	CTO: Provides	CTO: Provides	Practice: Provides
Clinical & Claims Data Analysis	Care gap identification	Practice; Panel; Coordinator; Data Analyst	1:6 practices; 1:20 practices	CTO: Provides	CTO: Provides	Practice: Provides
Care planning among risk-stratified	Care plans for high-risk and rising-risk patients	Care Manager; Health Worker	1:4 practices; 1:10 practices	CTO: Provides	CTO: Optional	Practice: Provides
Self-Management Support	Self-management support tools and training for patients and caregivers; Home visits to identify goals of care and needs assessment	Care Manager; Health Worker	1:4 practices; 1:10 practices	CTO: Provides	CTO: Optional	Practice: Provides

Transitional Care Management	Identify patients being discharged from hospital and ED, conduct transitional care visit	Care Manager	1:4 practices	CTO: Provides	CTO: Optional	Practice: Provides
Medication Management	Review of high-risk patients' medication lists and identify intervention	Pharmacist	1:20 practices	CTO: Optional	CTO: Optional	Practice: Provides

Covariates in this analysis fall into two categories: practice-level beneficiary characteristics and practice organization-level characteristics. *Covariates: Practice-level beneficiary characteristics* covariates include: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). *Practice organization-level characteristics* covariates include: total number of providers, percent of providers that are general practitioners and family, MDPCP participation track (I, II, III), and MUA status (yes; no).

Statistical Analysis

Descriptive statistics were used to examine the distribution of practice-level patient, practice, and geographic characteristics across MDPCP care management delivery options using chi-square tests and t-tests for tests of independence. **Regression analysis**. Poisson mixed-effects models were employed to assess whether there is an association between MDPCP HEART payments and primary care practice-level comprehensive care management composite measure scores. Poisson mixed-effects models were also employed to assess whether there is an association between MDPCP HEART payments and primary care practice-level social needs management composite measure scores. Additionally, Poisson mixed-effects models with interaction terms between HEART payments and care management delivery options were included to assess whether care management delivery options altered the association between HEART payments' association with primary care practice-level comprehensive care

management scores as well as social needs scores. Poisson models are preferred for the analysis because the outcome variable is a nonnegative count variable that is not normally distributed. The outcome variable met the Poisson variable assumption because the outcome variable's variance and mean were nearly identical (Wooldridge, 2015). Standard errors were clustered within primary care practices and were included as the random effect and patient and practice covariates were included in the models as fixed effects. Unstructured covariance matrices accounted for correlation within primary care practices (Barnett et al., 2010).

Models 1 through 6 assess the association between primary care practice-level comprehensive care management composite score and log HEART payments. **Model 1** includes the outcome variable comprehensive care management, log HEART payments, care management delivery options, practice-level patient characteristics: age, race, HCC risk scores, and dual eligibility status, practice-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track, CTO collaboration, and county. **Model 2** includes all the variables included in Model 1 as well as an interaction term between HEART payments and care management delivery options. **Model 3** is a stratified model that only includes MUA-designated practices and includes the outcome variable comprehensive primary care primary care, HEART payments, care management delivery options, practice-level patient characteristics: age, race, HCC risk scores, and dual eligibility status, practice-level characteristics: total number of providers, percent of providers that are family and general physicians, and MDPCP participation track. **Model 4** includes all the variables included in Model 1 as well as an interaction term between HEART payments and care management delivery options. **Model 5** is a stratified model that only includes non-MUA-designated practices and includes the outcome variable comprehensive primary care primary care, log HEART

payments, care management delivery options, practice-level patient characteristics: age, race, HCC risk scores, and dual eligibility status, practice-level characteristics: total number of providers, percent of providers that are family and general physicians, and MDPCP participation track. **Model 6** includes all the variables included in Model 1 as well as an interaction term between log HEART payments and care management delivery options.

Model 1: Full Model:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it})$

Model 2: Full Model with interaction term:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it}) + \beta_5(log\ HEART\ payments_{it} * Care\ management\ delivery\ options_{it})$

Model 3: MUA Only - Full Model:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it})$

Model 4: MUA Only - Full Model with interaction term:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it}) + \beta_5(log\ HEART\ payments_{it} * Care\ management\ delivery\ options_{it})$

Model 5: Non-MUA Only - Full Model:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it})$

Model 6: Non-MUA Only - Full Model with interaction term:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it}) + \beta_5(log\ HEART\ payments_{it} * Care\ management\ delivery\ options_{it})$

Where $\log(\mu_{it})$ represents comprehensive care management composite score count, *i* represents primary care practice and, *t* represents time or more specifically six-month intervals. Models 7 through 12 assess the association between primary care practice-level social needs management composite score and log HEART payments. **Model 7** includes the outcome variable social needs management, log HEART payments, care management delivery options, practice patient-level characteristics: age, race, HCC risk scores, and dual eligibility status, practice-level characteristics: total number of providers, percent of providers that are family and general physicians, and MDPCP participation track. **Model 8** includes all the variables included in Model 7 as well as an interaction term between log HEART payments and care management delivery options. **Model 9** is a stratified model that only includes MUA-designated practices and includes the outcome variable social needs management, log HEART payments, care management delivery options, practice-level patient characteristics: age, race, HCC risk scores, and dual eligibility status, practice-level characteristics: total number of providers, percent of providers that are family and general physicians, and MDPCP participation track. **Model 10** includes all the variables included in Model 7 as well as an interaction term between log HEART payments and care management delivery options. **Model 11** is a stratified model that only includes non-MUA-designated practices and includes the outcome variable social needs management, log HEART payments, care management delivery options, practice-level patient characteristics: age, race, HCC risk scores, and dual eligibility status, practice-level characteristics: total number of providers, percent of providers that are family and general physicians, and MDPCP participation track. **Models 12** includes all the variables included in Model 7 as well as an interaction term between log HEART payments and care management delivery options.

Model 7: Full Model:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it})$

Model 8: Full Model with interaction term:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it}) + \beta_5(log\ HEART\ payments_{it} * Care\ management\ delivery\ options_{it})$

Model 9: MUA Only - Full Model:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it})$

Model 10: MUA Only - Full Model with interaction term:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice_{it}) + log(Adjusted\ population - level\ characteristics_{it}) + \beta_5(log\ HEART\ payments_{it} * Care\ management\ delivery\ options_{it})$

Model 11: Non-MUA Only - Full Model:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it})$

Model 12: Non-MUA Only - Full Model with interaction term:
$\log(\mu_{it}) = \beta_0 + \beta_1(log\ HEART\ payments_{it}) + \beta_2(Care\ management\ delivery\ options_{it}) + \beta_3(Care\ management\ capabilities_{it}) + \beta_3(Primary\ care\ practice - level\ patient\ characteristics_{it}) + \beta_4(Primary\ care\ practice - level\ characteristics_{it}) + \beta_5(log\ HEART\ payments_{it} * Care\ management\ delivery\ options_{it})$

Where $\log(\mu_{it})$ represents social needs management composite score count, *i* presents primary care practice and, *t* represents time or more specifically six-month intervals between January 1, 2022 and March 31, 2023. Separate models were also run for the four other care management variables: risk-stratified care management, self-management and support, transitional care management, and comprehensive medication management; however, these models were not

included in the final analysis since all models were statistically insignificant. Sensitivity analyses were conducted by running all models on the individual care management components, as well as only with primary care practices that have three data points. All analyses were conducted using STATA, version 17.0 (StataCorp, College Station, Texas).

Results

There were 338,358 unique patients in quarter 1 2022 and quarter 2 2022 and 339,393 patients in quarter 1 2023. **Table 3.2** summarizes characteristics of MDPCP primary care practices by level of HEART payments. Primary care practices with high HEART payments on average had a greater percentage of HEART payment recipients (14.17%), patients in the HCC complex level (17.39%), dual-eligible patients (20.51%), and over 40% of primary care practices in this category had rural or MUA designations.

Table 3.2: Characteristics of MDPCP Primary Care Practices by Level of HEART Payments, January 1, 2022 – March 31, 2023

	Total Sample N=468	HEART Payment Low n=162	HEART Payment Moderate n=148	HEART Payment High n=158	*p-value*
Number of Patients Per Practice, Avg	741.72	475.29	747.43	1,013.10	0.000
Number of HEART Payment Recipients, Avg	42.41	4.04	16.83	107.05	0.000
Percent of HEART Payment Recipients, Avg	06.48	1.28	4.13	14.17	0.000
HEART payments, Avg $	13,524.24	1,289.39	5,344.42	34,152.31	0.000
Patient Age, %					
64	9.54	7.54	9.15	12.01	0.000
65-69	17.89	18.26	18.00	17.39	0.002
70-74	25.07	26.03	25.28	23.88	0.056
75-79	20.46	21.05	20.67	19.64	0.000
80-84	13.79	13.87	13.95	13.55	0.130
85 +	13.25	13.26	12.96	13.52	0.001
Patient Race & Ethnicity, %					

Black	24.71	24.08	23.84	26.20	0.664
Hispanic	1.38	2.54	1.10	0.44	0.000
White	66.02	61.51	67.98	68.82	0.004
Non-English	6.68	9.72	6.02	4.17	0.000
HCC Scores, Avg	1.09	1.02	1.08	1.18	0.000
HCC level 1, %	21.83	23.92	22..20	19.31	0.000
HCC level 2, %	23.56	24.79	23.77	22.09	0.000
HCC level 3, %	24.74	24.23	24.67	25.33	0.000
HCC level 4, %	14.29	13.11	13.915	15.88	0.000
HCC level Complex, %	15.58	13.96	15.45	17.39	0.000
Dual-eligible, %	17.65	16.95	15.45	20.51	0.000
Comprehensive Primary Care Payment, Avg $	12,587.92	7,230.54	11,531.84	19,177.74	0.000
Care Management Fees, Avg $	50,452.96	30,779.63	48,312.62	72,971.25	0.000
Performance-Based Incentive Payments, Avg $	29,686.90	19,012.68	27,863.364	42,545.24	0.000
Number of providers, Avg	2.96	2.19	2.67	4.05	0.000
Family Med + General Med Providers, %	23.24	30.88	20.82	17.63	0.000
Rural Status, %	33.63	25.68	34.40	41.14	0.032
MUA Status, %	26.06	19.58	14.03	44.42	0.000
Practice MDPCP Start Year, %					
2019, %	70.38	62.11	70.36	78.99	0.000
2020, %	17.69	21.05	17.65	14.22	
2021, %	11.94	16.84	11.99	6.78	
Care Management Delivery option, %					
50/50	47.09	50.11	42.76	48.14	0.167
70/30	30.57	27.37	33.71	30.85	
100/0	30.57	22.53	23.53	21.01	

Table 3.3 summarizes characteristics of MDPCP primary care practices by care management options (50/50 vs. 70/30 vs. 100/0). Practices in the 50/50 category had higher average HEART payments ($14,241.91 vs. $11,597.74), average percent of non-English speaking patients (8.20% vs 5.10%), and average percent of dual-eligible patients (19.36% vs.15.00%) compared to practices in the 100/0 category. Over 30% of practices in the 100/0

category had MUA designations. There was no difference in the percentage of practices with low, moderate, or high HEART payments across the three care management delivery options.

Table 3.3: Characteristics of MDPCP Primary Care Practices by Care Management Delivery Options, January 1, 2022 – March 31, 2023

	Total Sample N=468	Care Management Option: 50/50 n= 223	Care Management Option: 70/30 n=145	Care Management Option: 100/0 n= 100	*p-value*
Number of Patients Per Practice, Avg	741.72	665.83	817.18	798.41	0.000
Number of HEART Payment Recipients, Avg	42.41	44.61	43.46	36.35	0.000
Percent of HEART Payment Recipients, Avg	6.48	6.89	5.84	6.50	0.010
Heart payments, $	13,524.24	14,241.91	13,826.86	11,597.74	0.000
Patient Age, %					
64	9.54	9.61	9.80	9.04	0.397
65-69	17.89	17.69	17.85	18.36	0.000
70-74	25.07	24.85	25.21	25.37	0.000
75-79	20.46	20.42	20.80	20.01	0.172
80-84	13.79	13.85	13.80	13.62	0.011
85 +	13.25	13.58	12.53	13.56	0.000
Patient Race & Ethnicity, %					
Black	24.71	23.24	26.64	25.16	0.000
Hispanic	1.38	1.66	0.62	1.83	0.000
White	66.02	65.49	66.32	66.73	0.121
Non-English, %	6.68	8.20	5.50	5.10	0.000
HCC Score, Avg	1.09	1.11	1.09	1.07	0.034
HCC Level 1, %	21.83	21.07	21.77	23.51	0.000
HCC Level 2, %	23.56	23.60	23.62	23.39	0.000
HCC Level 3, %	24.74	24.79	25.28	23.89	0.085
HCC Level 4, %	14.29	14.24	14.32	14.34	0.000
HCC Level Complex, %	15.58	16.29	15.01	14.87	0.000
Dual-eligible, %	17.65	19.36	16.96	15.00	0.017
Comprehensive Primary Care Payment, Avg $	12,587.92	10,075.40	16,324.59	12,771.00	0.000
Care Management Fees, Avg $	50,452.96	46,699.05	55,901.43	50,910.374	0.000
Performance-Based Incentive Payments, Avg $	29,686.90	29,834.76	39,740.99	15,620.52	0.000

Number of providers, Avg	2.96	3.04	2.83	2.97	0.398
Family Med + General Med Providers, %	23.24	24.69	20.25	24.26	0.000
Rural Status, %	33.63	31.99	35.99	33.88	0.806
MUA Status%	26.06	22.26	26.90	32.90	0.035
Practice MDPCP Start Year, %					
2019	70.38	72.80	68.57	67.75	0.000
2020	17.69	16.07	26.43	9.12	
2021	11.94	11.13	5.00	23.13	
HEART Payment Level, %					
Low	34.57	36.79	30.95	34.85	0.167
Moderate	32.17	29.21	35.48	33.88	
High	33.26	34.00	33.57	31.27	

Table 3.4 summarizes care management characteristics of MDPCP primary care practices by HEART payment level. Primary care practices with high HEART payments on average had greater comprehensive care management composite scores (49.07) and on average had greater percentage of patients in risk-stratified care management (18.03%). Practices in the low HEART payment category had higher average comprehensive medication management scores (6.37 vs. 6.11) compared to practices in the high HEART payment category.

Table 3.4: Care Management Characteristics of MDPCP Primary Care Practices by HEART Payment Level, January 1, 2022 – March 31, 2023

	Total Sample N=468	HEART Payment Low n=162	HEART Payment Moderate n=148	HEART Payment High n=158	*p-value*
Comprehensive Care Management, Avg	48.63	48.40	48.44	49.07	0.040
(1) Risk-Stratified Care Management, Avg	14.93	14.86	14.80	15.13	0.122
Risk-stratified beneficiaries, Avg	97.78	98.56	98.07	96.68	0.000
Beneficiaries under care management,%	18.33	17.44	19.61	18.03	0.000
Beneficiaries under longitudinal care management with care plans, %					

Some (1-50%)	31.73	30.74	34.62	29.98	0.017
Most (51-95%)	20.60	22.32	23.08	16.41	
All (96-100%)	47.16	46.32	41.63	53.39	
(2) Self-Management and Support, Avg	4.59	4.61	4.52	4.64	0.944
(3) Transitional Care Management, Avg	5.28	5.37	5.31	5.16	0.523
Patient ED discharge follow up, %	84.93	86.30	86.45	81.99	0.011
Patient hospital discharge follow up, %	83.62	83.70	84.92	82.27	0.145
(4) Comprehensive Medication Management (CMM) , Avg	6.23	6.37	6.22	6.11	0.001
Practices providing CMM, %	97.82	98.53	97.74	97.16	0.000
(5) Social Needs Management, Avg	13.98	13.50	14.01	14.45	0.062
Populations screened for unmet social needs, %					
Targeted subpopulation	36.83	35.16	37.10	38.29	0.315
All beneficiaries	62.66	64.21	61.99	61.71	
Number of social needs screened	6.00	5.95	6.04	6.01	0.378
Types of social needs screened, %					
Financial resource strain	82.97	80.21	81.67	87.09	0.001
Food insecurity	88.79	82.32	90.05	94.31	0.000
Housing instability	86.03	81.05	86.65	90.59	0.000
Social isolation	83.33	81.05	81.90	87.09	0.002
Safety or interpersonal violence	71.47	72.63	70.14	71.55	0.854
Transportation	93.09	89.47	92.76	91.55	0.000
Utility needs	69.80	67.58	70.36	71.55	0.720
Number of established relationships with social resources, Avg	6.02	5.95	6.06	6.04	0.300
Established relationship with social resources, %					
Food insecurity	95.16	92.58	96.23	96.52	0.000
Housing instability	85.45	88.57	87.47	80.68	0.000
Utility needs	93.33	92.21	93.25	94.50	0.015
Financial resource strain	85.96	88.19	88.09	81.91	0.000
Transportation	97.42	97.41	97.07	97.75	0.031
Employment	91.49	88.32	88.79	96.36	0.000
Social isolation	86.99	89.35	87.85	83.92	0.002

Safety or interpersonal violence	93.69	91.59	93.87	95.72	0.000

Table 3.5 summarizes care management characteristics of MDPCP primary care practices by care management options (50/50 vs. 70/30 vs. 100/0). Practices in the 50/50 category had higher average risk-stratified care management scores (15.55 vs. 13.58) and higher average social needs management scores (14.69 vs. 11.12) compared to practices in the 100/0 category. Practices in the 100/0 option on average had higher comprehensive medication management scores (6.70).

Table 3.5: Care Management Characteristics of MDPCP Primary Care Practices by Care Management Delivery Options, January 1, 2022 – March 31, 2023

	Total Sample N=468	Care Management Option: 50/50 n= 223	Care Management Option: 70/30 n=145	Care Management Option: 100/0 n= 100	*p-value*
Comprehensive Care Management, Avg	48.64	49.89	49.48	44.83	0.337
(1) Risk-Stratified Care Management, Avg	14.93	15.55	14.95	13.58	0.000
Risk-stratified beneficiaries, Avg	97.78	97.82	97.57	97.96	0.022
Beneficiaries under care management, Avg	18.33	17.35	17.01	22.20	0.000
Beneficiaries under longitudinal care management with care plans, %					
Some (1-50%)	31.73	18.08	41.67	46.91	0.000
Most (51-95%)	20.60	8.19	24.76	41.04	
All (96-100%)	47.16	73.26	33.57	10.75	
(2) Self-Management and Support, Avg	4.59	4.74	4.5	4.34	0.000
(3) Transitional Care Management	5.28	5.30	5.18	5.38	0.935
Patient ED discharge follow up, %	84.93	83.98	82.88	89.7	0.004
Patient hospital discharge follow up, %	83.62	82.65	81.67	88.31	0.000
(4) Comprehensive Medication Management, Avg	6.23	6.06	6.17	6.70	0.000

Practices providing CMM, %	97.82	96.75	98.57	99.02	0.000
(5) Social Needs Management, Avg	13.98	14.69	14.98	11.12	0.293
Populations screened for unmet social needs, %					
Targeted subpopulation	36.83	38.49	33.10	38.44	0.083
All beneficiaries	62.66	60.59	66.67	61.56	
Number of social needs screened, Avg	6.00	6.11	6.57	4.89	0.298
Types of social needs screened, %					
Financial resource strain	82.97	90.88	82.14	67.43	0.000
Food insecurity	88.79	96.29	87.62	74.59	0.000
Housing instability	86.03	94.44	83.33	71.99	0.000
Social isolation	83.33	92.12	79.29	70.36	0.000
Safety or interpersonal violence	71.47	80.53	79.05	42.02	0.000
Transportation	93.09	97.68	91.67	85.34	0.000
Utility needs	69.80	77.59	79.05	40.72	0.000
Number of established relationships with social resources, Avg	6.02	6.13	6.60	4.89	0.307
Established relationship with social resources, %					
Food insecurity	95.16	95.83	95.65	92.58	0.000
Housing instability	85.45	80.69	92.00	88.24	0.000
Utility needs	93.33	95.23	95.48	80.00	0.000
Financial resource strain	85.96	80.78	93.91	87.44	0.000
Transportation	97.42	97.94	97.92	95.42	0.000
Employment	91.49	95.19	93.59	72.09	0.000
Social isolation	86.99	81.21	94.89	90.74	0.000
Safety or interpersonal violence	93.69	94.43	95.78	85.27	0.000

Figure 3.1. depicts MDPCP HEART payments by care management delivery options among all practices and stratified by MUA designation. Among all practices and practices with MUA designations care management delivery option 50/50 received the highest average HEART payments while primary care practices in the 70/30 category had the lowest average HEART payments.

Figures 3.2. – 3.3 depict MDPCP comprehensive care management composite scores and social needs management score by care management delivery options among all practices and stratified by MUA designation. Primary care practices in the 100/0 care management delivery category consistently had the lowest average complex care management and social needs management scores**.**

Figure 3.1: MDPCP HEART Payments by Care Management Delivery Options among All Practices, MUA-designated Practices, and Non-MUA-designated Practices, 2022 – 2023

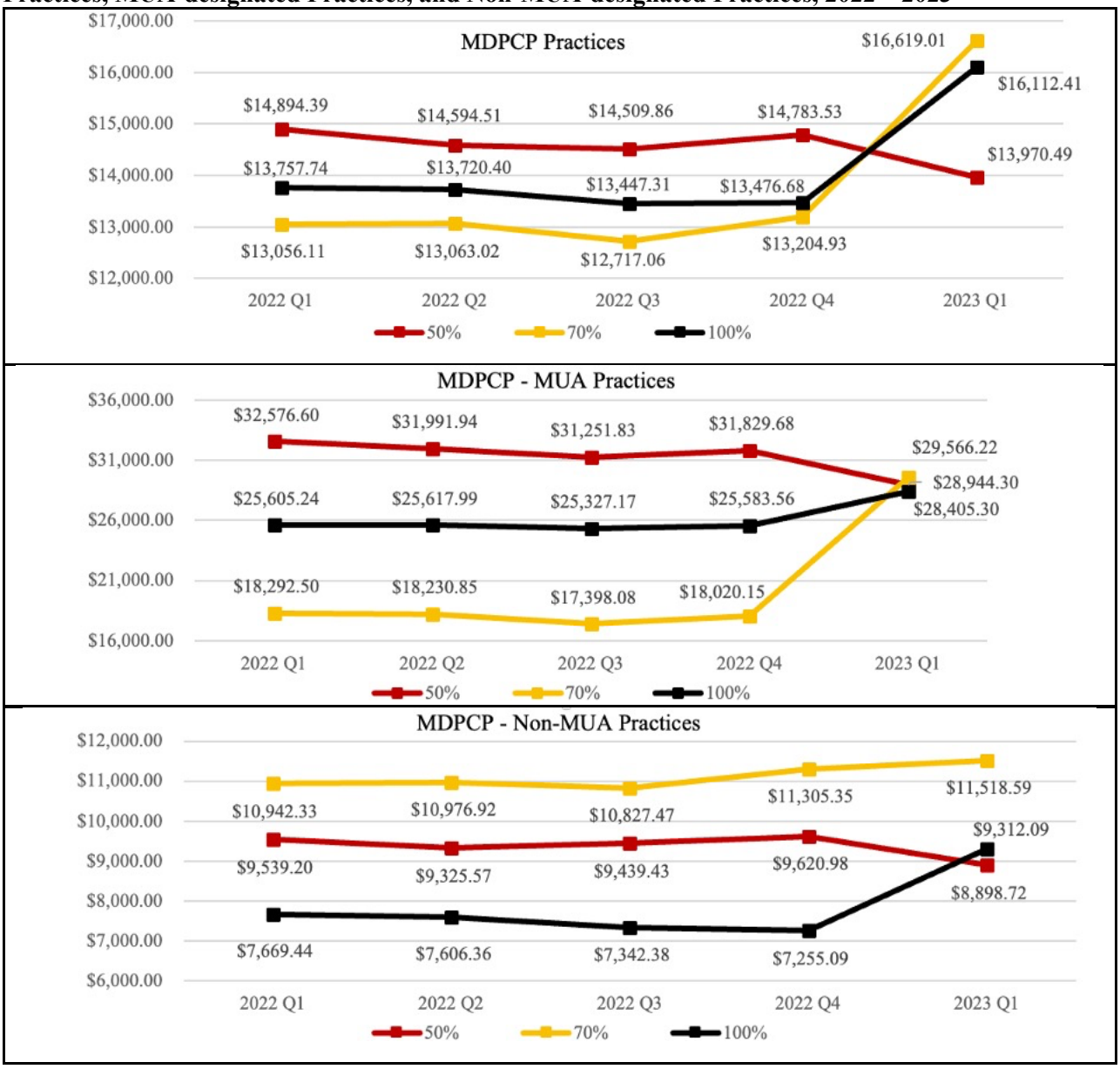


Figure 3.2: Comprehensive Care Management Score by Care Delivery Management Options among All Practices, MUA-designated Practices, and Non-MUA-designated Practices, 2022 – 2023



Figure 3.3: Social Needs Management Score by Care Delivery Management Options among All Practices, MUA-designated Practices, and Non-MUA-designated Practices, 2022 – 2023

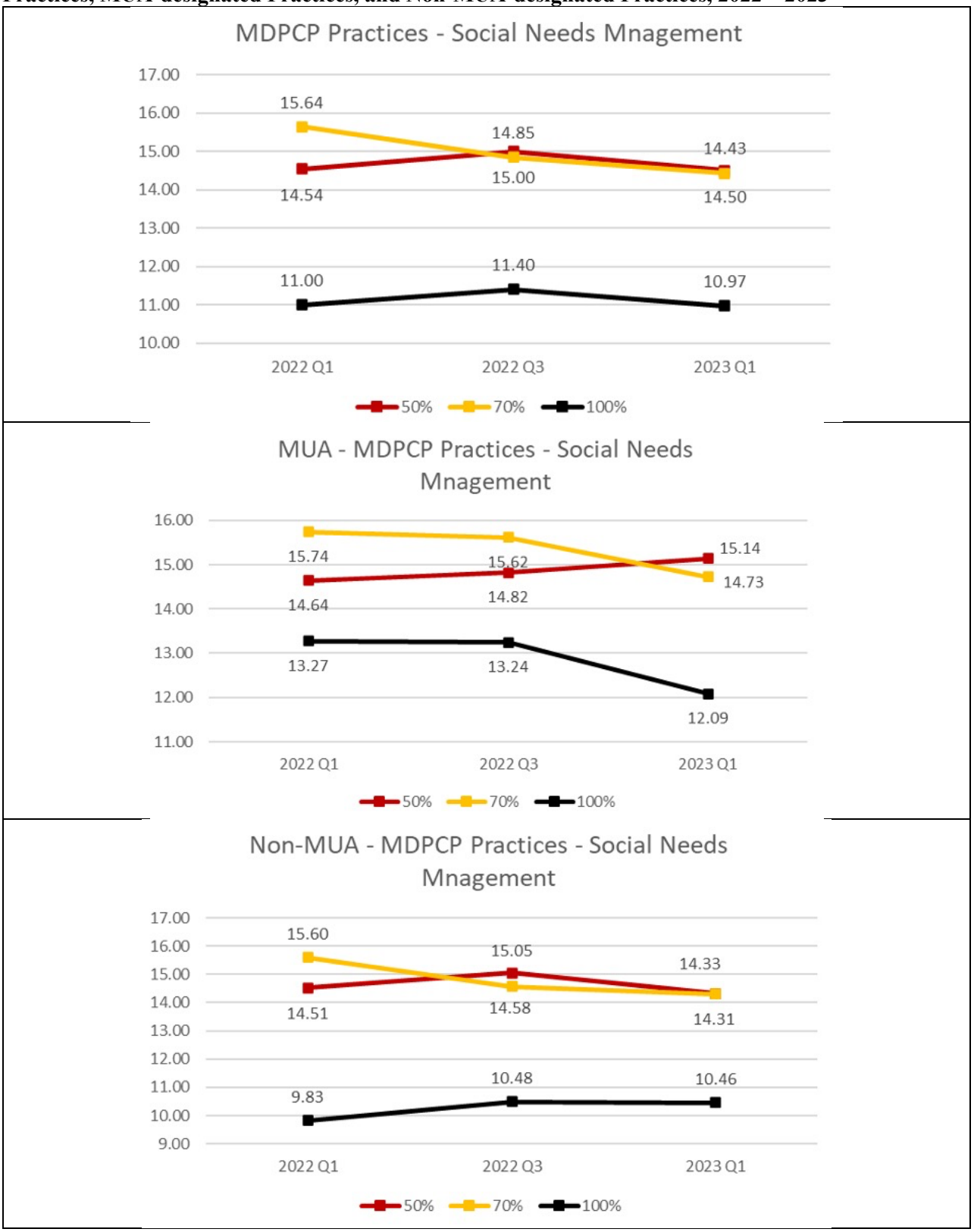


Table 3.6. show the results of the Poisson mixed-effects model 1 and model 2, which assessed whether HEART payments were associated with increased comprehensive care management composite scores and whether this association was altered by care management delivery options respectively. In **Model 1,** HEART payments were not statistically significantly associated with changes in primary care practice-level comprehensive care management scores; however, care management delivery options were. Primary care practices in the 100/0 care management delivery option (IRR .95, 95% confidence interval [CI]: 0.99-0.98) had lower comprehensive care management scores compared to primary care practices in the 50/50 care management delivery option. In **Model 2**, the interaction term between log HEART payments and care management delivery option was statistically significantly associated with increased primary care-level comprehensive care management scores among primary care practices in the 100/0 care management delivery option (IRR 1.02, CI: 0.99- 0.98). The slope of the interaction term is 0.02, which suggests that as HEART payments increase, care management scores among primary care practices in the 100/0 care management delivery option increase as well.

Table 3.6: Comprehensive Care Management, Poisson mixed-effects models, 2022 – 2023

	Model 1: Full Model N:468; Observations: 1,374	Model 2: Full Model with Interaction Term N:468; Observations: 1,374
	IRR (95%CI)	IRR (95%CI)
HEART Payments	1.00 (0.99, 1.01)	0.99 (0.98, 1.00)
Care Management Options		
Practice + CTO: 50%/50%	[Reference]	[Reference]
Practice + CTO: 70%/30%	0.90 (0.96, 1.01)	0.94 (0.82, 1.08)
Practice only: 100%/0%	0.95 (0.92, 0.98)**	0.77 (0.66, 0.91) **
Care Management Options x HEART Payments		
Practice + CTO: 50%/50% x HEART Payments	[Reference]	[Reference]
Practice + CTO: 70%/30% x HEART Payments	----	1.01 (0.99, 1.02)
Practice only: 100%/0% x HEART Payments	----	1.02 (1.01, 1.04) *
Random-effects Parameters		
Primary Care Practice	0.004 (0.003, 0.006)	0.004 (0.002, 0.005)

*p< 0.05, ** p<0.01, ***p<0.001. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, HEART., Health Equity Advancement Resource and Transformation, CTO., Care Transformation Organizations. **Model 1:** Log HEART payments, Care management delivery options (100/0, 50/50,

70/30), Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level capabilities: team huddles focused on beneficiary care (never; ad hoc; monthly; every two weeks/ weekly; daily), team meeting to discuss high-risk beneficiaries (never; ad hoc; monthly; every two weeks/ weekly; daily), review quality improvement data (never; ad hoc; annually; quarterly/ monthly; weekly), 24/7 electronic record access, practice site provides 24/7 coverage, enhanced appointment & communication capabilities, alternative approaches to care, patients are seen by the provider or care team they are empaneled, how often offices use data to plan the care they provide, whether offices use data to plan the care they provide, referral management w/ specialists, use of cost measures, use of utilization measures, use of patient experience measures, care management fee, performance based incentive payment, comprehensive primary care payment, Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I,II,III). **Model 2:** Model 1 + interaction term between Log HEART payments and Care management delivery options (50/50, 70/30, 100/0).

Table 3.7. show the results of the MUA designation stratified Poisson mixed-effects models which assessed whether HEART payments were associated with increased comprehensive care management scores and whether this association was altered by care management delivery options. Model 3 and model 4 are stratified models that only include 123 primary care practices with MUA designations. In **Model 3,** HEART payments were not associated with changes in primary care practice-level comprehensive care management scores; however, care management delivery options were. Primary care practices in the 100/0 care management delivery option (IRR 1.02, CI: 0.88- 0.98) had lower comprehensive care management scores compared to primary care practices in the 50/50 care management delivery option. In **Model 4**, the interaction terms between HEART payments and care management delivery options were not statistically significant.

Model 5 and model 6 are stratified models that only include 345 primary care practices with non-MUA designations. In **Model 5,** HEART payments and care management delivery options were not statistically significantly associated with changes in primary care practice-level comprehensive care management scores. In **Model 6**, the interaction term between HEART

payments and care management delivery options 50/50 (IRR 1.03, CI: 1.00- 1.04) and 70/30 (IRR 1.02, CI: 1.00- 1.05) were associated with increased primary care-level comprehensive care management scores. The slope of the interaction term between HEART payments and care management option 100/0 was 0.03, which demonstrates that as HEART payments increase, care management scores among primary care practices in the 100/0 care management delivery option increase as well. The slope of the interaction term between HEART payments and care management option 70/30 was 0.02, which suggests that as HEART payments increase, care management scores among primary care practices in the 70/30 care management delivery option increase as well.

Table 3.7: Comprehensive Care Management, Poisson mixed-effects MUA Designation Stratified Models, 2022 – 2023

	Model 3: MUA Only Full Model N:123; Obvs.: 358	Model 4: MUA Only Full Model with Interaction Term N:123; Obvs.: 358	Model 5: Non-MUA Only Full Model N: 345; Obvs.: 1,016	Model 6: Non-MUA Only Full Model with Interaction Term N: 345; Obvs.: 1,016
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
HEART Payments	1.01 (0.99, 1.02)	1.01 (0.99, 1.04)	0.99 (0.99, 1.01)	0.99 (0.98, 1.00)
Care Management Options				
Practice + CTO: 50%/50%	[Reference]	[Reference]	[Reference]	[Reference]
Practice + CTO: 70%/30%	0.98 (0.88, 0.98)	1.23 (0.94, 1.63)	0.98 (0.96, 1.02)	0.83 (0.71, 0.98)*
Practice only: 100%/0%	0.93 (0.88, 0.97)**	0.86 (0.64, 1.16)	0.96 (0.93, 1.00)	0.77 (0.63, 0.93) **
Care Management Options x HEART Payments				
Practice + CTO: 50%/50% x HEART Payments	[Reference]	[Reference]	[Reference]	[Reference]
Practice + CTO: 70%/30% x HEART Payments	----	0.98 (0.95, 1.00)	----	1.02 (1.00, 1.04)*
Practice only: 100%/0% x HEART Payments	----	1.01 (0.98, 1.04)	----	1.03 (1.01, 1.05)*

Random-effects Parameters				
Primary Care Practice	0.003 (0.001, 0.007)	0.002 (0.001, 0.007)	0.003 (0.001, 0.005)	0.002 (0.001, 0.005)

*p< 0.05, ** p<0.01. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, MUA., medically underserved area, Obvs., Observations, HEART., Health Equity Advancement Resource and Transformation, CTO., Care Transformation Organizations. **Model 3 / Model 5:** Log HEART payments, Care management delivery options (100/0, 50/50, 70/30), Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level capabilities: team huddles focused on beneficiary care (never; ad hoc; monthly; every two weeks/ weekly; daily), team meeting to discuss high-risk beneficiaries (never; ad hoc; monthly; every two weeks/ weekly; daily), review quality improvement data (never; ad hoc; annually; quarterly/ monthly; weekly), 24/7 electronic record access, practice site provides 24/7 coverage, enhanced appointment & communication capabilities, alternative approaches to care, patients are seen by the provider or care team they are empaneled, how often offices use data to plan the care they provide, whether offices use data to plan the care they provide, referral management w/ specialists, use of cost measures, use of utilization measures, use of patient experience measures, care management fee, performance based incentive payment, comprehensive primary care payment, Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I,II,III). **Model 4 - Model 6:** Model 3 / Model 5 + interaction term between Log HEART payments and Care management delivery options (50/50, 70/30, 100/0).

Table 3.8. shows the results of the Poisson mixed-effects model 7 and model 8, which assessed whether HEART payments were associated with increased social needs management composite scores and whether care management delivery options altered this association. In **Model 7,** HEART payments were not statistically significantly associated with changes in primary care practice-level comprehensive social needs management scores; however, care management delivery options were. Primary care practices in the 100/0 care management delivery option (IRR .81, CI: 0.74- 0.88) had lower comprehensive care management scores than those in the 50/50 care management delivery option. In **Model 8**, the interaction term between HEART payments and care management delivery option 100/0 (IRR 112, CI: 1.07- 1.18) was statistically significantly associated with primary care-level social needs management scores. The slope of the interaction term between HEART payments and care management option 100/0 was 0.12, which suggests that as HEART payments increase, social needs management scores among primary care practices in the 100/0 care management delivery option also increase.

Table 3.8: Social Needs Management, Poisson mixed-effects models, 2022 – 2023

	Model 7: Full Model N:468 ; Observations: 1,374	Model 8: Full Model with Interaction Term N:468; Observations: 1,374
	IRR (95%CI)	IRR (95%CI)
HEART Payments	1.02 (0.99, 1.05)	0.99 (0.95, 1.01)
Care Management Options		
Practice + CTO: 50%/50%	[Reference]	[Reference]
Practice + CTO: 70%/30%	0.97 (0.74, 0.88)	0.77 (0.52, 1.15)
Practice only: 100%/0%	0.81 (0.74, 0.88)***	0.29 (0.19, 0.47)***
Care Management Options x HEART Payments		
Practice + CTO: 50%/50% x HEART Payments	[Reference]	[Reference]
Practice + CTO: 70%/30% x HEART Payments	----	1.02 (0.98, 1.08)
Practice only: 100%/0% x HEART Payments	----	1.12 (1.06, 1.18)***
Random-effects Parameters		
Primary Care Practice	0.08 (0.07, 0.10)	0.08 (0.07, 0.10)

***p<0.001. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, HEART., Health Equity Advancement Resource and Transformation, CTO., Care Transformation Organizations. **Model 7:** log HEART payments, Care management delivery options (50/50, 70/30, 100/0), Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level capabilities: team huddles focused on beneficiary care (never; ad hoc; monthly; every two weeks/ weekly; daily), team meeting to discuss high-risk beneficiaries (never; ad hoc; monthly; every two weeks/ weekly; daily), review quality improvement data (never; ad hoc; annually; quarterly/ monthly; weekly), 24/7 electronic record access, practice site provides 24/7 coverage, enhanced appointment & communication capabilities, alternative approaches to care, patients are seen by the provider or care team they are empaneled, how often offices use data to plan the care they provide, whether offices use data to plan the care they provide, referral management w/ specialists, use of cost measures, use of utilization measures, use of patient experience measures, care management fee, performance based incentive payment, comprehensive primary care payment, Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I,II,III). **Model 8:** Model 7 + interaction term between log HEART payments and Care management delivery options (50/50, 70/30, 100/0).

Table 3.9. shows the results of the MUA-designation stratified Poisson mixed-effects models 9, 10, 11, and 12, which assessed whether the association between HEART payments and social needs management scores was altered by care management delivery options. Model 9 and

model 10 are stratified models that only include 123 primary care practices with MUA designations. In **Model 9,** HEART payments were not statistically significantly associated with changes in primary care practice-level comprehensive care management scores. In **Model 10**, the interaction term between log HEART payments and care management delivery options was not statistically significant.

Models 11 and 12 are stratified models that only include 345 primary care practices with non-MUA designations. In **Model 11,** HEART payments were not statistically significantly associated with changes in primary care practice-level social needs management scores; however, care management delivery options were. Primary care practices in the 100/0 care management delivery option (IRR .78, 95% confidence interval [CI]: 0.71- 0.88) had lower social needs management scores compared to primary care practices in the 50/50 care management delivery option. In **Model 12**, the interaction term between log HEART payments and care management delivery option was statistically significantly associated with increased primary care-level social needs management scores among primary care practices in the 100/0 care management delivery option (IRR 1.12, CI: 1.05- 1.20). The slope of the interaction term between HEART payments and care management option 100/0 is 0.12, which suggests that as HEART payments increase, social needs management scores among primary care practices in the 100/0 care management delivery option also increase.

Table 3.9: Social Needs Management, Poisson mixed-effects models, 2022 – 2023

	Model 9: MUA Only Full Model N:123; Obvs.: 358	Model 10: MUA Only Full Model with Interaction Term Model N:123; Obvs.: 358	Model 11: Non-MUA Only Full Model N: 345; Obvs.:1,016	Model 12: Non-MUA Only Full Model with Interaction Term N: 345; Obvs.: 1,016
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
HEART Payments	1.04 (0.99, 1.09)	1.01 (0.94, 1.09)	1.02 (0.99, 1.05)	0.99 (0.95, 1.03)

Care Management Options				
Practice + CTO: 50%/50%	[Reference]	[Reference]	[Reference]	[Reference]
Practice + CTO: 70%/30%	1.04 (0.89, 1.22)	1.21 (0.52, 2.77)	0.96 (0.88, 1.04)	0.72 (0.46, 1.15)
Practice only: 100%/0%	0.86 (0.73, 1.02)	0.36 (0.14, 0.91)	0.79*** (0.71, 0.88)	0.30*** (0.17, 0.52)
Care Management Options x HEART Payments				
Practice + CTO: 50%/50% x HEART Payments	[Reference]	[Reference]	[Reference]	[Reference]
Practice + CTO: 70%/30% x HEART Payments	----	0.98 (0.89, 1.07)	----	1.03 (0.98, 1.09)
Practice only: 100%/0% x HEART Payments	----	1.10 (0.99, 1.21)	----	1.12** (1.05, 1.20)
Random-effects Parameters				
Primary Care Practice	0.08 (0.06, 0.12)	0.08 (0.05, 0.11)	0.07 (0.05, 0.09)	0.07 (0.05, 0.09)

** p<0.01, ***p<0.001. Abbreviations: IRR., incidence risk ratios, CI., Confidence Intervals, MUA., medically underserved area, Obvs., Observations, HEART., Health Equity Advancement Resource and Transformation, CTO., Care Transformation Organizations. **Model 9 - Model 11:** log HEART payments, Care management delivery options (50/50, 70/30, 100/0), Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level capabilities: team huddles focused on beneficiary care (never; ad hoc; monthly; every two weeks/ weekly; daily), team meeting to discuss high-risk beneficiaries (never; ad hoc; monthly; every two weeks/ weekly; daily), review quality improvement data (never; ad hoc; annually; quarterly/ monthly; weekly), 24/7 electronic record access, practice site provides 24/7 coverage, enhanced appointment & communication capabilities, alternative approaches to care, patients are seen by the provider or care team they are empaneled, how often offices use data to plan the care they provide, whether offices use data to plan the care they provide, referral management w/ specialists, use of cost measures, use of utilization measures, use of patient experience measures, care management fee, performance based incentive payment, comprehensive primary care payment, Practice organization-level characteristics: total number of providers, , percent of providers that are family and general physicians, MDPCP participation track (I ,II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County**).** **Model 10 - Model 12:** Model 9 -Model 11 + interaction term between log HEART payments and Care management delivery options (100/0, 50/50, 70/30).

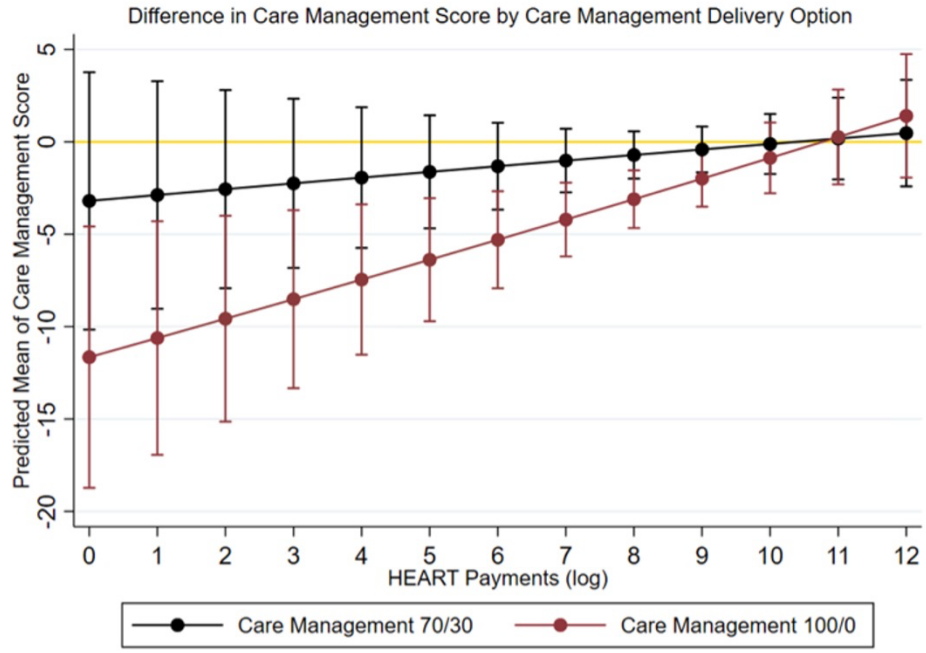
Figure 3.4. shows the average marginal effect of care management delivery options on primary care practice-level comprehensive care management scores at various amounts of HEART payments. Among all MDPCP primary care practices, the largest difference in the predicted mean care management scores between the 50/50 and 100/0 care management delivery options is -11.7 points when HEART payments are set to zero. As HEART payments increase, the difference in the predicted mean care management scores decreases to -1.99 points.

Figure 3.5. shows the average marginal effect of care management delivery options on primary care practice-level comprehensive care management scores at various amounts of HEART payments among MUA-designated practices. While the largest difference in the predicted mean care management scores between the 50/50 and 100/0 care management delivery options is when HEART payments are set to zero among MUA primary care practices, these differences were only statistically significant closer to the higher levels of HEART payments**.**

Figure 3.6. shows the average marginal effect of care management delivery options on primary care practice-level comprehensive care management scores at various amounts of HEART payments among non-MUA-designated practices. Among non-MUA MDPCP primary care practices, the largest difference in the predicted mean care management scores between the 50/50 and 100/0 care management delivery options, -12.6 points, and the 50/50 and 70/30 care management delivery option, -8.76, is when HEART payments are set to zero. As HEART payments increase, the difference in the predicted mean care management scores between 50/50 and 100/0 decreases to -2.16 points and -0.82 points between 50/50 and 70/30.

Figure 3.4: Marginal Probabilities of Comprehensive Care Management, January 1, 2022 – March 31, 2023

Model 2: Full Model with Interaction Term Model -N:468; Observations: 1,374

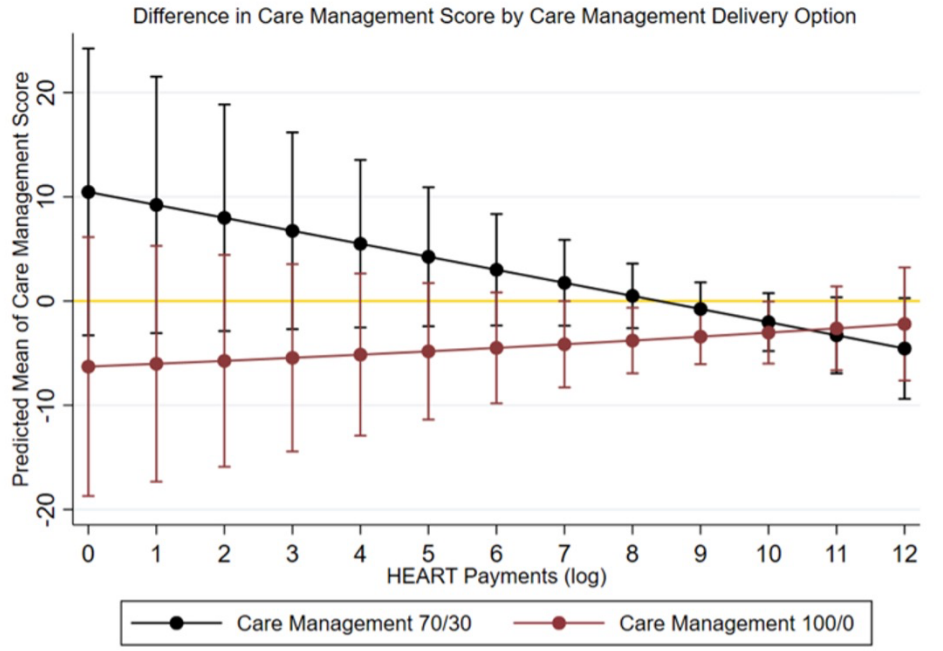


	CTO: 50/50	CTO: 70/30			CTO: 100/0		
HEART Payments (log)	Std. err.	Predicted Mean Care Management Scores	Std. err.	p-value	Predicted Mean Care Management Scores	Std. err.	p-value
0		-3.20	3.55	0.369	-11.66	3.61	0.001
1		-2.88	3.14	0.360	-10.62	3.23	0.001
2		-2.56	2.74	0.349	-9.57	2.84	0.001
3		-2.25	2.34	0.336	-8.52	2.46	0.001
4		-1.93	1.94	0.319	-7.45	2.08	0.000
5		-1.62	1.56	0.298	-6.38	1.70	0.000
6		-1.32	1.20	0.272	-5.30	1.34	0.000
7		-1.01	0.88	0.249	-4.21	1.02	0.000
8		-0.71	0.65	0.276	-3.10	0.80	0.000
9		-0.41	0.63	0.516	-1.99	0.77	0.010
10		-0.11	0.83	0.891	-0.87	0.98	0.373
11		0.18	1.13	0.872	0.26	1.31	0.840
12		0.47	1.47	0.747	1.41	1.70	0.409

Abbreviations: CTO., Care Transformation Organizations, HEART., Health Equity Advancement Resource and Transformation, Std.err., standard error.

Figure 3.5: Marginal Probabilities of Comprehensive Care Management among MUA-designated Practices, January 1, 2022 – March 31, 2023

Model 4: MUA Only Full Model with Interaction Term - n:123; Observations: 358

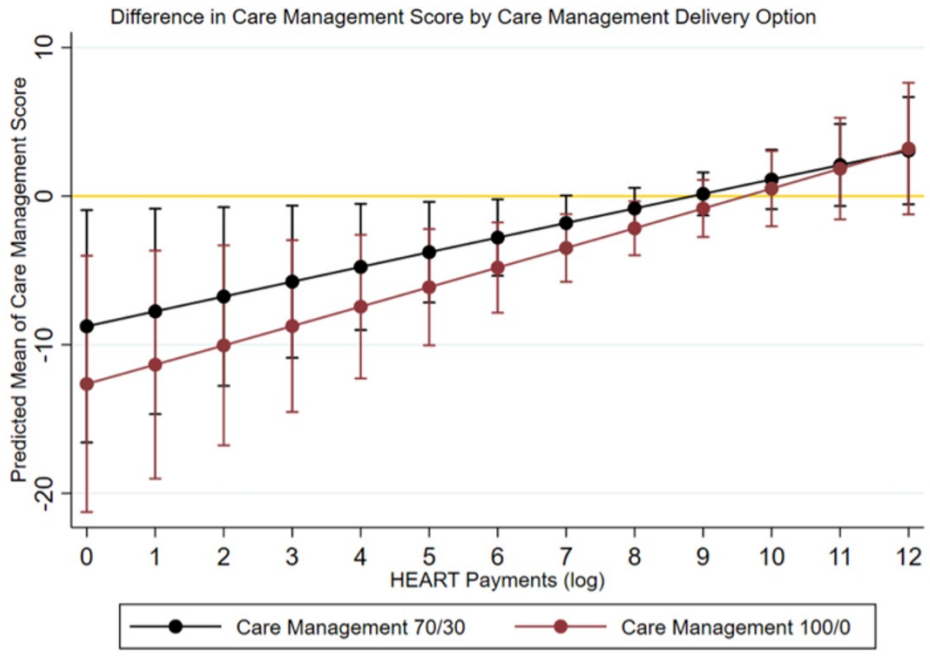


	CTO: 50/50	CTO: 70/30			CTO: 100/0		
HEART Payments (log)	Std. err.	Predicted Mean Care Management Scores	Std. err.	p-value	Predicted Mean Care Management Scores	Std. err.	p-value
0		10.46	7.02	0.136	-6.29	6.34	0.321
1		9.23	6.28	0.142	-6.0	5.77	0.297
2		7.98	5.54	0.150	-5.74	5.1	0.268
3		6.74	4.82	0.162	-5.45	4.58	0.235
4		5.50	4.10	0.180	-5.14	3.97	0.195
5		4.25	3.40	0.212	-4.83	3.34	0.149
6		3.00	2.73	0.271	-4.49	2.71	0.098
7		1.75	2.10	0.405	-4.15	2.11	0.050
8		0.49	1.58	0.754	-3.79	1.60	0.018
9		-0.76	1.30	0.558	-3.42	1.35	0.011
10		-2.02	1.42	0.154	-3.03	1.52	0.046
11		-3.29	1.86	0.077	-2.62	2.05	0.201
12		-4.55	2.47	0.065	-2.20	2.77	0.427

Abbreviations: CTO., Care Transformation Organizations, HEART., Health Equity Advancement Resource and Transformation, Std.err., standard error.

Figure 3.6: Marginal Probabilities of Comprehensive Care Management among Non-MUA-designated Practices, January 1, 2022 – March 31, 2023

Model 6: Non-MUA Only Full Model with Interaction Term - n: 345; Observations: 1,016



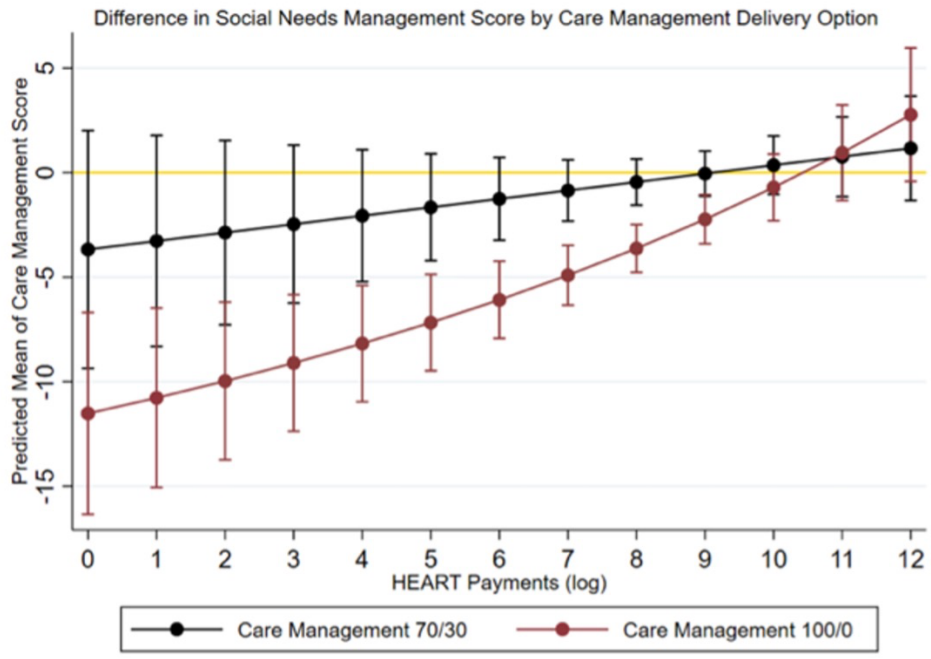
	CTO: 50/50	CTO: 70/30			CTO: 100/0		
HEART Payments (log)		Predicted Mean Care Management Scores	Std. err.	p-value	Predicted Mean Care Management Scores	Std. err.	p-value
0		-8.76	3.99	0.028	-12.64	4.40	0.004
1		-7.75	3.52	0.028	-11.34	3.92	0.004
2		-6.75	3.07	0.028	-10.05	3.43	0.003
3		-5.76	2.61	0.028	-8.74	2.95	0.003
4		-4.76	2.16	0.028	-7.44	2.47	0.003
5		-3.77	1.73	0.029	-6.13	1.99	0.002
6		-2.79	1.31	0.033	-4.81	1.55	0.002
7		-1.80	0.94	0.055	-3.49	1.16	0.003
8		-0.825	0.70	0.241	-2.16	0.93	0.020
9		0.15	0.74	0.837	-0.83	0.98	0.396
10		1.12	1.02	0.270	0.51	1.29	0.694
11		2.10	1.41	0.137	1.85	1.74	0.288
12		3.06	1.84	0.096	3.20	2.26	0.156

Abbreviations: CTO., Care Transformation Organizations, HEART., Health Equity Advancement Resource and Transformation, Std.err., standard error.

Figure 3.7. shows the average marginal effect of care management delivery options on primary care practice-level social needs management scores at various levels of HEART payments. Among all MDPCP primary care practices the largest difference in the predicted mean social needs management scores between the 50/50 and 100/0 care management delivery options is -11.5 points, when HEART payments are set to zero. As HEART payments increase the difference in the predicted mean social needs management scores decrease to -2.23 points**.**

Figure 3.7: Marginal probabilities of social needs management, January 1, 2022 – March 31, 2023

Model 8: - Full Model with Interaction Term - N:468; Observations: 1,374



	CTO: 50/50	CTO: 70/30			CTO: 100/0		
HEART Payments (log)		Predicted Mean Care Management Scores	Std. err.	p-value	Predicted Mean Care Management Scores	Std. err.	p-value
0		-3.68	2.90	0.205	-11.52	2.46	0.000
1		-3.27	2.57	0.204	-10.77	2.19	0.000
2		-2.87	2.25	0.202	-9.97	1.92	0.000
3		-2.46	1.93	0.201	-9.11	1.67	0.000
4		-2.06	1.61	0.201	-8.18	1.42	0.000
5		-1.66	1.30	0.203	-7.17	1.18	0.000
6		-1.26	1.01	0.214	-6.09	0.94	0.000

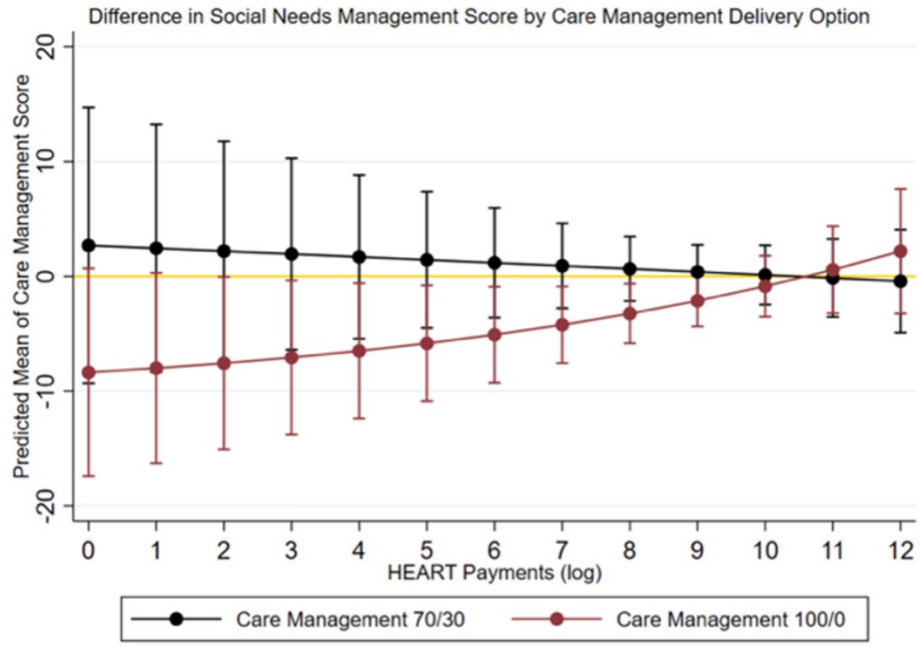
7		-0.85	0.75	0.254	-4.91	0.73	0.000
8		-0.45	0.56	0.425	-3.63	0.59	0.000
9		-0.05	0.55	0.932	-2.23	0.60	0.000
10		0.36	0.71	0.616	-0.71	0.81	0.382
11		0.36	0.97	0.434	0.95	1.17	0.414
12		1.17	1.27	0.361	2.77	1.63	0.089

Abbreviations: CTO., Care Transformation Organizations, HEART., Health Equity Advancement Resource and Transformation, Std.err., standard error.

Figure 3.8. shows the average marginal effect of care management delivery options on primary care practice-level social needs management scores at various levels of HEART payments among MUA-designated practices. Among MUA MDPCP primary care practices, the largest statistically significant difference in the predicted mean social needs management scores between the 50/50 and 100/0 care management delivery options was -7.57 points, when HEART payments were set to 3. As HEART payments increased, the difference in the predicted mean social needs management scores between 50/50 and 100/0 decreased to -3.24 points**.**

Figure 3.8: Marginal probabilities of social needs management among MUA-designated practices, January 1, 2022 – March 31, 2023

Model 10: MUA Only – Full Model with Interaction Term - n:123; Observations: 358



	CTO: 50/50	CTO: 70/30			CTO: 100/0		
HEART Payments (log)		Predicted Mean Care Management Scores	Std. err.	p-value	Predicted Mean Care Management Scores	Std. err.	p-value
0		2.69	6.13	0.661	-8.37	4.62	0.070
1		2.44	5.50	0.657	-8.00	4.23	0.059
2		2.12	4.88	0.653	-7.57	3.83	0.048
3		1.94	4.26	0.648	-7.07	3.43	0.039
4		1.69	3.64	0.642	-6.50	3.01	0.031
5		1.43	3.03	0.636	-5.84	2.58	0.023
6		1.18	2.44	0.629	-5.09	2.14	0.017
7		0.92	1.89	0.627	-4.23	1.70	0.013
8		0.65	1.43	0.649	-3.24	1.32	0.014
9		0.39	1.20	0.747	-2.13	1.14	0.062
10		0.12	1.31	0.929	-0.86	1.35	0.523
11		-0.15	1.73	0.930	0.57	1.94	0.769
12		-0.43	2.29	0.852	2.19	2.77	0.430

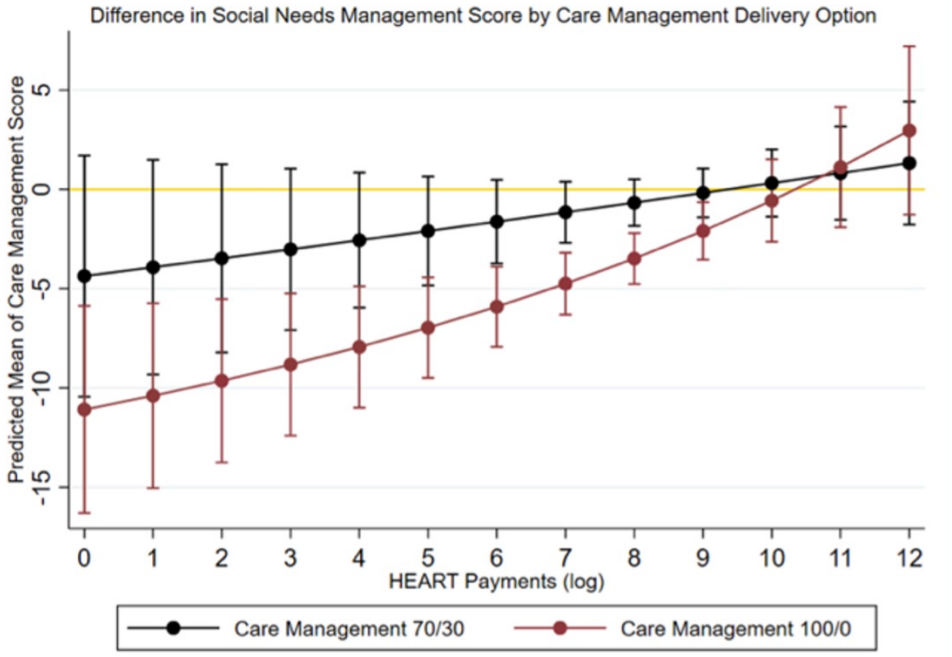
Abbreviations: CTO., Care Transformation Organizations, HEART., Health Equity Advancement Resource and Transformation, Std.err., standard error.

Figure 3.9. shows the average marginal effect of care management delivery options on primary care practice-level social needs management scores at various levels of HEART

payments among non-MUA-designated practices. Among non-MUA MDPCP primary care practices, the largest difference in the predicted mean social needs management scores between the 50/50 and 100/0 care management delivery options is -11.08 points, when HEART payments are set to zero. As HEART payments increase the difference in the predicted mean care management scores between 50/50 and 100/0 decreases to -2.09 points.

Figure 3.9: Marginal probabilities of social needs management among non-MUA-designated practices, January 1, 2022 – March 31, 2023

Model 12: Non-MUA Only – Full Model with Interaction Term - n: 345; Observations: 1,016



	CM: 50/50	CM: 70/30			CM: 100/0		
HEART Payments (log)		Predicted Mean Care Management Scores	Std. err.	p-value	Predicted Mean Care Management Scores	Std. err.	p-value
0		-4.36	3.10	0.159	-11.08	2.66	0.000
1		-3.92	2.76	0.155	-10.40	2.38	0.000
2		-3.47	2.42	0.151	-9.64	2.10	0.000
3		-3.02	2.08	0.146	-8.82	1.83	0.000
4		-2.56	1.73	0.140	-7.93	1.56	0.000
5		-2.09	1.40	0.134	-6.96	1.29	0.000
6		-1.62	1.07	0.131	-5.91	1.03	0.000
7		-1.15	0.79	0.145	-4.75	0.79	0.000

8		-0.66	0.60	0.267	-3.48	0.65	0.000
9		-0.18	0.63	0.780	-2.09	0.74	0.005
10		0.32	0.86	0.711	-0.56	1.06	0.594
11		0.82	1.20	0.493	1.12	1.54	0.469
12		1.33	1.58	0.400	2.97	2.16	0.170

Abbreviations: CTO., Care Transformation Organizations, HEART., Health Equity Advancement Resource and Transformation, Std.err., standard error.

Discussion

HEART Payments are innovative because they apply our understanding of the interaction between SDOH and health outcomes to provide additional support to primary care practices that treat patients with high disease burden and relative privilege. These payments align with expert recommendations, which encourage the exploration of alternative payment models that consider measures such as the Area Deprivation Index (ADI) (Phillips et al., 2023). Congress and the Secretary of Health and Human Services also recommend using measures such as ADI to adjust payments to primary care providers (Breslau et al., 2022). Recently, Medicare programs such as Accountable Care Organization Realizing Equity, Access, and Community Health and the Medicare Shared Savings Program began providing payments adjusted by patient ADI scores (Phillips et al., 2023). A survey of primary care providers found that two of the top three recommendations to transform primary care in the United States centered on changing how primary care is financed and moving away from fee-for-service reimbursement models (Phillips et al., 2023; Etz and Kurt et al., 2021). Unfortunately, non-fee-for-service payment models are far from the norm, with less than 50 percent of primary care providers in the United States receiving any form of value-based payments (Horstman and Lewis, 2023).

HEART payments' impact on care management and social needs service delivery varies by care management delivery option. CTOs provide the most comprehensive care management and social needs services; however, increased heart payments are associated with increasing

access to care management services among primary care practices that delivery care management in-house. These practices, on average, tend to have higher percentages of Black (25.16%) and Hispanic patients (1.83%), lower percentages of HCC complex level (14.87%), and dual-eligible patients (15.00%) and 32.90% have MUA designations, versus the total sample (26.06%). A recent study found that among physician practices, only 16 percent screened for social needs, and another found that practices, on average only screen for 2.4 social needs (Brewster et al., 2020 & Fraze et al., 2019). MDPCP practices surpass these results. On average, practices screen for six social needs and have established relationships with six social needs service providers.

While value-based program participation is more common among larger and urban practices, this is not necessarily the case with MDPCP participation, which has a robust sample of small and rural practices (Horstman and Lewis, 2023). MDPCP HEART payments provide additional support to providers that generally do not have room to risk entering value-based plans with downside risk. Though historically, there has been debate about the concept of adjusting payments based on socioeconomic factors, and early efforts to do so had mixed results, more recent discussions focus on the correct way to implement these adjustments rather than whether they should be done or not (Durfey et al., 2017). The association between increased HEART payments and increased delivery of social needs management aligns with the literature. While HEART payments are not value-based payments, primary care providers receiving value-based payments are generally more likely to screen their patients for social needs (Davidson and Kemper, 2020).

Another important takeaway is that without taking HEART payments into account, CTOs provide more comprehensive care management than primary care practices that provide care

management entirely on their own. CTOs are a relatively new care delivery entity that successfully provide care management services for primary care practices that do not have the infrastructure to provide comprehensive care management. Future research should explore the use of CTOs in other states attempting to expand primary care infrastructure.

Primary care practices with MUA designations consistently provided higher comprehensive care and social needs services. These results are similar to those assessing social needs screening among FQHCs, which found that FQHCs were more likely to screen for social needs than non-safety-net providers (Lewis et al., 2021). Heart payments remove the difference in care management comprehensiveness between 50/50 and 100/0 practices. HEART payments may help to standardize care management and social needs services provided to Medicare beneficiaries in MUA areas by increasing CM services among practices that provide care management in-house. Over half of all federally designated primary care shortage areas overlap with high-poverty census tracks (Thomas, 2014). Primary care practices in these areas are also generally understaffed and provide care to patients that are more likely to have lower income, and less likely to have employment, transportation, or access to healthy foods (Thomas, 2014). In order to improve the quality of care received by those in greatest need, it is extremely important to gain a better understanding of how these practices operate, often with fewer resources and lower levels of reimbursements.

Over 40 percent of practices receiving high HEART payments have MUA designations, meaning that more than half of primary care practices serving high portions of HEART beneficiaries are not located in medically underserved areas. Knowing where high-needs patients receive care will improve equitable distribution of resources to better support primary care practices that disproportionately serve high-needs patients. We find a positive association

between HEART payments and delivering comprehensive care management and social needs services to Medicare beneficiaries in non-MUA areas. Practices that treat high-needs patients dwell in a range of communities. Non-MUA practices that treat high-need patients might be less equipped to treat high-need patients when compared to MUA practices that have larger high-need patient populations. More research is needed to understand whether meaningful differences exist between the care management services provided in MUA-designated health care facilities versus facilities without MUA designations.

Strength and Limitations

There are several limitations associated with this analysis. This analysis only includes MDPCP primary care practices, and the alternative payment model being assessed is currently only available in Maryland. While this limits result generalizability, these results further our understanding of how primary care practices use alternative payment forms. More specifically, these results provide much needed sense of how primary care practices use alternative payment models to increase the types of care management services they provide. These results can also guide other states looking to diversify funding options for primary care practices.

The voluntary nature of the MDPCP means that the primary care practices in the program might not be representative of primary care practices in Maryland and across the United States; however, over 40 percent of all Maryland practices participated in the MDPCP during the analysis period which (Maryland Primary Care Program, 2022). MDPCP practices are extremely diverse when compared to previous Medicare demonstrations. This analysis includes a large number of small practices, which is more similar to the national distribution of primary care practice size (Rubio et al., 2023; Singh et al., 2020). The sample includes a large percentage of rural primary care practices. The percentage of rural practices is larger than Medicare

demonstrations (Singh et al., 2020). This sample also includes primary care practices with a higher percentage of black patients than previous Medicare demonstrations (Rubio et al., 2023; Singh et al., 2020). Another limitation is that the analysis period overlaps with
The COVID-19 pandemic changed care delivery and utilization in primary care practices.

Some additional strengths include the study's longitudinal design and the use of multiple data sources. This study is one of the first to assess, at the state level, the association between an alternative payment model and the delivery of five different care management services and is also the first study to assess whether the HEART payments are associated with the delivery of care management services.

Conclusion

Our results provide guidance on how patient socioeconomic information can be used to provide enhanced financial support to primary care practices supporting high-need patients. Additionally, our results demonstrate that ADI adjusted payments can improve access to care management and social needs services in primary care settings. Finally, our results provide a better understanding of how CTOs can enhance the delivery of care management services to FFS Medicare beneficiaries.

Chapter 4: Comprehensive Care Management and Primary Care Practice-Level Readmission Rates

Background

Nearly 20 percent of Medicare beneficiaries discharged from hospitals are readmitted within 30 days (Hochman and Asch, 2017). There is disagreement on which providers should be held responsible for patient readmissions. Some argue that unplanned 30-day readmissions can be attributed to poor hospital discharge processes, while others reason that many of the factors associated with hospital unplanned readmissions are outside hospitals' control (Zuckerman et al., 2016). For instance, readmissions that take place over a week after post-discharge could be more indicative of patient-level self-efficacy and the ability to manage their health management, the quality of care delivered in ambulatory care settings, and access to community resources (Kripalani et al., 2014) Additionally, post-discharge access to primary care are is associated with increased readmission rates (Murray et al., 2021; Joynt et al., 2019). While primary care is uniquely positioned to provide care management only, 50% of older adults that experienced 30-day hospital readmissions receive outpatient care Tak et al., 2020; Lum et al., 2012). When assessing gaps in necessary care, the Maryland Department of Health identified low care management use among high-risk and rising-risk patients as a major health care issue (Latif et al., 2020).

The Maryland Primary Care Program (MDPCP) is a voluntary Medicare demonstration modeled after the national Medicare demonstration program Comprehensive Primary Care Plus (CPC+). The MDPCP seeks to increase the delivery of comprehensive primary care, which is comprised of five care delivery areas: care management, access and continuity, care coordination, planned care for population health, and patient and caregiver engagement (Machta et al., 2021). Care management generally encompasses activities focused on improving patient

quality of life, patient health outcomes, and reducing unnecessary use of health care services (Peikes, Swankoski, O'Malley, and Timmins, 2021). The success of primary care interventions relies on a variety of factors. Generally, primary care practice-based care management interventions that are more comprehensive are associated with a decrease in readmissions. The most successful complex care management programs were also embedded in primary care practices, which enabled care managers to build strong relationships with patients and coordinate their care better (Spivack, DeWalt, Oberlander et al., 2021; Powers, Chaguturu, & Ferris, 2015; Powers et al., 2015). Successful care management interventions also facilitated intensive face-to-face interaction between care managers and patients and extensive interaction between care managers and providers (Spivack, DeWalt, Oberlander et al., 2021; Powers, Chaguturu, & Ferris, 2015). While primary care-based care management has been identified by both the state of Maryland and the federal government as a vital resource when seeking to reduce readmissions, there are gaps in our understanding of the types of care management services Maryland Medicare beneficiaries receive and whether MDPCP care management services are associated with decreased readmission rates among Medicare beneficiaries.

This analysis seeks to identify unique trajectories of comprehensive care management performance among MDPCP primary care practices and to examine the association between comprehensive care management performance trajectories and practice-level unplanned readmission rates. We hypothesize that there are distinct care management performance groups among MDPCP primary care practices and that primary care practices that provide higher levels of comprehensive care management will experience greater reductions in practice-level unplanned readmission rates

Methods

Data

This analysis uses three main secondary data sources: Maryland Primary Care Program data, Chesapeake Regional Information System for our Patients (CRISP) data, and hMetrix data. All data in this analysis are measured at the primary care practice level. This analysis includes data from July 1, 2020, to March 31, 2023. MDPCP data includes rosters of participating practices and rosters of participating Care Transformation Organizations (CTOs). MDPCP Care Transformation Reports include practice-level care delivery transformation data and practice structural and process capabilities. MDPCP Care Transformation Reports also include details on practice-level care management. MDPCP data includes practice ownership in formation, FQHC status, size, practice MDPCP participation track status, and practice-level provider information. CRISP data include beneficiary demographics and claims. The claims data captured in CPRISP are Medicare Fee-For-Service claims and Claim Line Feed (CCLF) data. CRISP data also provide beneficiary age, race and ethnicity, HCC risk tier, chronic conditions, preferred language, Medicare eligibility, enrollment characteristics, and hospital readmissions. hMetrix data provide practice-level payment information such as MDPCP Care Management payment, Comprehensive Primary payment, and Performance Based Incentive payment information.

Study Sample

MDPCP eligible primary care practices must have at least 150 attributed Medicare beneficiaries and be in one of the listed provider categories: General Practice, Family Medicine, Internal Medicine, Obstetrics and Gynecology, Pediatric Medicine, Geriatric Medicine, and co-located Psychiatry. Additionally, among participating practices, only Medicare fee-for-service

(FFS) attributed beneficiaries are allowed to participate in the program. This analysis includes primary care practices participating in the MDPCP between July 1, 2020, and March 31, 2023. The sample was further restricted to primary care practices that participated in the MDPCP for at least two years and to primary care practices with zero missingness among the variables included in this analysis. A final sample of 475 primary care practices out of the total 608 primary care practices were included in this analysis.

Dependent Variables

The dependent variable is primary care practice-level 30-day unplanned readmission rates. CRISP defines readmissions as an unplanned admission to the same or a different acute care hospital following a discharge from the same or a different acute care hospital within 30 days (CRISP, 2022). Readmissions not included in the analyses include readmissions for psychiatric disorders and planned readmissions for services such as transplant surgery, maintenance chemotherapy immunotherapy, rehabilitation, and non-acute readmission for scheduled procedures (CRISP, 2022). Readmission rates are created by dividing short-term acute care hospital admissions within 30 days of initial discharge by all admissions categorized as eligible for being considered a readmission. Readmissions are captured monthly at the primary care practice level (CRISP, 2022).

Independent Variables

The primary independent variable is a composite measure assessing the comprehensiveness of primary care practice-level care management. The measure captures five care management categories and is standardized to range between 0-5. Each care management category was also standardized to range from 0-1. Please see a more detailed information about the components of

the comprehensive care management variable: Comprehensive Care Management -

Standardized: (0 – 5 Points):

(1) Risk-stratified care management: (0 – 1 Points)
- Risk stratification – Methods
  - (1) Intuition only; (2) Data-driven algorithm only; (3) Two-step
- Risk stratification – Factor complexity
  - (1) Claims variables; (2) Clinical variables from the EHR; (3) Computed risk scores; (4) Pre-AH Tool (Likelihood for Avoidable Hospital Events report); (5) Other methods
- Risk stratification – The percent of beneficiaries risk-stratified out of total empaneled
  - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Lead Care Manager
  - (1) Yes; (2) No
- Longitudinal Care Management – The percent of beneficiaries under care management out of total empaneled
  - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Care Plan – The precent of beneficiaries under longitudinal care management with care plans
  - (0) None (0%); (1) Some (Up to 50%); (2) Most (51-95%); (3) All (96-100%)
- Care Plan – Document & storage
  - (0) No; (1) Care plans are stored but not health IT integrated; (2) Care plans are EHR or HIT integrated)

(2) Self-management and support (SMS): (0 – 1 Points)
- Populations that receive SMS
  - (1) All beneficiaries with targeted condition; (2) Risk status; (3) Poorly controlled disease; (4) Data from a formal self-management assessment tool; (5) Beneficiary interest; (6) Clinician referral/identification; (7) Other
- Self-management support activities
  - (1) No activities; (2) encourage beneficiaries to choose goals that are meaningful to them; include family/caregivers in goal setting and care plan development; (3) Connect or provide beneficiaries and caregivers with formal self-management support services at our practice or in the community; (4) measure beneficiaries' skills and progress; (5) Staff are trained in self-management support techniques

(3) Transitional care management (TCM): (0 – 1 Points)
- The percent of patient follow-up within one week post emergency department discharge
  - (1) None (0%); (2) Some (Up to 50%); (3) Most (51-95%); (4) All (96-100%)
- The percent of patient follow-up within 72 hours post hospital discharge
  - (1) None (0%); (2) Some (Up to 50%); (3) Most (51-95%); (4) All (96-100%)
- Admission/discharge/transfer information EHR/HIT system integration
  - (1) Yes; (2) No

(4) Comprehensive medication management (CMM): (0 – 1 Points)
- Delivery of CMM
  - (1) Yes; (2) No
- Populations that receive CMM
  - (1) Active medication issues (e.g., adverse reactions, adherence, not reaching intended treatment outcomes); (2) Potential therapy issues (e.g., high risk medications, polypharmacy, multi-therapy drug interactions, high cost medications); (3) Referred by practitioner or care team

(5) Social needs management (SNM): (0 – 1 Points)
- Populations that receive SNM
  - (1) Do not screen beneficiaries; (2) Targeted subpopulation; (3) All beneficiaries
- Types of social needs screened for
  - (1) Food insecurity; (2) Housing instability; (3) Utility needs; (4) Financial resource strain; (5) Transportation; (6) Social isolation; (7) Safety or interpersonal violence; (8) Other
- Inventory of social service resources
  - (1) Yes; (2) No
- Established relationship with social resources
  - (1) Food insecurity; (2) Housing instability; (3) Utility needs; (4) Financial resource strain; (5) Transportation; (6) Employment; (7) Social isolation; (8) Safety or interpersonal violence;

Covariates in this analysis include practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no); practice organization-level capabilities: care management fees, performance-based incentive payments, and comprehensive primary care payments, MDPCP participation track (I, II, III) and care management delivery options (50/50, 70/30, 100/0); and practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), county, medically underserved area (yes; no).

Statistical Analysis

The distribution of practice-level characteristics across MDPCP primary care practice care management performance classes was assessed using descriptive statistics such as chi-square tests and t-tests for tests of independence. **Trajectory analysis.** Group-based trajectory modeling (GBTM) was used to identify comprehensive care management performance groups among MDPCP primary care practices. GBTM is a specific type of finite mixture modeling that puts individuals, or in this care, primary care practices, with statistically similar trajectories into defined groups (Shearer et al., 2016; Nagin and Odgers, 2005). GBTM uses maximum likelihood estimation to identify the probability of an individual belonging to an identified group (Shearer et al., 2016; Nagin and Odgers, 2005). The identified groups are latent strata and capture primary care practices following similar comprehensive care management performance distribution trends or patterns rather than actual subpopulations (Shearer et al., 2016; Nagin and Odgers, 2010; Nagin and Odgers, 2005). Comprehensive care management GBTM was modeled using a censored normal distribution with the censored values set to capture the range of the unstandardized comprehensive care management variable (0 – 66). Censored normal distribution is generally chosen for survey-generated or composite score outcome variables (Nagin & Odgers, 2010). During sensitivity analyses, censored normal distribution was also applied to the standardized comprehensive care management variable (0-5).

GBTM:

$$\boldsymbol{P(Y_i|Time_i) = \sum_{j=1}^{j} \pi^j . P(Y_i|Time_i, j: \beta^j)}$$

Where P(Yi |Timei) represents the distribution of the outcome variable comprehensive care management which is conditional on time. Yi represents primary care practices' i's care management score sequence, Time represents time, which is measured by quarters complex care

management scores were reported, J represents the number of groups, π^j represents a primary care practices' probability of belonging to group j, and β^j represents the conditional distribution of Y*i*, comprehensive care management, given primary care practice assignment to *j* and also determines the specific shape of each group-based trajectory. The following tests were used to identify the best model fit: the Bayesian information criterion (BIC), entropy, estimated group proportions, average posterior probabilities (APP), and the odds of correct classification (OCC) (Shearer et al., 2016; Nagin and Odgers, 2010).

Regression analysis. Mixed-effect negative binomial regression models were employed to assess whether there was an association between MDPCP primary care-level comprehensive care management and primary care-practice-level all-cause 30-day readmission rates. Mixed-effect negative binomial regression models also assessed whether primary care-practice-level all-cause 30-day readmission rates varied between care management performance groups. Standard errors were clustered at the primary care practice level. Primary care practices were included in the model as the random effect, while patient and practice covariates were fixed effects. Unstructured covariance matrices were used in each regression model to account for primary care practices correlation (Jones and Nagin, 2013; Jones and Nagin, 2012; Barnett et al., 2010; Nagin and Odgers, 2010; Nagin, 2005; Nagin,1999).

Models 1 through 3 assess the association between primary care practice-level 30-day all-cause readmission rates and primary care practice-level comprehensive care management. **Model 1** is a crude model that includes the outcome variable primary care practice-level 30-day all-cause readmission rates, comprehensive care management performance trajectories, and time. **Model 2** includes all the variables included in Model 1 as well as practice patient-level characteristics: age, race, HCC risk scores, dual eligibility status, practice-level characteristics:

total number of providers, percent of providers that are family and general physicians, MDPCP participation track, care management delivery options, county, and MUA designation. **Model 3** includes the variables in Model 2 and an interaction term between comprehensive care management performance trajectories and time.

Model 1: Crude Model:
$\log Y_{it} = \beta_{0i} + \beta_1(\textit{Comprehensive care management performance trajectories}_{it}) + \beta_2(\text{Time})$
$\beta_{0_i} \sim N(\beta_0, \sigma^2_{b_0})$

Model 2: Full Model:
$\log Y_{it} = \beta_{0i} + \beta_1(\textit{Comprehensive care management performance trajectories}_{it}) + \beta_2(\textit{Primary care practice – level patient characteristics}_{it}) + \beta_3(\textit{Primary care practice-level characteristics}_{it}) + \beta_4(\text{Time})$
$\beta_{0_i} \sim N(\beta_0, \sigma^2_{b_0})$

Model 3: Full Model with Interaction Term between trajectories and time:
$\log Y_{it} = \beta_{0i} + \beta_1(\textit{Comprehensive care management performance trajectories}_{it}) + \beta_2(\text{Comprehensive } \textit{care management performance trajectories}_{it} * \textit{time}) + \beta_3(\textit{Care management capabilities}_{it}) + \beta_4(\textit{Primary care practice – level patient characteristics}_{it}) + \beta_5(\textit{Primary care practice-level characteristics}_{it}) + \beta_6(\text{Time})$
$\beta_{0_i} \sim N(\beta_0, \sigma^2_{b_0})$

Where Y represents Primary care practice-level 30-day all-cause readmission rates, i represents primary care practices, and t represents time, which is measured by six-month intervals. Sensitivity analyses were conducted by running all three models on comprehensive care management, risk-stratified care management, self-management and support, transitional care management, comprehensive medication management and social needs management. All analyses were conducted using STATA, version 17.0 (StataCorp, College Station, Texas).

Results

The final trajectory model with four groups was chosen based on the criteria in **Table 4.1.** The four-model option had the least negative BIC, which demonstrates the best model fit. When comparing model BICs, a model being smaller by a score of 10 or more indicates that the

model is a better fit (Nagin & Odgers, 2010; Lerch, 2020). Entropy assesses the accuracy of classifying primary care practices in trajectory groups (Mésidor et al., 2022; Herle et al., 2020; Nylund-Gibson K, Choi AY, 2018). The four-model option had an Entropy value of 0.92, and an entropy value greater than 0.80 indicates that there is less uncertainty about the model's classification (Mésidor et al., 2022; Herle et al., 2020; Nylund-Gibson K, Choi AY, 2018). GBTM also requires that a trajectory group must be greater than five percent of the total sample, and the smallest group in the four-model option represents 18.3% of the total sample (Andruff et al., 2009; Nagin & Odgers, 2010). Model adequacy was also assessed using post-estimation assessments. Posterior probabilities represent the probability that a primary care practice belongs to a trajectory group. The average of these scores represents trajectory group-level membership internal reliability (Andruff et al., 2009). In the four-model option, the average posterior probabilities were all above .93, which is over the recommended threshold of .70 (Nagin & Odgers, 2010; Lerch, 2020). Additionally, the odds of correct classification for each group in the four-model were greater than five (Nagin & Odgers, 2010; Lerch, 2020).

Table 4.1: Comprehensive Care Management Performance Trajectory Post Estimation Model Fit Assessment and Group Assessment

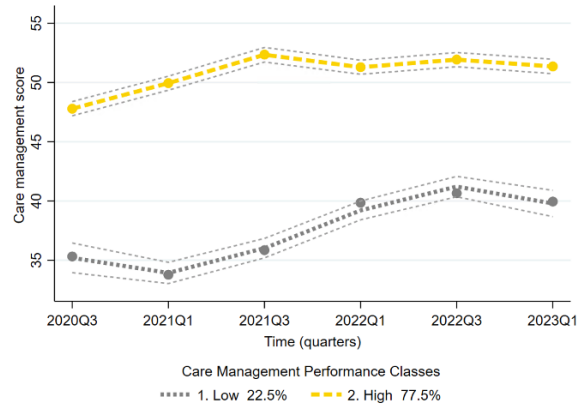
Group Numbers	Polynomial Order of each group trajectory	Group count	Estimated group proportions	BIC	Entropy	Average Posterior Probabilities	Odds of Correct Classification
2	3 5	1 = 106 2 = 369	1 = 22.4% 2 = 77.5%	-8906.10	0.958	1 = .975 2 = .990	1 = 135.14 2 = 30.58
3	3 5 5	1 = 88 2 = 123 3 = 264	1 = 18.0% 2 = 27.8% 3 = 54.1%	-8713.88	0.892	1 = .960 2 = .933 3 = .947	1 = 111.00 2 = 36.50 3 = 15.26
4	3 5 5 2	1 = 88 2 = 99 3 = 101 4 = 187	1 = 18.3% 2 = 21.1% 3 = 21.6% 4 = 39.0%	-8553.82	0.923	1 = .977 2 = .960 3 = .946 4 = .965	1 = 193.05 2 = 91.22 3 = 63.89 4 = 43.42

Abbreviation: BIC, Bayesian information criterion

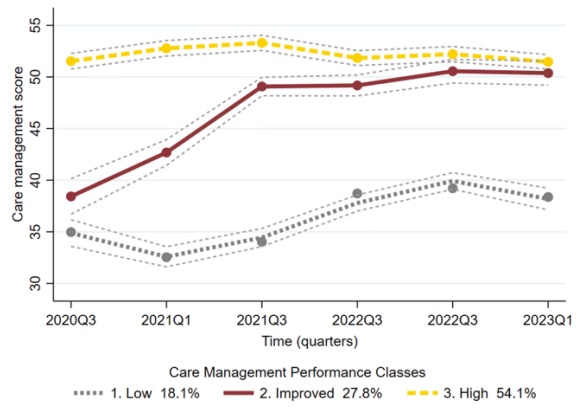
The GBTM two-group option identifies high and low performers **(Figure 4.1.Panel I)**, the GBTM three-group option identifies an additional group showing rapid improve **(Figure 4.1.Panel II)**, and in the final model the GBTM four-group option identifies an additional group of decliners **(Figure 4.1.Panel III)**.

Figure 4.1: Comprehensive Care Management Performance Trajectories, July 1, 2020 – March 1, 2023

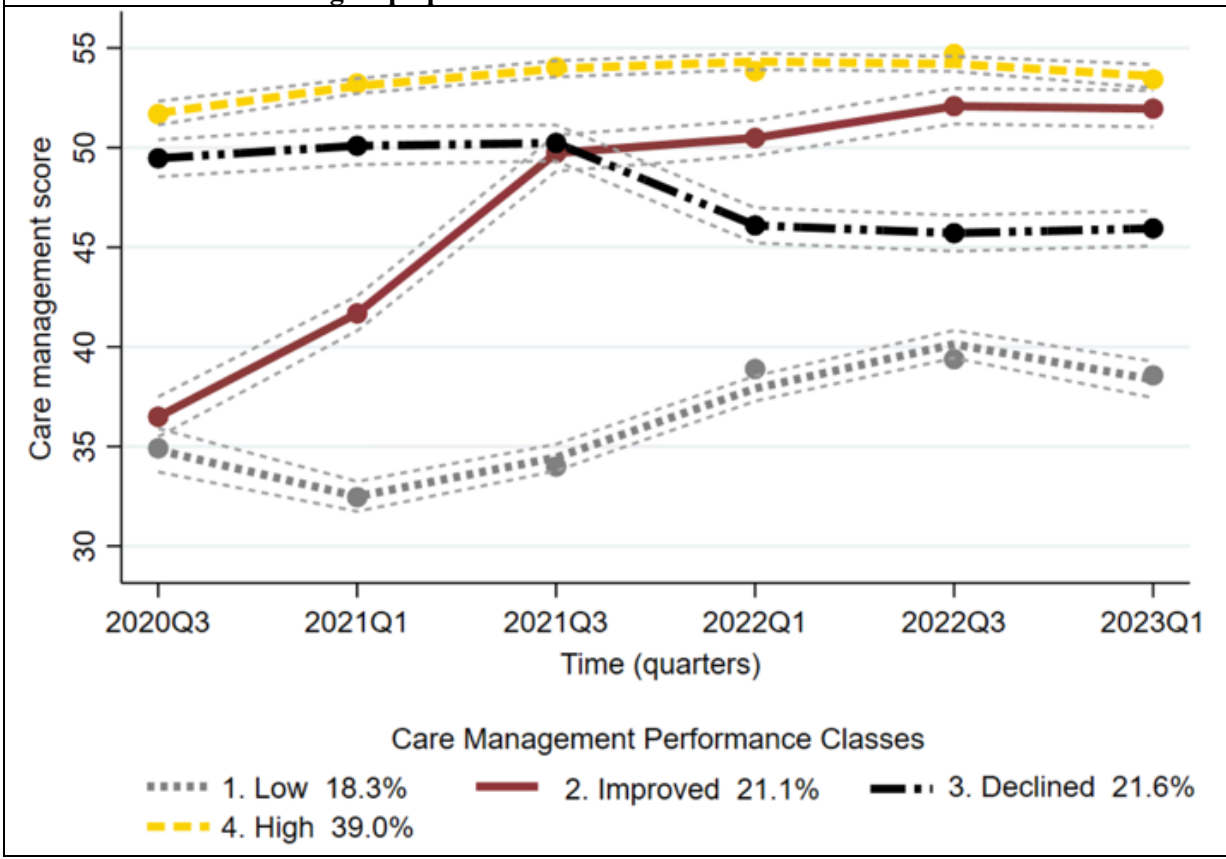
Panel I: GBTM – two-group option



Panel II: GBTM – three-group option



Panel III: GBTM – four-group option



Abbreviation: GBTM., group-based trajectory model

Table 4.2. assess comprehensive care management scores among each trajectory group over time. Except for the baseline time point 2020 Q3, each trajectory's average comprehensive care management scores significantly differed at each time point. Additionally, the average change in comprehensive care management score among trajectories is significantly different.

Table 4.2: Two-way Analysis of Comprehensive Care Management Score and Time by Care Management Performance Trajectory, July 1, 2020 – March 31, 2023, N=475

	Trajectory 1 Low	Trajectory 2 Improved	Trajectory 3 Declined	Trajectory 4 High	*p-value*
2020 Q3	2.64	2.66	3.73	3.85	0.294
2021 Q1	2.49	3.18	3.79	3.98	0.000
2021 Q3	2.59	3.68	3.82	4.04	0.000
2022 Q1	3.04	3.71	3.54	4.02	0.000
2022 Q3	3.12	3.89	3.53	4.12	0.000
2023 Q1	3.05	3.89	3.56	4.03	0.000
p-value	0.000	0.000	0.000	0.000	

Table 4.3 summarizes the characteristics of MDPCP primary care practices by comprehensive care management trajectories. The Low trajectory group had, on average, the highest percent of patients 85 years and older (16.98%), black patients (30.33%), and high-needs patients (31.77%). The Low trajectory group also had the lowest average of Care Management Fees ($46K) and Performance-Based Incentive Payments ($32K). Additionally Low trajectory group practices were less likely to have MUA designations (17.24%), were overrepresented in Southern Maryland (15.52), and were not present in Western Maryland regions. On average, the Improved trajectory group had the highest percent of Medicaid patients (14.27%). The Improved trajectory group had the highest average Performance-Based Incentive Payments ($67K). Additionally, Improved trajectory group practices were less likely to have MUA designations (17.97%) and were overrepresented in Central (58.43%) and Western (11.24%) Maryland

regions. On average, the Declined trajectory group had the largest percent of patients 64 and younger (11.70%) and Hispanic (1.66%) patients. Additionally, Declined trajectory group practices were more likely to have MUA designations (33.68%). The High trajectory group had, on average, the highest percent of non-English speaking (9.22%) patients while also having, on average, the lowest percent of patients 64 years and younger (9.74%) and black (21.93%) patients. Additionally, High trajectory group practices were more likely to have MUA designations (33.90%) and were overrepresented in Capital (34.48%) and Eastern(13.79%) Maryland regions.

Table 4.3: Baseline Characteristics of MDPCP Primary Care Practices by Care Management Performance Trajectories, 2020

	Total Sample N=475	Low n=87 18.3%	Improved n=91 21.6%	Declined n=100 21.6%	High n=197 39.0%	*p-value*
Number of Patients Per Practice, Avg	779.96	636.31	887.68	791.747	766.31	0.000
Patient Age, %						
64	10.60	10.80	10.96	11.70	9.74	0.000
65-69	19.04	17.58	19.78	19.41	18.95	0.000
70-74	25.45	23.05	26.26	25.08	26.04	0.000
75-79	19.00	18.13	19.12	19.04	19.21	0.000
80-84	12.91	13.42	12.11	12.80	13.20	0.000
85 +	12.97	16.98	11.74	11.94	12.84	0.000
Patient Race & Ethnicity, %						
Black	24.19	30.33	25.40	23.46	21.93	0.030
Hispanic	1.30	0.66	0.73	1.66	1.59	0.000
White	67.68	63.63	67.72	68.44	68.61	0.120
Non-English, %	6.64	3.33	3.67	6.70	9.22	0.000
HCC average score, Avg	1.05	1.13	1.03	1.08	1.03	0.000
HCC Level 1, %	17.71	15.77	18.51	17.38	18.13	0.013
HCC Level 2, %	28.49	26.10	30.44	27.26	28.95	0.000
HCC Level 3, %	17.08	16.72	16.93	16.53	17.58	0.133
HCC Level 4, %	9.16	9.61	8.86	9.13	9.17	0.000
HCC Level Complex, %	27.54	31.77	25.24	29.68	26.13	0.000
Medicaid, %	11.15	9.36	14.27	6.09	12.92	0.008
Dual-eligible, %	18.30	18.16	17.62	19.01	18.31	0.104
Comprehensive Primary Care Payment, $	2,785.16	2,589.60	513.83	6,886.64	1,772.81	0.000
Care Management Fees, $	59,784.44	46,783.08	57,559.83	77,288.70	55,699.18	0.000

Performance-Based Incentive Payments, $	50,599.92	32,571.61	67,595.15	50,493.20	50,144.01	0.000
Number of providers	3.09	2.97	3.12	4.03	2.62	0.000
Percentage Family Med + General Med Providers, %	24.18	21.86	26.97	22.87	24.25	0.722
Care Management Delivery Option, %						
50/50	49.49	34.48	74.16	47.37	45.40	0.000
70/30	29.09	41.38	20.22	9.47	35.63	
100/0	21.43	24.14	5.62	43.16	18.97	
Practice MDPCP Start Year, %						
2019	79.09	82.76	78.65	90.53	71.84	0.004
2020	20.91	17.24	21.35	9.47	28.16	
Rural Status, %	35.02	29.31	30.33	41.05	36.04	0.895
MUA Status, %	28.12	17.24	17.97	33.68	33.90	0.045
Region, %						
Capital	30.05	31.03	22.47	28.42	34.48	0.000
Central	51.44	46.55	58.43	53.68	48.28	
Eastern	8.89	6.90	1.12	8.42	13.79	
Southern	5.77	15.52	6.74	5.26	2.30	
Western	3.85	0.00	11.24	4.21	1.15	

Table 4.4 summarizes MDPCP primary care practice-level care management characteristics by comprehensive care management trajectories at baseline. The High trajectory group had the highest average risk-stratified care management (0.76), highest self-management and support (0.72), and social needs management (0.85) scores. The Declined trajectory group had the highest average scores for transitional care management (0.74) and comprehensive medication management (0.76). Only 40 percent of primary care practices in the Improved trajectory group provided comprehensive medication management compared to 98 percent of practices providing comprehensive medication management in the High trajectory group.

Table 4.4: Baseline Care Management Characteristics of MDPCP Primary Care Practices by HEART Payment Level, January 1, 2020

	Total Sample N=475	Low n=87 18.3%	2 Improved n=91 21.6%	Declined n=100 21.6%	High n=197 39.0%	*p-value*
Comprehensive Care Management, Avg	3.39	2.63	2.65	3.72	3.85	0.294

(1) Risk-Stratified Care Management, Avg	0.73	0.69	0.67	0.74	0.76	0.009
Risk-stratified beneficiaries, %	95.21	93.25	94.16	98.77	94.45	0.000
Beneficiaries under risk-stratified care management, %	19.95	31.67	14.42	20.99	18.31	0.000
Beneficiaries under longitudinal care management with care plans, %						
Some (1-50%)	38.70	67.24	51.69	14.74	35.63	0.000
Most (51-95%)	27.88	15.52	26.97	46.32	22.41	
All (96-100%)	32.93	17.24	20.22	37.89	41.95	
(2) Self-Management and Support, Avg	0.64	0.55	0.47	0.69	0.72	0.001
Number of populations receiving self-management support, Avg	4.29	3.56	3.34	4.80	4.74	0.045
Types of populations receiving self-management support, %						
Formal self-management assessment tool	28.03	8.06	29.84	27.75	36.19	0.000
General risk status	73.90	70.96	85.24	64.21	74.47	0.000
Beneficiary interest	79.79	70.36	49.39	91.47	93.75	0.000
Poorly controlled disease	95.03	90.12	91.25	98.49	97.37	0.000
Clinician referral	92.95	80.64	92.79	95.65	97.10	0.000
All beneficiaries with targeted condition(s)	77.28	48.58	80.27	81.93	86.06	0.000
Other populations	3.98	0.20	1.37	1.83	8.23	0.000
(3) Transitional Care Management, Avg	0.70	0.60	0.73	0.74	0.69	0.014
Patient ED discharge follow-up, %	77.86	73.65	85.78	84.81	71.61	0.000
Patient hospital discharge follow-up, %	78.91	72.50	83.82	85.51	74.98	0.000
(4) Comprehensive Medication Management (CMM), Avg	0.62	0.43	0.23	0.76	0.81	0.000
Practices providing CMM, %	83.17	84.48	40.44	94.73	98.27	0.000
(5) Social Needs Management, Avg	0.70	0.35	0.53	0.78	0.85	0.000
Populations screened for unmet social needs, %						
Targeted subpopulation	52.16	55.17	67.42	45.26	47.13	0.000
All beneficiaries	46.39	36.21	31.46	54.74	52.87	
Number of social needs screened, Avg	5.45	2.31	3.05	6.27	7.01	0.000
Types of social needs screened, %						
Financial resource strain	77.64	29.31	77.52	95.78	83.90	0.000
Food insecurity	86.05	44.82	74.10	96.84	100.00	0.000
Housing instability	81.73	32.75	68.53	94.73	97.70	0.000
Social isolation	72.83	32.75	29.21	96.84	95.40	0.000

Safety or interpersonal violence	73.31	37.93	77.52	68.42	85.63	0.002
Transportation	89.66	43.10	91.01	100.00	98.85	0.000
Utility needs	69.95	25.86	71.91	58.94	89.65	0.000
Other social needs	3.98	0.20	1.37	1.83	8.23	0.000
Number of established relationships with social resources, Avg	5.62	2.81	3.20	6.27	7.01	0.000
Office inventory of social services resources, Avg	97.83	93.10	97.75	98.94	98.85	0.000
Established relationship with social resources, Avg	5.62	2.81	3.20	6.27	7.01	0.000
Types of established relationship with social resources, %						
Food insecurity	98.04	88.46	95.45	98.91	100.00	0.000
Housing instability	86.47	84.21	36.06	97.77	98.82	0.000
Utility needs	79.03	46.66	32.81	91.07	96.79	0.000
Financial resource strain	81.11	47.05	39.13	91.20	98.63	0.000
Transportation	95.17	64.00	90.12	98.94	100.00	0.000
Employment	72.68	37.50	13.95	87.50	94.17	0.000
Social isolation	94.38	57.89	76.92	97.82	99.39	0.000
Safety or interpersonal violence	86.55	90.90	44.92	98.46	100.00	0.000
Other social needs	12.98	31.03	4.49	1.05	17.81	0.000

Table 4.5. show the results of the negative mixed-effects models, which assessed the association between care management trajectories and unplanned readmission rates. In **Model 1,** the Decline trajectory group had statistically significantly higher unplanned readmission rates than the High trajectory group (Odds Ratios [OR] 1.84 95% confidence interval [CI]: 1.24-2.72). In **Model 2**, there was no statistically significant difference in unplanned readmission rates between trajectory groups Low, Improved, or Declined and the High trajectory group. In Model 3, the interaction term between the comprehensive care management trajectories and time was statistically significantly associated with decreased primary care-level unplanned readmission rates among primary care practices in the Low trajectory group when compared to practices in the High trajectory (OR 0.97, 1.02, CI: 0.99- 0.98). The slope of the interaction term was - 0.03,

which demonstrates that as time progressed, primary care practice-level unplanned readmission rates decreased when compared to the High trajectory group.

Table 4.5: Comprehensive Care Management Performance Trajectories, Negative Binomial Mixed-Effects Regression Models, July 1, 2020 – March 31, 2023

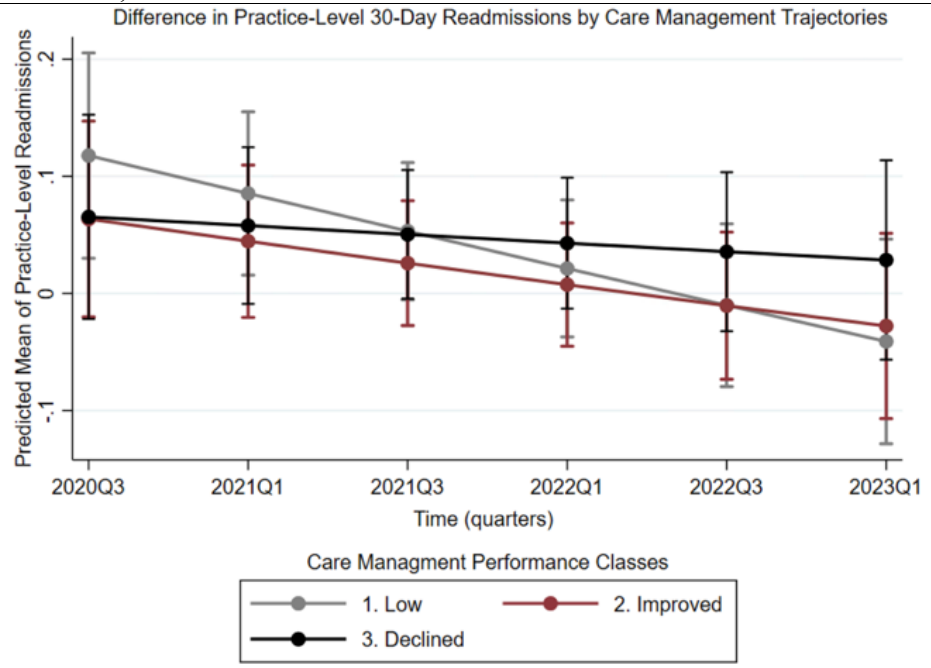
	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model N:475; Observations: 2,596	Model 3: Full Model Interaction Term N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Comprehensive Care Management			
Trajectory 4: High	[Reference]	[Reference]	[Reference]
Trajectory 1: Low	0.93 (0.63, 1.38)	1.23 (0.89, 1.69)	5.25 (1.45, 19.03)**
Trajectory 2: Improved	1.37 (0.94, 2.01)	1.10 (0.83, 1.47)	2.50 (0.75, 8.29)
Trajectory 3: Declined	1.84 (1.24, 2.72)**	1.30 (0.95, 1.76)	1.75 (0.48, 6.41)
Time	0.99 (0.98, 1.00)	1.01 (0.99, 1.02)	1.02 (1.01,1.03)**
Trajectory 4: High x Time	[Reference]	[Reference]	[Reference]
Trajectory 1: Low x Time	--	--	0.97 (0.94, 0.99)*
Trajectory 2: Improved x Time	--	--	0.98 (0.96, 1.01)
Trajectory 3: Declined x Time	--	--	0.99 (0.96, 1.02)
Random-effects Parameters			
Primary Care Practice	1.34 (1.00, 1.79)	0.02 (0.00, 5.45)	0.02 (0.00, 12.09)

*p< 0.05, ** p<0.01. OR., odds ratios, CI., confidence intervals. **Models 2 - 3:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

Figure 4.2. Shows the average marginal effect of comprehensive care management performance trajectories on primary care practice-level unplanned readmission rates between July 1, 2020 – March 31, 2023. The Low trajectory had statistically significant higher predicted mean practice-level unplanned readmission rates than the High trajectory during 2020 Q3 and 2021 Q1 however, as time progressed the difference in unplanned readmission rates became

insignificant. While not statistically significantly different at all timepoints from the High trajectory, as time progresses practice-level unplanned readmission rates decrease among all comprehensive care management performance trajectories. Tables 4.6 – 4.11 are located in the appendix and include separate negative binomial mixed-effects regression models assessing the association between comprehensive care management score, risk-stratified care management, self-management and support, transitional care management, comprehensive medication management, and social needs management and primary care practice-level unplanned readmission rates.

Figure 4.2: Marginal Probabilities Comprehensive Care Management Performance Trajectories Interacted with Time, July 1, 2020 – March 31, 2023 - N: 475; Observations: 2,596



Timepoints	High Trajectory	Low Trajectory			Improved Trajectory			Declined Trajectory		
		Predicted Mean Unplanned Readmission Rates	Std. err.	p-value	Predicted Mean Unplanned Readmission Rates	Std. err.	p-value	Predicted Mean Unplanned Readmission Rates	Std. err.	p-value
2020 Q3	[Reference]	0.11	0.04	0.008	0.06	0.04	0.136	0.07	0.04	0.142
2021 Q1	[Reference]	0.08	0.03	0.016	0.04	0.03	0.179	0.06	0.03	0.090
2021 Q3	[Reference]	0.05	0.02	0.075	0.02	0.02	0.341	0.05	0.02	0.072
2022 Q1	[Reference]	0.02	0.02	0.474	0.01	0.02	0.780	0.04	0.02	0.132
2022 Q3	[Reference]	-0.01	0.03	0.776	-0.01	0.03	0.745	0.03	0.03	0.303
2023 Q1	[Reference]	-0.04	0.04	0.358	-0.02	0.04	0.491	0.02	0.04	0.511

Abbreviation: Std.err., standard error.

Discussion

When assessing the impact of an intervention, there is a benefit in identifying performance groups among intervention participants. GBTM identified four clear categories of MDPCP primary care comprehensive care management performance. This information provided insight into why we saw a proportional association between comprehensive care management score and readmission rates over time in the analysis that did not control for comprehensive care management performance trajectory groups. Relative to the High trajectory group, primary care practices in the Low trajectory group experienced a steeper decline in primary care practice-level unplanned readmission rates. Primary care practices in the Low trajectory group had, on average, the highest percent of older, black, and high-needs patients, while primary care practices in the High trajectory group had, on average, the highest percent of non-English speaking patients and the lowest percent of black patients. The MDPCP has an additional three years until it concludes, and further analyses should be conducted with these additional years included.

The COVID-19 pandemic overlaps this analysis period. Maryland's first three COVID-19 cases were confirmed on March 5, 2020, and the baseline point for this analysis is July 2020 (Moore & Hartner, 2021). While the COVID-19 pandemic might impact readmission rates in Maryland, variation in the rate of readmission reductions among the trajectory groups might indicate the COVID-19 pandemic did not wholly negate the association between MDPCP care management services and unplanned readmission rates.

The MDPCP is a subcomponent of the Maryland Total Cost of Care (TCOC) Model which also began on January 1, 2019. The model includes three parts: the Hospital Payment Program, the Care Redesign Program, and the Maryland Primary Care Program. While these other TCOC programs also seek to reduce admissions, the TCOC is a statewide program, and

patients, providers, and primary care practices in the MDPCP were exposed to the same intervention.

Though this analysis assesses the association of care management and readmissions at the primary care practice level and employs care management performance trajectories to evaluate the association between care management performance and readmission rates, the results of this analysis align with existing literature. Improvement in care management score among the Low trajectory resulted in a decrease in primary care practice-level unplanned readmission rates, which is similar to other care management interventions associated with readmission reductions. A recent causal analysis of the PCP+, the national equivalent of the MDPCP, found the program did not reduce unplanned readmissions (Singh et al., 2024).

Strength and Limitations

This analysis includes several limitations as well as strengths. While this analysis only includes MDPCP primary care practices and MDPCP participation is voluntary, which limits its generalizability, over 40 percent of primary care practices in Maryland participated in the MDPCP (MDPCP, 2020; MDPCP, 2022; Schrader et al., 2021). Additionally, the primary care practices that participated in the MDPCP are more diverse than practices that traditionally participate in Medicare demonstration programs (Rubio et al., 2023; Singh et al., 2020). For instance, this analysis includes a larger percentage of small practices and rural practices than demonstrations such as the PCP+ (Singh et al., 2020). Practices in this analysis also have a higher percentage of black patients compared to primary care practices that have participated in previous Medicare demonstrations (Rubio et al., 2023; Singh et al., 2020).

Using multiple data sources, such as self-reported care transformation data and claims data, enhances our understanding of how primary care practices use alternative forms of payment

to increase the types of care management services they provide. An additional limitation is that COVID-19 overlaps the analysis period. Research has demonstrated that COVID-19 did alter care delivery practices in ambulatory settings. For instance, there was increased use of telehealth services throughout the pandemic (Shaver, 2022). Additional strengths of this analysis include the longitudinal design and the use of a novel approach to identify MDPCP care management performance classes, which can be used to better understand what contributes to the successful implementation of future Medicare demonstrations.

Conclusion

These results provide a better understanding of MDPCP primary care practice comprehensive care management performance and the association between primary care practice-level ability to provide complex care management and unplanned readmission rates. Comprehensive care management performance was inconsistent among MDPCP primary care practices, and heterogeneity of comprehensive care management performance over time impacts the association between care management and readmission rates.

Chapter 5: Conclusion and Future Direction

Summary

Results from Chapter 2 demonstrate that increased primary care practice capabilities were associated with increased comprehensiveness among the comprehensive care management composite, risk-stratified care management, self-management and support care management, transitional care management, comprehensive medication care management, and social needs management. Additionally, the association between primary care capabilities and care management comprehensiveness varied across each of the five care management services. Chapter 2 also shows that, within Maryland, there is geographic variation in the level of care management comprehensiveness.

Results from Chapter 3 demonstrate that patient-level ADI adjusted payments can improve access to care management and social needs services in primary care settings. Additionally, chapter 4 shows that MDPCP primary care practices that chose the 50/50 CTO care management delivery option provided the most comprehensive primary care. These results reinforce the success and necessity of CTOs when trying to transform primary care-based care management services. Lastly, this chapter provides guidance to other states on how to direct funds to primary practices that serve high percentages of high-needs patients living in high-deprivation areas.

Results from Chapter 4 provide a detailed understanding of how MDPCP primary care practices performed in their ability to provide care management over time. Clear classes of care management performance were identified, and variations in levels and directions of care management performance were identified. Understanding how primary care practices performed gives the state an opportunity to better support practices that underperform. Chapter 4 also

demonstrates an association between comprehensive care management and primary care practice unplanned readmission rates among certain care management performance classes.

Policy Implications and Future Research

This section outlines four key areas of focus as policy implications and for future research: (1) the identification of geographic variation in primary care practice capabilities' association with the delivery of care management services, (2) the use of prospective payments such as HEART payments, (3) partnerships with care transformation organizations, and (4) the identification of performance classes within Medicare demonstration programs.

Based on the results, additional research is needed to assess whether geographic variation in the provision of care management exists nationally. CMMI should use primary care practice capabilities that have been proven to be associated with the provision of care management services to assess care management readiness among applicants in future demonstrations, such as Primary Care First and the Making Care Primary Model (Frehn et al., 2022; Spivack et al., 2022; Rodriguez et al., 2016; Murray, Rodriguez, & Lewis, 2020). If gaps in care management capabilities are identified, then CMMI should offer tailored support to address the identified gaps. This will also ensure more equitable inclusion of lower-resourced primary care practices, which generally disproportionately service racial and ethnic minorities, in care transformation efforts. Steps such as these will ensure we move away from the lack of diversity among primary care practices participating in national care transformation demonstrations such as the CPC+ (Rubio et al., 2023; Miller-Rosales et al., 2023).

While CMS and CMMI are beginning to roll out equity-centered value-based reimbursements via the Rewarding Excellence for Underserved Populations (REUP) initiative, only 46 percent of primary care practices currently receive any form of value-based payments

(Horstman, 2023; Jacobs, 2023). Federal and state governments should continue exploring how to redirect financial support to high-needs patients via alternative payment models. Primary care practices in burdened areas disproportionately serve high-needs patients. These results demonstrate that alternative payment models, such as the HEART payments, improve MUA-designated practices' ability to deliver care management services. More research is needed to better understand how alternative payments such as the HEART payments transform other comprehensive primary care components. Causal inference analyses would also improve our understanding of how HEART payments directly impact care delivery transformation efforts in primary care settings.

Partnerships with care transformation organizations (CTOs) should be explored in future Medicare primary care demonstrations. CMS has set a goal of having all FFS Medicare beneficiaries participate in primary care transformation programs; however, as of June 2023, less than 50% of US primary care practices participated in these programs (Rawal, 2023). Within the MDPCP, CTOs helped primary care practices increase patient access to services without the financial resources and time commitment generally needed to provide these services internally. Federal and state governments could facilitate CTO partnerships among under-resourced primary care practices. Partnerships like this would improve access to enhanced services among under-resourced. This could also allow under-resourced primary care practices to pool resources by sharing CTO services.

The identification of performance classes within Medicare demonstration programs provides a better understanding of MDPCP comprehensive care management performance and the association between primary care practice-level ability to provide care management services and unplanned readmission rates. Comprehensive care management performance was not

consistent among MDPCP primary care practices, and heterogeneity of comprehensive care management performance over time impacts the association between care management and readmission rates. Performance classes should be identified in future Medicare demonstrations as well. Identifying performance classes will improve our understanding of how these interventions are implemented in real-world settings and will enable us to better support participating practices that are consistently identified as low performers.

Additionally, identifying and evaluating high-performing practices can improve our understanding of what primary care practice-level structural and process capabilities are needed to provide comprehensive primary care successfully. Assessing the association between primary care intervention performance class and patient health outcomes is extremely important. We cannot expect these interventions to impact practices and patients similarly. Using GBTM to identify variation in adherence and even treatment effects will improve our understanding of which populations need additional support and whether the intervention is reaching the desired population. For instance, analyses such as GBTM could identify that under-resourced primary care practices with high-risk and high-burdened patients have lower program adherence over time, which might indicate that the intended target population does not truly have access to the intervention. Practices with high adherence to the intervention design should be assessed separately, and subpopulation analyses should also be included in formal evaluations.

Appendix A: Chapter 2

Appendix Table 2.13: Individual MDPCP primary care practice capabilities associated with comprehensive care management, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
Team huddles focused on beneficiary care			
Never; Ad hoc; Monthly; Every two weeks	[Reference]	[Reference]	[Reference]
Weekly; Daily	0.979 (0.946, 1.013) 0.225	0.979 (0.947, 1.013) 0.220	0.973 (0.943, 1.00) 0.089
Team meeting to discuss high-risk beneficiaries			
Never; Ad hoc; Monthly; Every two weeks	[Reference]	[Reference]	[Reference]
Weekly; Daily	1.013 (0.978, 1.050) 0.72	1.010 (0.975, 1.047) 0.576	1.022 (0.986, 1.059) 0.234
Review quality improvement data			
Never; Ad hoc; Annually; Quarterly	[Reference]	[Reference]	[Reference]
Monthly; Weekly	1.007 (0.971, 1.045) 0.691	1.018 (0.981, 1.057) 0.337	1.002 (0.966, 1.040) 0.905
24/7 electronic record access	1.809 (1.608, 2.036) 0.000	1.734 (1.542, 1.952) 0.000	1.575 (1.382, 1.796) 0.000
Practice site provides 24/7 coverage	0.941 (0.899, 0.984) 0.010	0.941 (0.899, 0.985) 0.009	0.941 (0.897, 0.988) 0.014
Enhanced appointment & communication capabilities	1.022 (1.009, 1.034) 0.000	1.020 (1.008, 1.033) 0.001	1.016 (1.004, 1.028) 0.007
Alternative approaches to care	0.990 (0.976, 1.005) 0.187	0.992 (0.977, 1.006) 0.269	0.992 (0.978, 1.005) 0.235
Patients are seen by the provider or care team they are empaneled	1.09 (0.986, 1.214) 0.089	1.099 (0.995, 1.214) 0.063	1.104 (0.990, 1.230) 0.075
How often offices use data to plan the care they provide	0.993 (0.972, 1.015) 0.545	0.994 (0.973, 1.015) 0.563	0.999 (0.979, 1.019) 0.910
Whether offices use data to plan the care they provide	1.029 (1.004, 1.055) 0.025	1.027 (1.002, 1.054) 0.037	1.033 (1.008, 1.058) 0.008
Referral management w/ specialists	1.004 (1.001, 1.006) 0.010	1.003 (1.001, 1.006) 0.015	1.003 (0.999, 1.005) 0.058
Use of cost measures	1.030 (1.017, 1.042) 0.000	1.029 (1.016, 0.041) 0.000	1.022 (1.010, 1.035) 0.000
Use of utilization measures	1.001 (0.998, 1.005) 0.491	1.001 (0.997, 1.005) 0.535	1.002 (0.998, 1.006) 0.312
Use of patient experience measures	1.002 (0.991, 1.012) 0.766	1.003 (0.993, 1.013) 0.557	1.006 (0.996, 1.015) 0.248
Care Management Fee	1.000 (1.000, 1.000) 0.004	1.000 (1.000, 1.000) 0.007	1.000 (1.000, 1.000) 0.072

Performance based incentive payment	0.999 (0.999, 0.999) 0.000	0.999 (0.999, 0.999) 0.000	0.999 (0.999, 1.00) 0.108
Comprehensive primary care payment	1.000 (0.999, 1.000) 0.682	1.000 (0.999, 1.000) 0.809	0.999 (0.999, 1.000) 0.579
MUA Status			
No	--	--	[Reference]
Yes	--	--	0.934 (0.882, 0.989) 0.021

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** Seventeen practice capabilities variables. **Model 2: Model 1 +** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Appendix Table 2.14: MDPCP primary care practice principal component capabilities with MDPCP practice provision of comprehensive care management, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics	Model 4: Practice Characteristics + Interaction Term
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
PC 1. Referral management/ Quality improvement infrastructure	1.03 (1.02, 1.04) 0.000	1.03 (1.02, 1.04) 0.000	1.03 (1.02, 1.03) 0.000	1.029 (1.020, 1.038) 0.000
PC 2. MDPCP payments	1.00 (0.99, 1.01) 0.345	1.00 (0.99, 1.01) 0.442	0.99 (0.98, 1.01) 0.990	1.000 (0.989, 1.010) 0.981
PC 3. Planned care and population health	1.02 (1.01, 1.04) 0.000	1.02 (1.01, 1.04) 0.000	1.03 (1.02, 1.04) 0.000	1.046 (1.031, 1.060) 0.000
PC 4. Continuity of care/ Enhanced access to care	1.09 (1.08, 1.10) 0.000	1.08 (1.07, 1.10) 0.000	1.08 (1.06, 1.09) 0.000	1.084 (1.069, 1.099) 0.000
PC 5. Care team composition and activities	1.01 (0.99, 1.02) 0.057	1.01 (0.99, 1.01) 0.064	0.98 (0.99, 1.01) 0.276	1.004 (0.993, 1.014) 0.437
PC 6. Enhanced access to care	0.98 (0.97, 0.99) 0.000	0.97 (0.97, 0.98) 0.000	0.98 (0.97, 0.99) 0.000	0.979 (0.969, 0.989) 0.000
MUA Status				
No	--	--	[Reference]	[Reference]
Yes	--	--	0.94 (0.89, 0.99) 0.046	0.95 (0.89, 1.01) 0.116
MUA Status * PC 3. Planned care and population health				0.97 (0.94, 0.99) 0.032

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** PC variables. **Model 2: Model 1 +** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no). **Model 4:** Model 3 + interaction term between PC 3 and MUA designation.

Appendix Table 2.15: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of risk-stratified care management, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
PC 1. Referral management/ Quality improvement infrastructure	0.98 (0.98, 0.99) 0.001	0.98 (0.97, 0.99) 0.000	0.99 (0.98, 0.99) 0.005
PC 2. MDPCP payments	1.00 (0.99, 1.00) 0.351	1.00 (0.99, 1.01) 0.057	0.99 (0.99, 1.00) 0.312
PC 3. Planned care and population health	1.02 (0.99, 1.00) 0.351	1.02 (1.01, 1.03) 0.000	1.02 (1.01, 1.03) 0.000
PC 4. Continuity of care/ Enhanced access to care	1.03 (1.02, 1.04) 0.000	1.03 (1.02, 1.04) 0.000	1.03 (1.02, 1.03) 0.000
PC 5. Care team composition and activities	1.01 (1.00, 1.02) 0.000	1.01 (1.00, 1.01) 0.003	1.01 (1.00, 1.01) 0.033
PC 6. Enhanced access to care	0.98 (0.97, 0.98) 0.000	0.97 (0.97, 0.98) 0.000	0.98 (0.97, 0.99) 0.000
MUA Status			
No	--	--	[Reference]
Yes	--	--	0.94 (0.89, 0.99) 0.032

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** PC variables. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Appendix Table 2.16: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of self-management and support, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics	Model 4: Practice Characteristics + Interaction Term
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
PC 1. Referral management/ Quality improvement infrastructure	1.07 (1.05, 1.09) 0.000	1.07 (1.05, 1.09) 0.000	1.07 (1.05, 1.09) 0.000	1.07 (1.05, 1.09) 0.000
PC 2. MDPCP payments	0.98 (0.97, 0.99) 0.032	0.98 (0.96, 0.99) 0.008	0.97 (0.95, 0.99) 0.042	0.97 (0.95, 0.99) 0.042
PC 3. Planned care and population health	1.02 (1.00, 1.04) 0.003	1.02 (1.00, 1.04) 0.003	1.03 (1.01, 1.05) 0.000	1.05 (1.03, 1.07) 0.000
PC 4. Continuity of care/ Enhanced access to care	1.02 (1.01, 1.03) 0.001	1.01 (1.00, 1.03) 0.009	1.01 (0.99, 1.03) 0.146	1.01 (0.99, 1.03) 0.157
PC 5. Care team composition and activities	1.01 (1.00, 1.03) 0.018	1.01 (1.00, 1.03) 0.010	1.01 (0.99, 1.03) 0.101	1.01 (0.99, 1.02) 0.192
PC 6. Enhanced access to care	0.65 (0.97, 0.99) 0.322	1.00 (0.99, 1.02) 0.193	1.00 (0.99, 1.02) 0.387	1.00 (0.98, 1.02) 0.51
MUA Status				
No	--	--	[Reference]	[Reference]
Yes	--	--	0.90 (0.81, 0.99) 0.050	0.91 (0.81, 1.01) 0.105
MUA Status * PC 3. Planned care and population health				0.95 (0.91, 0.99) 0.021

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** PC variables. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Appendix Table 2.17: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of transitional care management, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics	Model 4: Practice Characteristics + Interaction Term
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
PC 1. Referral management/ Quality improvement infrastructure	1.02 (1.00, 1.04) 0.007	1.01 (1.00, 1.03) 0.023	1.01 (0.99, 1.03) 0.084	1.00 (0.98, 1.02) 0.673
PC 2. MDPCP payments	1.01 (1.00, 1.02) 0.034	1.02 (1.01, 1.04) 0.001	1.00 (0.98, 1.02) 0.653	1.00 (0.98, 1.02) 0.663
PC 3. Planned care and population health	1.03 (1.01, 1.05) 0.003	1.0 (1.01, 1.05) 0.002	1.0 (1.00, 1.05) 0.004	1.02 (1.00, 1.05) 0.010
PC 4. Continuity of care/ Enhanced access to care	1.02 (0.99, 1.04) 0.061	1.01 (0.99, 1.04) 0.131	1.04 (1.01, 1.07) 0.002	1.04 (1.01, 1.07) 0.001
PC 5. Care team composition and activities	1.02 (1.00, 1.04) 0.008	1.02 (1.00, 1.04) 0.008	1.03 (1.01, 1.05) 0.003	1.03 (1.01, 1.05) 0.002
PC 6. Enhanced access to care	1.01 (0.99, 1.02) 0.195	1.01 (0.99, 1.02) 0.380	1.01 (0.99, 1.03) 0.275	1.01 (0.99, 1.03) 0.188
MUA Status				
No	--	--	[Reference]	[Reference]
Yes	--	--	0.98 (0.86, 1.11) 0.778	0.98 (0.86, 1.12) 0.830
MUA Status * PC 1. Referral management/ Quality improvement infrastructure				1.06 (1.00, 1.11) 0.020

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** PC variables. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Appendix Table 2.18: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of medication management, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics	Model 4: Practice Characteristics + Interaction Term
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
PC 1. Referral management/ Quality improvement infrastructure	1.00 (0.98, 1.02) 0.632	0.99 (0.98, 1.01) 0.969	0.98 (0.96, 1.00) 0.221	0.98 (0.96, 1.00) 0.142
PC 2. MDPCP payments	1.00 (0.98, 1.01) 0.925	1.00 (0.98, 1.02) 0.665	1.02 (0.99, 1.04) 0.068	1.02 (0.99, 1.05) 0.056
PC 3. Planned care and population health	1.06 (1.03, 1.10) 0.000	1.07 (1.03, 1.10) 0.000	1.08 (1.05, 1.11) 0.000	1.11 (1.07, 1.16) 0.000
PC 4. Continuity of care/ Enhanced access to care	1.34 (1.26, 1.43) 0.000	1.33 (1.24, 1.42) 0.000	1.34 (1.26, 1.42) 0.000	1.34 (1.26,1.43) 0.000
PC 5. Care team composition and activities	0.99 (0.96, 1.01) 0.480	0.98 (0.96, 1.01) 0.418	0.98 (0.95, 1.01) 0.428	0.98 (0.95, 1.01) 0.252
PC 6. Enhanced access to care	0.95 (0.94, 0.97) 0.000	0.94 (0.93, 0.96) 0.000	0.92 (0.90, 0.95) 0.000	0.92 (0.90, 0.94) 0.000
MUA Status				
No	--	--	[Reference]	[Reference]
Yes	--	--	0.97 (0.86, 1.09) 0.397	1.00 (0.89, 1.13) 0.902
MUA Status * PC 3.				0.92 (0.86, 1.12) 0.005

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** PC variables. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Appendix Table 2.19: MDPCP primary care practice principal component capabilities associated with MDPCP practice provision of social needs management, Poisson regression models

	Model 1: Crude	Model 2: Patient Characteristics	Model 3: Practice Characteristics	Model 4: Practice Characteristics + Interaction Term
	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value	IRR (95%CI) p-value
PC 1. Referral management/ Quality improvement infrastructure	1.07 (1.05, 1.10) 0.000	1.082(1.05, 1.10) 0.000	1.07 (1.04, 1.09) 0.000	1.07 (1.04, 1.09) 0.000
PC 2. MDPCP payments	1.01 (0.99, 1.02) 0.268	0.99 (0.97, 1.01) 0.529	1.00 (0.97, 1.02) 0.938	1.00 (0.97, 1.02) 0.866
PC 3. Planned care and population health	1.00 (0.97, 1.02) 0.982	1.00 (0.97, 1.02) 0.940	1.02 (0.99, 1.05) 0.136	1.04 (1.00, 1.08) 0.032
PC 4. Continuity of care/ Enhanced access to care	1.21 (1.15, 1.27) 0.000	1.19 (1.13, 1.25) 0.000	1.16 (1.11, 1.22) 0.000	1.16 (1.11, 1.22) 0.000
PC 5. Care team composition and activities	1.01 (0.98, 1.03) 0.615	1.00 (0.98, 1.02) 0.690	0.98 (0.95, 1.01) 0.249	0.98 (0.95, 1.00) 0.150
PC 6. Enhanced access to care	0.95 (0.93, 0.97) 0.000	0.95 (0.93, .97) 0.000	0.96 (0.90, 0.95) 0.025	0.96 (0.94, 0.99) 0.017
MUA Status				
No	--	--	[Reference]	[Reference]
Yes	--	--	0.91 (0.79, 1.06) 0.253	0.93 (0.80, 1.08) 0.357
MUA Status * PC 3.				0.94 (0.89, 0.99) 0.037

Abbreviations: IRR., incidence risk ratios, CI., confidence intervals, MUA., medically underserved area. **Model 1:** PC variables. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no). **Model 3: Model 2** + Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, MDPCP participation track (I, II, III), CTO collaboration (yes; no), county (Allegany, Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester County, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Saint Mary's, Somerset, Talbot, Washington, Wicomico, Worcester County), and MUA status (yes; no).

Appendix B: Chapter 4

Appendix Table 4.6: Comprehensive Care Management, Negative Binomial Mixed-Effects Regression Models, , July 1, 2022 – March 31, 2023

	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model N:475; Observations: 2,596	Model 3: Full Model with Interaction Term N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Comprehensive Care Management	0.96 (0.79, 1.17)	0.85 (0.71, 1.02)	0.39 (0.18, 0.82)*
Time	0.99 (0.98, 1.00)	1.01 (1.00, 1.02)*	0.95 (0.89, 1.01)
Comprehensive Care Management x Time	--	--	1.02 (1.00, 1.03)*
Random-effects Parameters			
Primary Care Practice	1.39 (1.04, 1.85)	0.03 (0.00, 2.30)	0.03 (0.00, 2.64)

*p< 0.05. OR odds ratios. Abbreviations: OR., odds ratios, CI., confidence intervals. **Model 1** Comprehensive care management and time. **Model 2 – Model 3:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

Appendix Table 4.7: Risk-stratified care management, Negative Binomial mixed-effects regression models, July 1, 2020 – March 31, 2023

	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)
Risk Stratified Care Management	3.36 (0.88, 12.85)	0.94 (0.27, 3.27)
Time	0.99 (0.98, 1.00)	1.01 (0.99, 1.023072)
Random-effects Parameters		
Primary Care Practice	1.36 (1.02, 1.82)	0.03 (0.00, 2.32)

Abbreviations: OR., odds ratios, CI., confidence intervals. **Model 1** Risk-stratified care management and time. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

Appendix Table 4.8: Self- management and support, Negative Binomial mixed-effects regression Models , July 1, 2020 – March 31, 2023

	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)
Self-management and support	0.63 (0.29, 1.36)	0.59 (0.31, 1.12)
Time	0.99 (0.98, 1.00)	1.01 (0.99, 1.02)
Random-effects Parameters		
Primary Care Practice	1.37 (1.03, 1.83)	0.02 (0.00, 6.90)

Abbreviations: OR., odds ratios, CI., confidence intervals. **Model 1** Self-management and support and time. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

Appendix Table 4.9: Social needs management, Negative Binomial mixed-effects regression Models, July 1, 2020 – March 31, 2023

	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model Ω N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)
Social needs management	0.97 (0.61, 1.53)	0.74 (0.48, 1.14)
Time	0.99 (0.98, 1.00)	1.01 (0.99, 1.02)
Random-effects Parameters		
Primary Care Practice	1.39 (1.04, 1.85)	0.03 (0.00, 2.31)

Abbreviations: OR., odds ratios, CI., confidence intervals. **Model 1** Social needs management and time. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

Appendix Table 4.10: Comprehensive medication management, Negative Binomial mixed-effects regression Models, July 1, 2020 – March 31, 2023

	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)
Comprehensive medication management	0.98 (0.64, 1.51)	0.91 (0.62, 1.33)
Time	0.99 (0.98, 1.00)	1.01 (0.99, 1.02)
Random-effects Parameters		
Primary Care Practice	1.39 (1.04, 1.85)	0.03 (0.00, 2.10)

Abbreviations: OR., odds ratios, CI., confidence intervals. **Model 1** Comprehensive medication management and time. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

Appendix Table 4.11: Transitional care management, Negative Binomial mixed-effects regression Models, July 1, 2020 – March 31, 2023

	Model 1: Crude Model N:475; Observations: 2,596	Model 2: Full Model N:475; Observations: 2,596
	OR (95%CI)	OR (95%CI)
Transitional Care Management	0.82 (0.44, 1.54)	0.70 (0.39, 1.23)
Time	0.99 (0.98, 1.00)	1.01 (1.00, 1.02)*
Random-effects Parameters		
Primary Care Practice	1.40 (1.05, 1.86)	0.03 (0.00, 1.97)

*p< 0.05. Abbreviations: OR., odds ratios, CI., confidence intervals. **Model 1** transitional care management and time. **Model 2:** Practice-level beneficiary characteristics: age (the percentage of patients that are 65-69, 70-74, 75-79, 80-84), race (percentage of black patients), HCC risk scores (practice average score), and dual eligibility status (yes; no), Practice organization-level characteristics: total number of providers, percent of providers that are family and general physicians, ownership status (system, independent), MDPCP participation track (I, II, III care management delivery options (50/50, 70/30, 100/0), care management fee, performance based incentive payment, comprehensive primary care payment, county, MUA status (yes; no).

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