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The Impacts of Team-based Care on Primary Care Quality: Evaluating Evidence from the State Innovation Model (SIM) Program in Connecticut

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Abstract

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In 2013, CMMI awarded Connecticut a $45 million State Innovation Model (SIM) grant to support healthcare payment and delivery model reforms aimed at improving health system performance, increasing quality of care, and decreasing costs. In the five years that followed, the Office of Healthcare Strategy led care delivery changes across the state with an emphasis on bolstering the role of primary care. In particular, many of these efforts centered on furthering team-based, patient-centered models, such as the patient-centered medical home (PCMH). In this dissertation, I use physician, patient, clinical outcome, and organizational data from the SIM project to explore the impact of team-based primary care on three areas of healthcare quality.

In the first paper of this dissertation, I explore the relationship between team-based care and physician burnout using physician-reported survey data. I hypothesized that primary care physicians would exhibit greater levels of burnout compared to specialists, and that those physicians who were practicing under team-based models would be less likely to report burnout. I conducted both multivariate linear regression analyses and inverse probability weighting with regression adjustment to test this hypothesis, evaluating the impact of care teams, PCMH-designation, and ACO-designation on burnout. Primary care physicians were more burnt out than specialists. In addition, I found that while care teams did reduce physician burnout, models that encouraged the use of care teams, including PCMHs and ACOs, did not. In addition to informing

the literature on team-based primary care, this paper advances the evidence base on physician burnout, an increasingly critical area to understand given the COVID-19 pandemic and its exacerbation of existing physician burnout challenges.

In the second paper, I assess the relationship between four medical home organizational characteristics – organization size & affiliation, payment reform experience, team-based care, and patient tracking and reporting – and antihypertensive medication monitoring using fuzzy set Qualitative Comparative Analysis (QCA). I hypothesized that team-based care would be positively associated with antihypertensive treatment monitoring. However, I found that primary care organizations that had a commitment to IT programs, care management protocols, and policies to track their patient populations were most likely to perform antihypertensive monitoring. This chapter used data from an organizational-level practice survey and clinical outcome data, and served to assess clinical quality among organizations participating in the SIM project.

In the third chapter of this dissertation, I assess the impact of team-based care on four summary measures of patient experience: timely care, communication, coordination, and courteous staff. In addition, I explore whether the relationship between care teams and patient experience differed by a patient's health status. I hypothesized that team-based models of primary care would be positively associated with all four domains of patient care experiences, with the strongest effects observed for the domains of communication and courteous staff. I found that teams had a small, but statistically significant, impact on both the communication and courteous staff measures, with the strongest association between teams and courteous staff. In addition, I observed that teams had the largest impact on patients in poor health for the courteous staff measure; however, I did not have observe differential effects of teams among chronically ill patients for the other three outcomes.

Taken together, the papers presented in this dissertation serve three purposes; they 1) evaluate key metrics for policymaking purposes in the state of Connecticut; 2) inform the evidence base around the impact of delivery reform on physicians, patients, and other key stakeholders and; 3) contribute to the peer-reviewed literature on team-based care.

The Impacts of Team-Based Care on Primary Care Quality: Evaluating Evidence from the State Innovation Model (SIM) Program in Connecticut

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Table of Contents

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Introduction

Primary care has been referred to as the "cornerstone" of the healthcare system.[1] Primary care organizations have been described as "complex adaptive systems," often serving a wide variety of patient needs and diseases.[2] Given their importance to the overall healthcare system and their influence in managing patients over time, primary care organizations have been a focus of delivery reform efforts. Since 2010, CMS has supported the development of innovative payment and delivery models through the Center for Medicare & Medicaid Innovation (CMMI). In 2013, CMMI awarded Connecticut a $45 million State Innovation Model (SIM) grant to support healthcare payment and delivery model reforms aimed at improving health system performance, increasing quality of care, and decreasing costs. A central tenet of the SIM program in Connecticut was to promote and evaluate team-based, patient-centered medical home models (PCMHs) for primary care.

A medical home is "a model or philosophy of primary care that is patient-centered, comprehensive, team-based, coordinated, accessible, and focused on quality and safety."[3] PCMH models promote interdisciplinary teams as a means of achieving many of these goals.[4] As such, primary care transformation initiatives similar to the SIM project have led to the addition of new staff roles at participating practices, such as care managers and behavioral health clinicians.[5]

Healthcare "teams" have been described and defined in a variety of different ways.[6] According to the Institute of Medicine, "team-based care" refers to "the provision of health services to individuals, families, and/or their communities by at least two health providers who

work collaboratively with patients and their caregivers—to the extent preferred by each patient—to accomplish shared goals within and across settings to achieve coordinated, high-quality care."[7]

Although the importance of primary care has long been recognized, assessing primary care quality has been an ongoing challenge among practitioners and policymakers.[8,9] Using data from the SIM project in Connecticut, this dissertation focuses on assessing the relationship between team-based primary care and quality across three key domains: physician burnout, medication monitoring, and patient experience.

The SIM project team collected data from physicians, primary care organizations, patients, and payers. It is thus a unique opportunity to evaluate primary care quality across a range of outcomes and from a variety of stakeholder perspectives. This dissertation explores several questions across three Aims; these are as follows:

Aim 1 Physician Burnout: Were primary care physicians more burned out than specialists in Connecticut at the beginning of the SIM transformation project? Are team-based models of care associated with reductions in physician burnout?

Aim 2 Medication Monitoring*:* Which organizational characteristics (among organization size & affiliation, payment reform experience, team-based care, and patient tracking and reporting) are related to higher rates of annual monitoring for chronic antihypertensive medications?

Aim 3 Patient Experience: Is team-based primary care positively associated with patient care experiences? Does this relationship differ by the patient's health status?

Chapter 1 (Aim 1) analyzes the association between team-based care and physician burnout, a pervasive challenge across the healthcare workforce. This analysis seeks to understand whether teams have a protective effect on burnout. Though the primary goal of this chapter is to serve as a baseline for understanding physician burnout at the beginning of the SIM project in 2014, it may also inform future efforts to reduce physician burnout, a critical challenge following the global COVID-19 pandemic. Chapter 2 (Aim 2) assesses the relationship between four PCMH organizational characteristics – organization size & affiliation, payment reform experience, team-based care, and patient tracking and reporting – and antihypertensive medication monitoring. This chapter serves to assess clinical quality among organizations participating in the SIM project. Chapter 3 (Aim 3) assesses the impact of team-based care on patient experiences of care, an increasingly important measure of quality. Further, it seeks to investigate whether patients with chronic illnesses are impacted differently than healthier patients by team-based primary care.

Others have noted that efforts to transform primary care delivery are in their infancy, and primary care performance measures will continue to evolve.[10] Primary care organizations are heterogeneous and challenging to study, and successful delivery models are hard to replicate.[11] This dissertation contributes to the growing literature on primary care delivery models and policy-led reform. This research is necessary to inform effective health system design, generating an evidence base that future policy- and practice-led reform efforts can build upon to improve clinical quality, support the healthcare workforce, and provide exceptional patient experiences.

Chapter 1

Do team-based models of primary care reduce rates of physician burnout?

Introduction

According to the Institute of Medicine, "team-based care" refers to "the provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively with patients and their caregivers—to the extent preferred by each patient—to accomplish shared goals within and across settings to achieve coordinated, high-quality care."[12] The implementation of team-based care is an important tenet of comprehensive care models, such as the patient-centered medical home (PCMH), which seek to improve care coordination and quality.[13]

Organizational quality assessment and improvement efforts that evaluate such models have traditionally emphasized patient-related outcomes (e.g., clinical health or patient experiences).[14, 15] While these data are critical for policymakers, healthcare organizations, and patients, fewer analyses have focused on the effects on physicians and other caregivers.[16] However, the health and satisfaction of clinicians are increasingly viewed as important indicators of organizational quality.[17] This is especially true in primary care.[18]

The concept of "physician burnout" was introduced in the 1970's to describe the professional and personal exhaustion that could result from the stresses of providing medical care.[19] Since that time, there have been multiple efforts to define, measure, and reduce physician

burnout.[20] There are multiple definitions of burnout, but most include three interrelated concepts, identified by Maslach et al in the 1980's: emotional exhaustion, depersonalization, and low personal achievement.[21]

Physician burnout is an ongoing and pervasive challenge across the healthcare workforce. Nearly half of the physician workforce in the US reports at least one symptom of burnout.[22] Physicians display greater rates of burnout when compared to other US workers with similar levels of education and professional degree attainment.[23] The COVID-19 pandemic has emphasized and exacerbated these challenges by placing strain on the healthcare system, and on primary care clinicians in particular.[24]

The consequences of burnout are serious for physicians, healthcare organizations, and patients. Physician burnout has been associated with reduced productivity, lower work satisfaction, and higher rates of depression among physicians.[25] Burnout has also been associated with increased risk of substance abuse among physicians.[26]

Physician burnout also negatively affects healthcare organizations. Turnover negatively affects organizational culture and morale among remaining physicians and healthcare workers.[27] It has been estimated that replacing a primary care physician can cost an organization $400,000[1] per physician.[28]

In some respects, the consequences of burnout among physicians do not differ from burnout among professionals in other fields. Chronic workplace stress in any industry can negatively impact both workers and organizations. However, workplace stress and its effects are of particular concern in healthcare settings because physician burnout negatively affects patient care and outcomes. Increases in depersonalization among physicians has been associated with

[1] Estimate published in 1995; adjusted for inflation in 2020.

lower patient satisfaction and longer post discharge recovery time, after controlling for severity of illness and other demographic factors.[29] Physician burnout has been associated with increases in medical errors within surgical disciplines.[30]

Interventions to reduce burnout include both physician-directed approaches and organization-directed approaches. Physician-directed approaches focus on improving mindfulness and personal coping strategies in physicians, while organization-directed approaches emphasize changes to the work environment.[31] A recent systematic review and meta-analysis found that organization-directed approaches were more likely to reduce burnout than individual physician-direct interventions.[32] Initial evidence suggests that implementing a team-based care model is one strategy organizations can use to improve the work environment, and researchers have called for additional analyses on the association between team-based care and physician burnout.[33]

In 2013, the Center for Medicare & Medicaid Innovation (CMMI) awarded Connecticut a $45 million State Innovation Model (SIM) grant to support healthcare payment and delivery model reforms aimed at improving health system performance, increasing quality of care, and decreasing costs. A central tenet of the SIM program in Connecticut was to promote, advance, and evaluate patient-centered care services in the state, including patient-centered medical home models (PCMH). A medical home is "a model or philosophy of primary care that is patient-centered, comprehensive, team-based, coordinated, accessible, and focused on quality and safety."[34] All data for this study come from the SIM project.

The physician-level data evaluated in this analysis was collected in 2014, at the beginning of the SIM program. Since then, the state implemented numerous interventions and programs to support value-based payment and delivery reform. This analysis provides a baseline for

policymakers and clinical leaders against which future transformation initiatives can be compared to.

Research Questions

This analysis will explore two research questions: Were primary care physicians more burned out than specialists in Connecticut at the beginning of this transformation project? And, are team-based models of care associated with reductions in physician burnout?

Although numerous interventions to reduce physician burnout have been suggested, few have been systematically studied.[35] Efforts to improve physician burnout have been varied in their structure and success. Addressing physician burnout should be an important component of care transformation efforts. Evidenced-based solutions to mitigate burnout will lead to a more sustainable healthcare system for physicians, healthcare organizations, and patients.

Hypotheses & Rationale

Hypothesis 1: Primary care physicians will exhibit greater levels of burnout than specialist physicians in Connecticut.

Rationale: In national studies, rates of physician burnout are higher among physicians on the "front lines" of care, including those in emergency medicine, general internal medicine, and family medicine.[36] While largescale, national studies are useful, healthcare care delivery differs widely across the United States.[37] Therefore, research that analyzes state-level data is necessary for designing and directing state-led policies.

The causes for greater burnout among physicians in these specialties are not fully understood, though some have pointed to increased clerical work (as opposed to clinical) among primary care physicians, heavy workloads, and feelings of undervaluation.[38]

Hypothesis 2: Team-based models of care will be associated with reductions in physician burnout.

Rationale: Teams have been studied extensively in the organizational literature, with reviews finding that, in general, there is evidence indicating that team-based forms of organizing are often associated with better organizational effectiveness compared to more traditional (i.e., siloed) forms of organizing.[39] The presence of teams can reduce stress for team members, particularly for highly complex tasks.[40] Working on care teams in physician organizations may reduce physician burnout through improved workflows, relief of simple physician tasks, and increase the physicians' abilities to focus on higher acuity patients.[41]

Methods

Data Source

The data for these analyses were collected by a State Innovation Model (SIM) 2014 Physician Survey. In 2014, the SIM team conducted a survey of licensed physicians in Connecticut. The physician survey was conducted with a stratified sample of primary care and specialist physicians in November-December 2014. The sample included physicians in the following specialties, which were chosen based on their role in managing patients with chronic disease: Cardiology, Endocrinology, Gastroenterology, OB/GYN, Pulmonology, Family

Medicine/Internal Medicine, and General Pediatrics. The breakdown of physician specialties that received the mailing were are shown in **Table 1.1.**

The State Comptroller's Office provided a sample of Connecticut physicians in selected specialties actively practicing in the State, and indicated whether they were affiliated with one of the state's advanced networks in which physicians bore some degree of financial risk for a portion of the patient care they provided (e.g., shared savings programs, ACOs). This sample was then matched with a list of member physicians from the Connecticut State Medical Society to obtain preferred mailing addresses and phone numbers. Physician records were matched using the Pi algorithm developed by UConn Health's Center for Public Health and Health Policy and the UConn Department of Computer Science and Engineering.

Table 1.1 Physician Sample by Specialty

Specialty	***Sample that Received Mailing***
Family Medicine / Internal Medicine	1,228
General Pediatrics	670
Cardiology	459
OB/GYN	419
Endocrinology	145
Gastroenterology	280
Pulmonology	204

The survey was mailed to 3,200 physicians in Connecticut with reminders conducted via telephone. The survey yielded 1,082 completed responses (representing a 39% adjusted response rate).

The topics asked about in the survey included: demographic characteristics, access to information technology, practice ownership, affiliation status with larger care systems, physicians' attitudes and concerns regarding care coordination, physician's beliefs about which providers comprise the care team, and physicians' mental health status and challenges.[42]

The data were collected by the SIM evaluation team prior to my involvement on the project team. The data had been published for a descriptive state report.[43] This analysis adds to the earlier work, as the questions on team-based care and physician burnout had not been a focus of earlier analyses. In addition, the earlier evaluation was primarily descriptive and did not include regression modeling.

Key Measures

Independent Variables

Physician Specialty: The specialties included in the physicians the sample were: Cardiology, Endocrinology, Gastroenterology, OB/GYN, Pulmonology, Family Medicine, Internal Medicine, and Pediatrics. This variable was coded as a binary variable (1/0). Primary Care Physicians (including OB/GYN, Family Medicine, Internal Medicine, and Pediatrics) were coded as 1, and Specialists (Cardiology, Endocrinology, Gastroenterology, Pulmonology) were coded as 0. Physicians were classified based on their response to the following question:

> ***Q1:*** *What is your primary area of practice?*
> - ***Answers:*** Family Medicine, General Internal Medicine, General Pediatrics, General Practice, OB-GYN, Medical Subspecialty (Please Specify), Pediatrics Subspecialty (Please specify), Other (Please specify)

Team-Based Care: Physicians that indicated that their organization used teams were coded as 1. Physicians that did not indicate the presence of teams were coded as 0. Physicians were

classified as either participating or not participating in team-based care based on their response to the following question:

> ***Q20:*** *"Primary care teams" are groups of physicians and other staff who meet with each other regularly to discuss the care of a defined group of patients. Does your practice use primary care teams?*
> - ***Answers:*** Binary (Y/N)

PCMH-Designation: Physicians that indicated that their organization was a PMCH were coded as a 1. Physicians that did not indicate that their organization was a PCMH were coded as 0. The PCMH model advocates for the use of patient-centered care teams. PCMH-designation was used as measure of team-based care, as organizations that choose to adopt the PCMH model are theoretically more likely to have care teams.

> ***Q42:*** *Is your practice a designated PCMH?*
> - ***Answers:*** Binary (Y/N)

ACO-Designation: Physicians that indicated that their organization was a ACO were coded as a 1. Physicians that did not indicate that their organization was an ACO were coded as 0. The ACO model also advocates for the use of patient-centered care teams (source). ACO-designation was used as measure of team-based care, as organizations that choose to adopt an ACO model are theoretically more likely to have care teams.

> ***Q14:*** *Does your practice participate in a Shared Savings Program or Accountable Care Organization (ACO)?*
> - ***Answers:*** Binary (Y/N)

Dependent Variables

Physician Burnout: Self-reported physician burnout was assessed using physician responses to four questions from the Physician Survey (**Table 1.2**). Three of the questions included responses on a 6-point frequency scale, while one of the questions offered responses on a 4-point frequency scale. These questions were:

Table 1.2 Physician Burnout Measures

Question	Answers (Score)
Q54: In the last 12 months, how often have you considered leaving clinical practice?	Never (1) Once a month or less (2) A few times a month (3) Once a week (4) A few times a week (5) Every day (6)
Q55: In the last 12 months, how often have you considered reducing your panel size?	Never (1) Once a month or less (2) A few times a month (3) Once a week (4) A few times a week (5) Every day (6)
Q56: In the last 12 months, how often have you felt burned out from your work?	Never (1) Once a month or less (2) A few times a month (3) Once a week (4) A few times a week (5) Every day (6)
Q57: How often do you feel that you are more callous toward people now than you were before you became a doctor?	Never (1) Rarely (2) Sometimes (3) Often (4)

Covariates

A range of covariates were evaluated in this analysis. Physician-level covariates included gender, years of physician practice, race, and hours a week spent on direct patient care. Organizational-level covariates included organizational size and the presence of electronic health records (EHRs).

Analysis

Descriptive statistics were used to describe physician and organization demographics, the presence of team-based care, and burnout characteristics of the physician sample. T-tests were used to compare primary care physicians to specialist physicians along burnout variables.

Multivariate linear regression analyses were conducted to evaluate the impact of care teams, PCMH-designation, and ACO-designation on physician burnout. Regression analyses were conducted on two burnout variables: self-reported physician burnout and increased callousness towards patients compared to when one first became a doctor.

Covariates were selected based on variables' relationships to both the predictor and outcome variables (see **Table 1.6**), as well as the prior literature. The background literature showed mixed evidence on the relationship between physician demographics and likelihood of physician burnout. In one analysis, gender and physician age were evaluated. While physician age was associated with burnout, with older age showing a weak but consistent association with reduced burnout, physician gender was not associated with burnout.[44] In another study, female physicians were shown to exhibit burnout at nearly double the rate of male physicians.[45] Given this evidence, both physician years of practice and gender were included. There is little evidence linking physician race to differences in burnout, so this variable was excluded from the analysis.[46] Whether a physician was a primary care physician or a specialist was included. Weekly patient care hours were also included. Organizational variables included organizational size and EHR adoption. Sensitivity analyses, including interactions between covariates, were evaluated.

To make stronger inferences regarding causality, a final set of models were constructed using inverse probability weighting with regression adjustment. This method is doubly-robust, as it combines outcome regression with a model for the exposure to estimate the causal effect of an

exposure on an outcome.[47] Inverse probability weighting uses the propensity score to the weight subjects by their likelihood of receiving treatment, based on observed covariates. Weighting subjects in this way creates a "synthetic sample" in which treatment assignment is independent of the covariates included in the model.[48]

Results

Characteristics of Physicians & Organizations

Survey respondents were predominantly white (85%), male (62.5%) and from primary care (68.7%). Physician age was not collected, but we used years in practice as a proxy for physician age because physicians with more years in practice tend to be older than physicians with fewer years in practice. The most frequent categories of practice years reported were "21-30 Years" (27.6%) and "More than 30 Years" (39.8%). **Table 1.3** reports the characteristics of responding physicians.

Table 1.3 Characteristics of Physicians

Characteristic	n (%)
Gender (n = 1081)	
Male	676 (62.5)
Female	155 (37.5)
Years in Practice (n = 1056)	
1-10	86 (8.1)
11-20	259 (24.5)
21-30	291 (27.6)
More than 30	420 (39.8)
Race (n = 1043)	
White	857 (82.1)
Non-White*	186 (17.83)
Specialty (n = 1078)	
Primary Care	740 (68.7)
Specialist	338 (31.4)
Patient Care Hours Weekly (n = 1064)	
1-20	144 (13.5)
21-40	573 (53.9)
41-60	316 (29.7)
More than 61	31 (2.9)

**Non-white includes Hispanic, Black, Asian, Islander, and Indian Alaskan respondents*

Physicians were also asked about characteristics of their organizations, including PCMH status, ACO status, organizational size, and whether the practice had electronic health records (EHRs). Results are given in **Table 1.4.** About a quarter (25.8%) of physicians reported that their organizations participated in a PCMH, and 40.9% reported that their organizations were part of an ACO. The most frequent organizational size was 2-10 physicians in a medical group (61.4%). A majority of physicians reported that their organizations had an EHR (82.8%).

Table 1.4 Characteristics of Organizations

Question	n (%)
Care Teams (n = 1034)	
Yes	149 (14.4)
No	885 (85.6)
PCMH Designation (n = 1013)	
Yes	251 (25.8)
No	762 (75.2)
ACO Designation (n = 979)	
Yes	298 (40.9)
No	575 (59.1)
Organizational Size (n = 1044)	
Small (1-30 MDs)	931 (89.2)
Large (31or more MDs)	113 (10.8)
Practice has EHR (n = 1076)	
Yes	891 (82.8)
No	185 (17.2)

Presence of Care Teams & Organizational Delivery Models that Promote Team-Based Care

A minority (14.4%) of respondents reported the use of care teams in their organizations. Among those who reported care teams, the most frequent care team members were Nurse Care Managers and Care Coordinators. Teams were more commonly reported by primary care physicians (16% reported care teams) compared to specialists (10% reported care teams).

ACO designation (40.9%) was more commonly reported than PCMH designation (25.8%). Among physicians who reported ACO designation, a minority (19.1%) reported care teams. Among respondents who reported organizational PCMH designation, a larger share (31.7%) reported care teams.

Burnout Among All Physicians

Responses to the four burnout variables are presented in **Table 1.5**. Around a third of physicians (33.2%) reported that they felt burned out at least once a week. Around a quarter (25.8%) reported that they felt more callous towards patients compared to when they first became a doctor at least once a week. 17.4% of physicians reported that they considered leaving practice at least once a week, and 13.3% reported that they considered reducing their patient panel size at least once a week.

Older physicians might be more likely to consider scaling back or leaving their practice hours if they are close to retirement age. Because the physician sample included a large number of physicians with many years of practice, we evaluated the association between each of the burnout variables and years of practice. These analyses indicated that physician age was a significant predictor of these two variables. Therefore "leaving practice" and "panel size reduction" were not used in subsequent analyses.

Self-reported "burnout" and "callousness" were selected as they key outcome variables of interest to assess physician burnout for multivariate analyses, as they were not associated with physician years of practice.

Correlations between all study variables are reported in **Table 1.6**.

Table 1.5 Reported Burnout

Characteristic	n (%)
Leaving (n=1067)	
Never	478 (44.8)
1x/mo or less	264 (24.7)
Few times/mo	139 (13.0)
1x/week	41 (3.8)
Few times/week	71 (6.7)
Everyday	74 (6.9)
Panel Size Reduction (n=1059)	
Never	612 (57.8)
1x/mo or less	188 (17.8)
Few times/mo	118 (11.1)
1x/week	39 (3.7)
Few times/week	48 (4.5)
Everyday	54 (5.1)
Self-Reported Burnout (n=1068)	
Never	183 (17.1)
1x/mo or less	290 (27.15)
Few times/mo	240 (22.5)
1x/week	117 (11.0)
Few times/week	149 (14.0)
Everyday	89 (8.33)
More Callous (n=1067)	
Never	454 (42.55)
Rarely	338 (31.68)
Sometimes	221 (20.71)
Often	54 (5.06)

Table 1.6 Correlation Matrix between All Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. BURNED OUT	1.00											
2. MORE CALLOUS	.37*	1.00										
3. CARE TEAMS PRESENT	-.06*	-.02	1.00									
4. MALE GENDER	-.08*	-.08*	.03	1.00								
5. PRACTICE YEARS	-.04	-.16*	-.01	.33*	1.00							
6. WHITE RACE	.05	-.03	-.03	.12*	.14*	1.00						
7. PRIMARY CARE SPECIALTY	.08*	.04	.08*	-.22*	-.02	-.02	1.00					
8. PATIENT CARE HOURS	.09*	.07*	-.07*	.22*	.05	-.02	-.09*	1.00				
9. PCMH STATUS	.11*	.01	.28*	-.01	-.04	0.0	.27*	-.10*	1.00			
10. ACO STATUS	.02	.00	.11*	.04	-.06	.03	-.01	0.0	.32*	1.00		
11. ORGANIZATIONAL SIZE	.02	-.03	.07*	.07*	0.0	.05	-.12*	-02	.12*	.09*	1.00	
12. PRACTICE HAS EHR	.09*	.03	.10*	-.01	-.12*	-.03	-.09*	.01	.24*	.15*	.22*	1.00

** $p<.05$*

Burnout Differences Between Primary Care Physicians and Specialists

Next, differences between primary care and specialist physicians were assessed using t-tests. Means and confidence intervals are reported for both questions in **Table 1.7**. There is a statistically significant difference between the two groups, with primary care physicians reporting more frequent burnout, but not callousness.

Table 1.7 Comparing Primary Care Physicians and Specialists on Burnout Variables

	Primary Care (N=730)		**Specialist (334)**		**Difference**	
Variables	**Mean**	**[95% CI]**	**Mean**	**[95% CI]**	**Mean**	**[95% CI]**
Burned Out	3.10	2.99- 3.22	2.85	[2.69, 3.00]	-.25	[-.45, -.06]*
More Callous	1.91	1.84-1.97	1.83	[1.73, 1.93]	-.08	[-.19, .04]

** p<.05*

Association between Team-Based Care and Physician Burnout

Multivariate linear regressions were used to evaluate the relationship between team-based care measures and physician burnout measures, self-reported burnout and callousness towards patients. **Table 1.8** shows the results from the two models. The first model included the outcome variable, burnout, while the second model included the outcome variable, callousness.

Table 1.8 Multivariate Linear Regression Results

	Model 1: Burnout		Model 2: More Callous	
	Coefficient (SE)	**p-value**	**Coefficient (SE)**	**p-value**
Teams Present	-.309 (.152)	0.043*	.02 (.090)	0.806
Male Gender	-.424 (.119)	0.000*	-.12 (.070)	0.085
Years in Practice (ref: 1-10)				
11-20	.254 (.210)	0.228	.05 (.124)	0.686
21-30	.398 (.210)	0.059	-.08 (.125)	0.549
More than 30	.233 (.210)	0.267	-.28 (.124)	0.025*
Primary Care Physician	.112 (.121)	0.355	.08 (.072)	0.292
Patient Care Hours Weekly (ref: 1-20)				
21-40	.547 (.160)	0.001*	.28 (.096)	0.004
41-60	.790 (.174)	0.000*	.42 (.103)	0.000*
More than 61	.562 (.341)	0.100	.06 (.202)	0.769
Large Organizational Size	.066 (.167)	0.692	.05 (.099)	0.621
PCMH Designation	.455 (.138)	0.001*	.01 (.082)	0.898
ACO Designation	-.151 (.111)	0.172	-.03 (.065)	0.648
EHRs Present	.32 (.140)	0.022*	.04 (.083)	0.638
Constant	2.137 (.277)	0.000	1.74 (.164)	0.000

** p<.05*

In Model 1, the following variables were shown to significantly decrease self-reported burnout: care teams present and male gender. Conversely, the following variables were shown significantly increase self-reported burnout: patient care hours weekly (including 21-40 hrs/wk and 41-60 hrs/wk), PCMH designation, and EHRs present. In Model 2, years in practice (more than 30 years) was shown to significantly decrease callousness, while patient care hours weekly (41-60 hours) was shown to significantly increase callousness.

Sensitivity analyses were conducted. This included multivariate linear models with interactions between gender and physician specialty, and gender and patient care hours. These were analyzed in two separate models with burnout as the outcome. Neither model was statistically

significant. In addition, organizational size was re-categorized such that a "small" organization was defined as less than 10 physicians. This did not change the direction or significance of the results.

Inverse Probability Weighting with Regression Adjustment

Models using inverse probability weighting with regression adjustment were used to further evaluate the relationship between care teams and physician burnout, controlling for observed covariates and yielding the average treatment effect (ATE) of care teams. Six models were created.

In Models 1 and 2, the main independent variable was team-based care. The covariates that informed the propensity score weighting were gender, years of practice, primary care specialty, hours of patient care weekly, physician race, organizational size, PCMH-designation, ACO-designation, and the presence of EHRs. The linear regression outcome model was adjusted for: gender, years of practice, primary care specialty, PCMH-designation, and organizational size. The model was conducted for both outcome variables, burnout and callousness. Balance checks were conducted. **Table 1.9** shows the results.

Table 1.9 Inverse Probability Weighting with Regression Adjustment (Teams)

Variables	**ATE (SE) Teams**	**[95% CI]**	**p-value**
Model 1: Burnout	-.286 (.128)	[-.534, -.037]	.024*
Model 2: More Callous	-.027 (.085)	[-.193, .139]	.749

** p<.05*

Models 3 and 4 evaluated the average treatment effect of PCMH-designation on burnout and callousness. The covariates that informed the propensity score weighting were gender, years of practice, primary care specialty, hours of patient care weekly, physician race, organizational size, team-based care, ACO-designation, and the presence of EHRs. The linear regression outcome model was adjusted for: gender, years of practice, primary care specialty, team-based care, and organizational size. **Table 1.10** shows the results for Models 3 and 4.

Table 1.10 Inverse Probability Weighting with Regression Adjustment (PCMH-Designation)

Variables	**ATE (SE) PCMH-Designation**	**[95% CI]**	**p-value**
Model 3: Burnout	.266 (.157)	[-.041, .573]	.090
Model 4: More Callous	-.118 (.038)	[-.302, .066]	.209

** p<.05*

Models 5 and 6 evaluated the average treatment effect of ACO-designation on burnout and callousness. The covariates that informed the propensity score weighting were gender, years of practice, primary care specialty, hours of patient care weekly, physician race, organizational size, team-based care, PCMH-designation, and the presence of EHRs. The linear regression outcome model was adjusted for: gender, years of practice, primary care specialty, team-based care, and organizational size. **Table 1.11** shows results for Models 5 and 6.

Table 1.11 Inverse Probability Weighting with Regression Adjustment (ACO-Designation)

Variables	ATE (SE) ACO-Designation	[95% CI]	p-value
Model 5: Burnout	-.167 (.106)	[-.375, .041]	.116
Model 6: More Callous	-.015 (.066)	[-.144 .114]	.821

* *p<.05*

Discussion

In this state-wide study of physician burnout, we found that burnout was a substantial issue across the physician population in Connecticut at the onset of the SIM program in 2014, with more than a third of physicians self-reporting that they had felt burned out at least once a week within the past 12 months. We also evaluated callousness towards patients as a second measure of burnout and found that this was less common, with only a small portion (5%) of physicians reporting that they often felt more callous towards patient than when they first became a physician.

Our findings indicated that self-reported burnout, but not callousness towards patients, was significantly higher among primary care physicians compared to specialists. Physician participation in care teams was significantly associated with a reduction in self-reported burnout, but not with self-reported callousness towards patients. Organizational models that encourage the use of care teams, including PCMHs and ACOs, do not appear to reduce burnout or callousness among physicians in those practices. Contrary to what we hypothesized, PCMH designation may actually have the opposite effect for physicians and increase rates of physician burnout.

There were several potential limitations to this study. First, analytical plans for this study originally included a comparative analysis of the 2014 SIM Physician Survey to a follow-up survey

with the same set of questions, which was planned for 2020. This type of analysis would have yielded insight into changes related to the SIM program during this time period. However, the 2020 survey was in the field when the COVID-19 pandemic occurred in March 2020 and had to be cancelled. This limited analyses to cross-sectional evaluations of the 2014 data, which represented the beginning of the SIM intervention period. Therefore, this analysis is most useful for understanding baseline characteristics of physician burnout prior to many of the SIM programs and interventions. Compared to 2014, primary care practices may be more skilled at operating and succeeding under new care delivery models, which would likely reduce burnout among physicians. At the same time, burnout among clinical providers has notably increased during the COVID-19 pandemic, which has reinforced the importance of implementing solutions to address burnout.[49] Therefore, although dated, the findings from this analysis may inform current burnout strategies in the pandemic-era.

A second limitation of this study was that it was difficult to assess the nature and extent of interactions among team members. The survey question related to care teams asked physicians whether there were teams at their organizations; however, it did not ask about the quality or effectiveness of those teams. Team culture, dynamics, and leadership affect the effectiveness of collaboration in healthcare settings, and greater visibility into these relationships would have improved the interpretation of our results.[50]

In light of these findings, solutions to address burnout should consider the role of teams in supporting physicians. Care teams were shown to significantly reduce self-reported burnout, but not callousness towards patients, in both our adjusted multivariate analyses and in a follow up model using inverse probability weighting with regression adjustment.

However, this issue may be complex, as unexpectedly, our multivariate analysis showed that PCMH designation significantly increased – rather than decreased – the likelihood of physician burnout. These findings differed from earlier analyses on the Comprehensive Primary Care (CPC), a federally-led multi-payer initiative designed to strengthen primary care, which found that practice transformation did not have negative effects on physician satisfaction.[51]

PCMH models encourage the use of care teams and coordinated patient care, so it was hypothesized in this study that PCMH designation would reduce physician burnout. Although a second model using inverse probability weighting with regression adjustment evaluated the average treatment effect of PCMH designation and did not find that it significantly increased burnout among physicians, the relationship was directionally consistent with the multivariate model. It is possible that PCMH models, which promote the use of care teams, may also increase administrative responsibilities for physicians. This relationship should be further evaluated in future studies.

Notably, only a small portion of physicians reported that they were considering leaving practice or reducing their panel sizes, meaning that many physicians were struggling with symptoms of burnout while continuing to treat patients. These challenges were particularly concerning among primary care physicians, as consistent with national-level analyses, primary care physicians were found to report at higher levels than specialists in the state. Finally, while it was not the focus of this analysis, we also found that female physicians were more likely to experience burnout, but not callousness compared to male physicians. Organizations may need programs and policies to specifically support female physicians.

This study has implications for both physician practice organizations and policymakers. Although the data analyzed in this analysis come from 2014, the current healthcare workforce and

burnout challenges related to the COVID-19 pandemic have highlighted that burnout remains a pervasive challenge throughout the healthcare system. Physician practice organizations should design structures and interventions to reduce burnout, including interventions that encourage team-based care.

However, policymakers should use caution when advocating for broad-based policies that promote new organizational models, such as PCMHs and ACOs. While these models do encourage the use of team-based care, implementing them may have both positive and negative effects on physician burnout. Therefore, a more nuanced understanding of how to support physicians under these models is necessary for optimal health system design.

Chapter 2

Which organizational characteristics
are associated with better medication monitoring in primary care?

Introduction

Pharmaceutical drugs for the prevention and treatment of clinical conditions are an increasingly common component of chronic disease management.[52] According to a survey conducted by the Centers for Disease Control and Prevention (CDC), 48.9% of the general population report taking at least one prescription drug in the prior 30 days, and 24% report taking three or more medications.[53,] Furthermore, nearly three-quarters of all physician office visits involve drug therapy.[54]

While medications are an integral part of treatment, they have risks. Adverse drug events, such as harmful drug reactions or drug-drug interactions, can occur when drugs are prescribed inappropriately by clinicians or not adequately monitored over time. The prevalence of preventable adverse drug events in ambulatory care settings has been estimated to be 16.5%.[55]

The Primary Care Collaborative, a not-for-profit organization dedicated to advancing the patient-centered medical home in primary care, defines comprehensive medication management as "the standard of care that ensures each patient's medications (whether they are prescription, nonprescription, alternative, traditional, vitamins, or nutritional supplements) are individually assessed to determine that each medication is appropriate for the patient, effective for the medical condition, safe given the comorbidities and other medications being taken, and able to be taken by the patient as intended."[56]

Appropriately managing patients' medication needs is challenging, and as a result, primary care organizations use a variety of strategies to prevent medication-related problems.[57] Managing patients' medications may include assessing therapeutic effectiveness and cost, as well as evaluating a patient's likelihood of adherence with the medication regimen.[58] This is particularly important for chronic conditions, such as diabetes, COPD, and hypertension.[59] Primary care teams – particularly those that incorporate pharmacists – may be better equipped to identify and prevent medication-related problems.[60]

In 2013, the Center for Medicare & Medicaid Innovation (CMMI) awarded Connecticut a $45 million State Innovation Model (SIM) grant to support healthcare payment and delivery model reforms aimed at improving health system performance, increasing quality of care, and decreasing costs. A central tenet of the SIM program in Connecticut was to promote, advance, and evaluate patient-centered care services in the state, including medical home models. A medical home is "a model or philosophy of primary care that is patient-centered, comprehensive, team-based, coordinated, accessible, and focused on quality and safety."[61]

Approximately 47% of adults nationwide and 30.4% of adults in Connecticut have diagnosed high blood pressure (i.e., hypertension).[62,63] Antihypertensive medications, including thiazide-type diuretics, angiotensin-converting enzyme inhibitors (ACEIs), angiotensin-receptor blockers (ARBs), calcium-channel blockers, and β-blockers, are commonly used as treatment for hypertension, in conjunction with lifestyle modifications.[64] Monitoring of antihypertensive treatment can identify potential adverse drug events, including increased risk of ED visits; however, researchers have found that antihypertensive medication monitoring is not routinely conducted.[65,66,67]

Research Question

Using data from organizational-level surveys and other data that were collected as part of the SIM project, we investigate the following research question: Are certain organizational characteristics related to higher rates of annual monitoring for chronic antihypertensive medications? Specifically, we assess the relationship between four PCMH organizational characteristics – organization size & affiliation, payment reform experience, team-based care, and patient tracking and reporting – and rates of annual monitoring for antihypertensive medications in primary care organizations in Connecticut.

Hypothesis & Rationale

Hypothesis: Team-based care will be positively associated with monitoring of antihypertensive treatment.

Rationale: Team-based care is an important component of medical home models of primary care.[68] "Team-based care" is defined by the Institute of Medicine as, "the provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively with patients and their caregivers—to the extent preferred by each patient—to accomplish shared goals within and across settings to achieve coordinated, high-quality care."[69] Teams have been studied extensively and the research indicates that teams are often more effective than when clinician and staff work without formal means of coordinating.[70] Provider teams have been shown to outperform solo practitioners in managing chronic diseases in terms of process-based and/or clinical outcome-based measures of chronic disease management.[71]

In primary care, integrated team-based care has been associated with a significantly higher proportion of patients with controlled hypertension.[72]

The team-based care measure used in this study indicates whether there was pharmacy involvement on the care team. Although pharmacists have traditionally focused primarily on medication dispensing, they are increasingly involved in a wider range of clinical activities aimed at optimizing drug therapy.[73, 74] Research has shown that physician-pharmacist collaboration in primary care has the potential to improve blood pressure, cholesterol, and glucose control in patients with chronic conditions (e.g., hypertension, diabetes, or asthma).[75, 76, 77, 78] In a review and meta-analysis of clinical trials that evaluated the role of team-based care involving a pharmacist or nurse, researchers found that team-based care was associated with improved blood pressure control.[79]

Methods

Data

The data for these analyses were responses to a Primary Care Organization Survey and clinical measures that were compiled by the SIM evaluation team. These are described below.

The SIM evaluation team developed and administered the 2019 Primary Care Organization Survey, a 40-question survey instrument that evaluated four aspects of primary care organizations: 1) organizational characteristics and governance; 2) health information technology; 3) quality improvement; and 4) clinical care delivery.

The Connecticut Office of Health Strategy (OHS), which ran the SIM project, commissioned the survey in early 2019. OHS was interested in evaluating primary care organizations that had participated in SIM programs during the CMMI grant test period (2013-

2019) to understand the organizational changes they had made to achieve success under state-led quality improvement and payment reform initiatives.

To develop the survey, we first compiled a list of potential survey items based on a literature review, conversations with state officials, and an in-depth review of The National Survey of ACOs (NSACO), a longitudinal survey of ACOs first fielded in 2012.[80] Because ACOs and the medical home primary care organizations in the sample share similar goals (e.g., improved quality, reduced costs, and patient-centered care), using these measures of organization attributes was a useful starting point.

The survey items were refined through joint discussions with representatives from OHS, Yale research team members, and researchers from University of Connecticut. The survey was pilot tested with two organizations in September 2019 by conducting a 30-minute interview with the organizations' CEOs. Based on this feedback, our team made changes to the survey instrument to improve ease of answering and interpretability for participants.

We invited primary care networks and providers in Connecticut that were participating in one or more shared savings contracts with commercial, Medicare and/or Medicaid payers to respond. This group included both Advanced Networks (ANs),[2] which predominantly serve commercially-insured patients, and Federally Qualified Health Centers (FQHCs),[3] which predominantly serve Medicaid patients. In October 2019, the survey was sent via email to all primary care practices participating in the SIM transformation project, which was 20 ANs and 17

[2] **"Advanced network"** means a provider organization or group of provider organizations that shall include primary care providers within one or more practices with PCMH status or PCMH accreditation, as applicable, but not including a glide path practice, and that complies with the composition specified in section 17b-262-1098 of the Regulations of Connecticut State Agencies. (Definition from eregulations.connecticut.gov)
[3] **Federally Qualified Health Centers** are community-based health care providers that receive funds from the HRSA Health Center Program to provide primary care services in underserved areas. They must meet a stringent set of requirements, including providing care on a sliding fee scale based on ability to pay and operating under a governing board that includes patients. (Definition from https://www.hrsa.gov/opa/eligibility-and-registration/health-centers/fqhc/index.html)

FQHCs in Connecticut. Individuals who were invited to complete the survey on behalf of their organizations were typically CEOs, Chief Operating Officers, or Chief Quality Officers. The practices were identified as participating in SIM by OHS, which provided all contact information for these individuals.

Data were collected via the online survey platform, Qualtrics, from October 2019 to January 2020. We telephoned practices to encourage them to complete the survey over the phone in December 2019. 11 ANs and 12 FQHCs responded to the survey, totaling 23 respondent organizations (62% response rate). Descriptive data were compiled for an internal OHS state report in 2020.

Clinical Measures

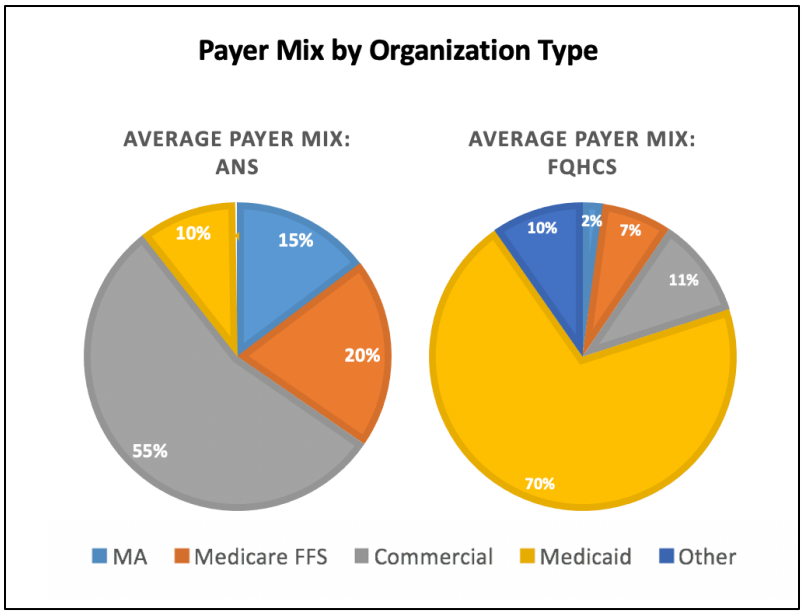
Clinical quality data collected by the SIM evaluation team were also used in this study. The SIM team collected clinical quality data from primary care ANs in Connecticut in 2017. These 21 measures include organizational-level, process-based measures of care (e.g., cervical cancer screening, diabetic eye exams, and annual monitoring of antihypertensive medications). These data were reported in a consumer-oriented online tool, "Healthscore CT," to improve comparability of primary care providers in the state.[81]

AN Data Set

The survey data and clinical measures were linked to create the final dataset for these analyses. Data collected from FQHCs for the state report using the *Primary Care Organization Survey* were excluded. Only ANs were included for two reasons. First, ANs and FQHCs typically serve distinct patient populations, and it was determined that these would not be comparable to

one another. FQHCs, by definition, serve underserved areas or populations.[82] We confirmed this by analyzing the average payer mix for ANs and FQHCs reported in the survey. We found that, on average, commercial insurance was the most common insurance type among ANs (55% of payer mix), while Medicaid was the most common among FQHCs (70%). See **Exhibit 2.1** for average payer mix by organization type.

Exhibit 2.1 Average Payer Mix by Organization Type (AN vs. FQHC)



Second, the process-based quality outcome of interest in the SIM Summary Clinical Measures was only available for ANs. The final dataset included 10 ANs, as one organization was removed from the analysis due to missing data.

Measures

Independent Variables: Four variables were used to define each study organization: Organization Size and Affiliation, Payment Reform & Experience, Team-Based Care, and Patient Tracking & Reporting (**Table 2.1**). Each variable was constructed using survey question responses on the "Primary Care Organization Survey." The process of combining survey questions to form these independent variables followed the QCA process, and is described in the Analysis section below.

Table 2.1 Independent Variables

Independent Variable & Definition	***Survey Questions Used in Measurement***
1. Organization Size & Affiliation This measure reflects a primary care organization's size and affiliation status	*(Q2) Organization type:* • *Primary care only* • *Multi-disciplinary without hospital partners* • *Multi-disciplinary with hospital partners* *(Q5) Please indicate the number of providers employed and affiliated within your network who are predominantly dedicated to providing primary care:* • *MD / DO____*
2. Payment Reform Experience This measure reflects a primary care organization's experience with value-based payment reform	*(Q7) With which of the following Connecticut payers do you currently have a shared savings program? Check all that apply.** • *Medicare FFS (MSSP/Next Gen)* • *Aetna* • *Anthem* • *Cigna* • *Connecticare* *Harvard Pilgrim Healthcare* • *United HealthCare* • *Dept of Social Services/Medicaid* **For analysis, this was changed to "Number of SSP Payer Partners (2019)."* *(Q8) When did your network first execute a shared savings program contract in Connecticut?*** • *2012 or earlier* • *2013* • *2014* • *2015* • *2016*

	• *2017* • *2018* • *I do not know* ***For analysis, this was changed to "Years of SSP Experience."* *(Q10) Please estimate the number of patients seen by PCPs within your organization in the past year. Please DO NOT include patients included by a partner organization.* • *# of patients seen by PCPs/year (unduplicated) ___* • *# of patients attributed to upside only SSP (or similar agreement) ___* • *# of patients attributed under upside and downside SSP (or similar i.e., premium sharing) ___*
3. Team-Based Care This measure evaluates a primary care organization's commitment to team-based care	*(Q28) Please estimate the unduplicated number of staff members by professional category dedicated to primary care. Where a staff member falls into two professional categories (e.g., a CHW serving as Patient Navigator), please attribute to only one.* • *Estimates given for: Care Management/Coordination Registered Nurses (RNs) & Licensed Practical Nurses (LPNs), Care Management/Coordination Social Workers or similar, Licensed Practical Nurses (Clinical), Registered Nurses (Clinical), Medical Assistant, Patient Navigators, Chronic Disease Educator (e.g., Asthma, Diabetes)* *(Q33) How many pharmacists and pharmacy techs (FTEs) are dedicated to your primary care team(s)? Please enter "0" if no pharmacists/pharmacy technicians are involved:* • *Pharmacists___* • *Pharmacy Technicians___*
4. Patient Tracking & Reporting This measure reflects a primary care organization's commitment to electronically tracking patients and quality measures within their system	*(Q21) For what percentage of your PCPs do you provide claims based quality measures (e.g., A1C testing)* • *None, None to <25%, 25% to <50%, 50% to<75, >75%, I don't know* *(Q22) Electronic Admission, Discharge, and Transfer (ADT) alerts?* • *None, None to <25%, 25% to <50%, 50% to<75, >75%, I don't know* *(Q22) At least monthly reports of frequent utilizers or high risk patients?* • *None, None <25%, 25% to <50%, 50% to<75, >75%, I don't know*

Clinical Measures (Dependent Variable): Antihypertensive medication monitoring was assessed using the organizational performance on the measure, "Annual Monitoring for Patients on Persistent Medications (MPM)." It is defined by the National Quality Forum as:

> "This measure assesses the percentage of patients 18 years of age and older who received a least 180 treatment days of ambulatory medication therapy for a select therapeutic agent during the measurement year and at least one therapeutic monitoring event for the therapeutic agent in the measurement year. Report the following [two] rates and a total rate:
>
> - *Rate 1:* Annual Monitoring for patients on angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARB): At least one serum potassium and a serum creatinine therapeutic monitoring test in the measurement year.
> - *Rate 2:* Annual monitoring for patients on diuretics: At least one serum potassium and a serum creatinine therapeutic monitoring test in the measurement year.
> - *Total rate* (the sum of the two numerators divided by the sum of the two denominators)"[83]

This is a process-based quality measure that evaluates monitoring in antihypertensive care. Process-based measures in healthcare typically reflect provider actions and observance of accepted recommendations for clinical practice.[84] These data come from the SIM "Summary Clinical Measures."

Analysis

Descriptive analyses are reported for all survey questions. The main analysis strategy used in this study was Qualitative Comparative Analysis (QCA). This method was used to evaluate which organizational characteristics, or groups of characteristics, are associated with higher rates of annual monitoring for antihypertensive medication. The QCA method is well-suited to this project as it is designed for analyzing a relatively small number of in-depth cases (N=5-50).[85]

Background on QCA

QCA was developed in the 1980s and 1990s by political scientists[86] because case study methods often provide significant detail, but lack statistical power due to small sample sizes. The method "enable[s] systematic cross-case comparisons, while at the same time attending to within-case complexity, particularly in small- and intermediate-N research designs".[87] QCA has been used

primarily to evaluate social systems that are characterized by causal complexity, and in situations where data may be both qualitative and quantitative.[88]

The method is one of a broader set of methods known as "Configurational Comparative Methods," which rely on set theory and logic for analysis, rather than statistics. Such methods are particularly helpful for evaluating the types of complex relationships that are encountered in real-world, dynamic settings and have been used in the field of implementation science.[89]

QCA uses Boolean algebra and formal logic to assess connections.[90] Unlike regression analysis, the method relies on the assumption that there are multiple pathways to the same outcome, and that system characteristics may work in tandem to produce a given outcome.[91] The method requires the researcher to classify and describe cases based on both quantitative and qualitative "causal conditions" (i.e., independent variables), and evaluate their relationship to an outcome of interest through set membership connections. The method seeks to establish necessary and sufficient conditions for the outcome.[92]

In 2013, the Agency for Healthcare Research & Quality (AHRQ) published a brief on the use of the method to evaluate PCMH models of primary care, noting its benefits for evaluating primary care organizations.[93] There is growing recognition that QCA is a powerful tool for health evaluation research, especially for mixed methods health research.[94]

Types of QCA

There are two primary types of QCA analysis: crisp set QCA and fuzzy set QCA. The distinction between the two rests on how the researcher defines set membership for each causal condition included in the analysis. In crisp set QCA, a case's designation for set membership is binary, either 0 (out of the set) or 1 (in the set) for each condition. For example, a political scientist

might be interested in the relationship between democracy and a country's economic growth rate. To determine set membership for the condition "democracy," the researcher would classify cases (i.e., countries) as either a democracy (1) or not a democracy (0).

In fuzzy set analysis, cases may have varying degrees of membership in a set between 0 (fully out of the set) and 1 (fully in the set). For a given condition, a case may be fully in a set, fully out of a set, or partially in a set. The AHRQ methodological brief used the following example of the use of the method in this setting:

> The fuzzy set of medical homeness may include practices that are fully in the set of medical homes (membership = 1), some that are "almost medical homes" (membership = 0.9), some that are more in than out of the set of medical homes (membership = 0.67), and so on, down to those that are fully out of the set of medical homes (membership = 0). Similarly, practices can be classified according to membership in sets defined by implementation components (such as high, medium, or low accessibility to patients); practice characteristics (such as being an independent practice or part of a larger delivery system); or patient characteristics (such as the proportion of low-, moderate-, and high-income patients).[95]

For this analysis, the fuzzy set QCA methodology was selected, as the organizational conditions analyzed (organization size & affiliation, payment reform experience, team-based care, and patient tracking & reporting) did not lend themselves to simple, binary measurement.

QCA Analytical Process

Methodologically, this analysis follows the analytical process described by Ragin.[96] The accompanying fsQCA 3.0 Mac software, developed by Charles Ragin and Sean Davey, was used to conduct this analysis.[97]

Fuzzy set QCA analysis entails the following steps:[98, 99, 100]

1. **Select Sample of Cases:** First, a researcher must identify the relevant cases for the QCA analysis. Cases must be similar enough to be compared, but differ enough to detect meaningful variation.

2. **Identify Outcome Variable:** Then, a researcher identifies the outcome variable of interest.

3. **Identify Causal Conditions:** Next, a researcher selects the "causal conditions," or the characteristics of each case. The researcher will evaluate the effect of these conditions on the outcome of interest.

4. **Create Macro Causal Conditions (i.e., independent variables):** If several conditions measure similar constructs, conditions may be combined to create "macro-conditions." In statistical analysis, these are called the independent variables.

5. **Create the Raw Data Table:** In the raw data table, each row is a case and each column is a causal condition or the outcome variable. The researcher inputs raw data, both qualitative and quantitative, into the table. The raw data table is typically created in Microsoft Excel and then loaded into the fsQCA software for subsequent steps.

6. **Calibrate Causal Conditions:** Calibration is one of the most critical steps in any QCA analysis. Ragin differentiates "calibration" from "measurement" in that the researcher creates a scale by which to measure each causal condition between 0 and 1.

7. **Evaluate Necessary and Sufficient Conditions:** This step identifies the necessary and sufficient conditions for the outcome, as well as causal recipes of combinations of conditions through truth table analysis. This evaluative step using Boolean logic uses relationships between conditions and outcomes to understand conditions' impact on the outcome of interest.

QCA Model for Organizational Characteristics Associated with Antihypertensive Monitoring

In this section, we describe each of these steps in the present QCA analysis. The QCA model included 10 Advanced Network (AN) primary care organizations in Connecticut that responded to the *2019 Primary Care Network Survey*. In this analysis, all participating primary care organizations had a medical home designation in Connecticut. The dependent measure used in this analysis was "Annual Monitoring for Patients on Persistent Medications (MPM)," was used for all ANs.

Causal conditions were selected through a literature review in three areas: medical home organization, ACO organization, and pharmacy organization. First, we reviewed the peer-reviewed and gray literature related to medical home organizations. According to the National Committee for Quality Assurance, there are six medical home program concept areas: team-based

care and practice organization, knowing and managing your patients, patient-centered access and continuity, care management support, care coordination and care transitions, performance measurement and quality improvement.[101] Many of these themes were also prevalent in the peer-reviewed papers analyzed.[102, 103]

Next, we reviewed the literature related to ACO organization. ACOs and medical homes share similar goals (e.g., improved quality and reduced costs), and both models focus on transforming primary care. In a taxonomy of ACOs that was published by Shortell et al. in 2014, the researchers identified eight organizational attributes and used them to define 173 different ACO organizations. [104] These eight attributes were: size; breadth of provider group participation; scope of services provided; integrated delivery system (IDS) participation; percent primary care physicians; institutional leadership model; performance management accountability; and prior payment reform experience. Although some of these were not relevant to the present study, size, breadth of provider group participation, and prior payment reform experience were deemed relevant for inclusion.

Lastly, we considered organizational characteristics that might be most salient for antihypertensive medication monitoring by evaluating the pharmacy organization literature. Pharmacists working on primary care teams can educate patients and clinical providers on medication use, as well as improve workflows for medication optimization and relieve physicians of medication-related tasks.[105]

Based on this literature review, we compiled a list of 10 causal conditions that related to the literature and were collected using the *SIM 2019 Primary Care Organization Survey*. These are listed in **Table 2.2.** In a later step in this analysis, these 10 causal conditions were rolled up

into the four macro-causal conditions (i.e., independent variables), previously defined in **Table 2.1**.

Table 2.2 Causal Conditions

Component Causal Condition	2019 Primary Care Organization Survey Question	Inclusion Based On
Organizational Model	Q2	ACO Organization Literature
Organization Size (MDs Employed & Affiliated)	Q5	ACO Organization Literature
Number of SSP Payer Partners (2019)	Q7	ACO Organization Literature
Years of SSP Experience	Q8	ACO Organization Literature
Percent of Patients Under Risk-Based Agreement	Q10	ACO Organization Literature
Clinical Support Staff Per PCP	Q5 & Q28	PCMH Literature
Pharmacy Involvement on Care Team	Q33	Pharmacy Literature
Offer Claims Based Quality Measures to PCPs	Q21	PCMH Literature
Electronic Admission, Discharge, and Transfer (ADT) alerts	Q22	PCMH Literature
Monthly Reports of Frequent Utilizers or High-Risk Patients	Q22	PCMH Literature

Several of the causal conditions measured similar constructs. Therefore, "macro-causal conditions" were created, each consisting of 2-3 component causal conditions that measured similar constructs. In statistical analyses, the macro-causal conditions are often called the "independent variables." The macro-causal conditions and their component causal conditions are shown in **Table 2.3**.

Table 2.3 Macro-Causal Conditions

Macro-Causal Condition (i.e., Independent Variable)	***Component Causal Conditions Included***
1. Organization Size & Affiliation *This measure reflects a primary care organization's size and affiliation status*	• Organizational Model • Organization Size (MDs Employed & Affiliated)
2. Payment Reform Experience *This measure reflects a primary care organization's experience with value-based payment reform*	• Number of SSP Payer Partners (2019) • Years of SSP Experience • Percent of Patients Under Risk-Based Agreement
3. Team-Based Care *This measure evaluates a primary care organization's commitment to team-based care*	• Clinical Support Staff Per PCP • Pharmacy Involvement on Care Team
4. Patient Tracking & Reporting *This measure reflects a primary care organization's commitment to electronically tracking patients and quality measures within their system*	• Offer Claims Based Quality Measures to PCPs • Electronic Admission, Discharge, and Transfer (ADT) alerts • Monthly Reports of Frequent Utilizers or High Risk Patients

Next, a data table was created in Microsoft Excel. Each row in the raw data table corresponded to an individual case, and each column represented a component causal condition **Table 2.4**. Raw survey data was inputted into the table.[4] Next, the data table was analyzed using the fsQCA software.

[4] The fsQCA software cannot accept missing values in the raw data table. Missing values were estimated using secondary research and literature reviews.

Table 2.4 Data Table

	Organization Size & Affiliation		Payment Reform Experience			Team-Based Care		Patient-Tracking & Reporting			Outcome
	Organizational Model	Number of PCPs (Employed & Affiliated)	Number of SSP Payer Partners (2019)	Years of SSP Experience	Percent of Patients Under Risk-Based Agreement	Pharmacy Involvement on Primary Care Team	Clinical Support Staff per PCP	Offer Claims Based Quality Measures to PCPs	Electronic Admission, Discharge, and Transfer (ADT) alerts	Monthly Reports of Frequent Utilizers or High Risk Patients	Annual Monitoring for Anti-Hypertensive Medications (Outcome Variable)
Org. 1	Multi-disciplinary without hospital partners	360	1	7	0.15	Yes	0.31	25% to <50%	>75%	50% to <75%	87.9%
Org. 2	Multi-disciplinary with hospital partners	65	4	2	0.30	Yes	0.48	75% or more	>75%	>75%	84.5%
Org. 3	Primary care only	285	7	7	0.84	Yes	1.08	75% or more	50% to <75%	50% to <75%	88.1%
Org. 4	Multi-disciplinary with hospital partners	166	6	6	0.67	Yes	0.41	75% or more	>75%	>75%	83.1%
Org. 5	Multi-disciplinary with hospital partners	300	4	6	0.38	Yes	0.09	75% or more	>75%	>75%	83.2%
Org. 6	Multi-disciplinary with hospital partners	240	5	6	0.75	Yes	0.33	75% or more	>75%	>75%	82.7%
Org. 7	Multi-disciplinary with hospital partners	170	7	4	0.88	Yes	1.38	75% or more	>75%	>75%	83.6%
Org. 8	Multi-disciplinary without hospital partners	40	5	3	0.31	No	0.40	75% or more	>75%	>75%	86.6%
Org. 9	Multi-disciplinary with hospital partners	39	5	3	0.19	Yes	0.21	75% or more	>75%	>75%	81.1%
Org. 10	Multi-disciplinary without hospital partners	88	6	6	0.63	No	1.25	75% or more	None	<25%	84.0%

Next, we calibrated the raw data according to Ragin's fsQCA methodology.[106] To do this, the researcher selects three anchor points in the raw data for each condition: 1) Threshold for full set membership (.95) 2) The cross-over point (.5); and 3) the threshold for full non-membership (.05). Whenever possible, external standards should be used to define the anchor points. Calibrated scores should reflect how cases relate to one another, as well as external standards or norms. If there is no substantive knowledge base on a given measure, the statistical properties (i.e., mean, standard deviation) of the researcher's dataset may be used.

Using the fsQCA software, we transformed the raw data into scores from 0-1. Calibration points were based on both extensive external research and internal data distribution in the raw data if external data points were not available. Next, these calibrated scores were rolled up by macro-condition, resulting in the calibrated data table shown in **Table 2.5**.

Table 2.5 Calibrated Macro-Condition Table

	Organization Size & Affiliation	Payment Reform Experience	Team-Based Care	Patient-Tracking & Reporting	Outcome
Org. 1	0.75	0.3367	0.52	0.5833	0.95
Org. 2	0.805	0.2	0.805	1	0.38
Org. 3	0.55	0.99	0.99	0.8333	0.96
Org. 4	0.985	0.9333	0.755	1	0.13
Org. 5	1	0.5267	0.55	1	0.14
Org. 6	1	0.91	0.535	0.9016	0.09
Org. 7	0.985	0.8267	1	1	0.2
Org. 8	0.41	0.35	0.23	1	0.83
Org. 9	0.65	0.3367	0.55	0.9479	0.02
Org. 10	0.63	0.9133	0.495	0.4167	0.27

The QCA method is designed to assess necessary and sufficient causal conditions, or combinations of conditions, for the outcome of interest using the calibrated data. This is conducted through truth table construction and analysis, which serves as a way to identify conditions, or

combinations of conditions, that are sufficient for the outcome to occur. A truth table is a data matrix with 2^k rows, where k is the number of macro-causal conditions. Rows of the truth table reflect all possible combinations of conditions and their outcomes. The truth table analysis is conducted in fsQCA software and evaluates set relationships between conditions and the outcome.

The QCA method uses two measures to assess goodness-of-fit, consistency and coverage. Consistency refers to strength of the relationship between the causal condition and the outcome across all cases. It is reported on a 0-1 scale. Coverage refers to the proportion of cases to which that relationship applies. It is also reported on a 0-1 scale. Consistency and coverage are reported for both necessary and sufficient conditions. Results from the truth table analysis are reported in the results section.

Results

Descriptive analyses are reported for all survey questions used to inform the QCA model. Mean and range are reported for continuous variables and counts with percentages were reported for categorical variables in **Tables 2.6 and 2.7**. Given the small sample size (n=10), standard deviations are not be reported.

Table 2.6 Continuous Variable Survey Questions

Condition	Mean (Range)
Number of PCPs (Employed & Affiliated)	175.3 (39-360)
Number of SSP Partners (2019)	5 (1-7)
Years of SSP Experience	5 (2-7)
Clinical Support Staff per PCP	.59 (.09-1.38)
Annual Monitoring for Anti-Hypertensive Medications (Outcome Variable)	84.5% (81.1-88.1%)

Table 2.7 Categorical Variable Survey Questions

Condition	N (%)
Organizational Model	
Primary care only	1 (10%)
Multi-disciplinary without hospital partners	3 (30%)
Multi-disciplinary with hospital partners	6 (60%)
Pharmacy Involvement on Care Team	
Yes	8 (80%)
No	2 (20%)
Offer Claims Based Quality Measures to PCPs	
None	0 (0%)
None to <25%	0 (0%)
25% to <50%	1 (10%)
50% to<75	0 (0%)
>75%	9 (90%)
I don't know	0 (0%)
Electronic Admission, Discharge, and Transfer (ADT) alerts	
None	1 (10%)
None to <25%	0 (0%)
25% to <50%	1 (10%)
50% to<75	1 (10%)
>75%	8 (90%)
I don't know	0 (0%)
Monthly Reports of Frequent Utilizers or High Risk Patients	
None	0 (0%)
None to <25%	1 (10%)
25% to <50%	0 (0%)
50% to<75	2 (20%)
>75%	7 (70%)
I don't know	0 (0%)

QCA Model Output

Using the calibrated data table, the truth table was constructed and analyzed in the fsQCA software. Necessary conditions were evaluated first. The consistency and coverage scores to evaluate the necessity of the macro-causal conditions are reported in **Table 2.8.**

Table 2.8 Necessary Conditions for Medication Monitoring for Antihypertensive Medications

A necessary condition is a condition that must be present for an outcome to occur; however, it does not necessarily guarantee on its own that the outcome will be present

Macro-Condition	Consistency	Coverage
Organization Size & Affiliation	.74	.38
Payment Reform Experience	.68	.42
Team-Based Care	.74	.45
Patient Tracking & Reporting	.88	.40

We use 0.8 as the consistency level for necessity, as is commonly done in the literature.[107,108] There is no standard for coverage level. Patient tracking & reporting was the only necessary condition identified for positive outcomes for medication monitoring for antihypertensive conditions, meaning that this condition must be present for the outcome to occur at the .8 consistency level. Next, sufficiency was evaluated. At the .8 consistency level, no sufficient conditions or combination of conditions were identified for positive antihypertensive monitoring for persistent medications.

As a sensitivity analysis, the consistency level for sufficiency was reduced to .7, based on recommendations in the literature.[109] At the .7 level, two combinations of macro-causal conditions were found to be sufficient for the outcome.[110] Using the QCA method, multiple pathways may be found for the same outcome. These two solutions are listed in **Table 2.9**.

Table 2.9 Sufficiency for Antihypertensive Monitoring at .7 Consistency Level

A sufficient condition is a condition, or set of conditions, that will always produce the outcome

Outcome	Macro-Conditions Identified	Consistency	Coverage	Interpretation
Antihypertensive Monitoring for Persistent Medications	~organization + ~ssp + ~team + tracking	.78	.29	High antihypertensive monitoring is observed in practices that have patient tracking & reporting, but do not have large networks, shared savings program experience, or team-based care.
	organization + ssp + ~team + ~tracking	.73	.18	High antihypertensive monitoring is observed in practices that are large and affiliated and have shared savings program experience, but do not have team-based care or patient tracking & reporting.

~ Denotes the absence of that condition

Discussion

This analysis evaluated the relationship between four organizational characteristics – organization size & affiliation, payment reform experience, team-based care, and patient tracking and reporting – and antihypertensive medication monitoring within 10 AN primary care organizations in Connecticut. It was hypothesized that team-based care would be associated with improved monitoring due to the addition of pharmacists, nurses, and other caregivers who could support efforts to manage and evaluate patient medications.

Our QCA analysis revealed that team-based care was neither a necessary nor sufficient condition for higher rates of antihypertensive medication monitoring. This finding differs from earlier work in antihypertensive medication management, which has found that team-based care – particularly when it includes pharmacists – is associated with improved hypertensive management and patient outcomes.[111, 112] Our QCA model revealed one necessary condition, patient tracking and reporting. Primary care organizations that had a commitment to IT programs, care

management protocols, and policies to track their patient populations were most likely to perform antihypertensive monitoring. This condition was also present in one of the sufficient solutions at the .7 consistency level. This finding emphasizes the importance of systems for managing and tracking patients within healthcare organizations.

There are several possible explanations for these results. First, this analysis was limited by the lack of more specific information around the roles and responsibilities of non-physician caregivers, particularly of pharmacists. The team-based care measure used in this analysis was informed by two components: 1) support staff per physician; and 2) pharmacy involvement on the care team. The survey questions did not ask participants about the quality or depth of those team member collaborations, and few organizations provided information on collaborative practice agreements, pharmacist workflows, and co-location despite survey questions on those topics. With a relatively small number of organizations, it was therefore difficult to detect meaningful differences based on the presence of a pharmacist team member alone.

Second, although team-based care did not influence rates of monitoring in our study, medication monitoring is only one component of comprehensive medication management for chronic conditions.[113] Future research could involve a wider range of medication therapy-related outcome variables, including patient clinical outcomes or experience data, aimed at a more holistic view of comprehensive medication management. It is encouraging that results indicated that those provider organizations that invested in programs and policies to track patients did indeed experience higher rates of monitoring within their organizations.

There were several additional limitations in this study. Inherent to QCA, and to most qualitative methods, is the researcher's subjective decision-making. Researchers select relevant cases and set calibration points within the raw data based on theoretical reasoning and published

results. For these reasons, this analysis should be considered descriptive and exploratory, rather than causal.[114] All primary care organizations in the sample performed fairly well along the antihypertensive monitoring measure, as seen in the raw data prior to QCA calibration. In the descriptive analysis, we reported that variation in the outcome measure ranged from 81% to 88%. It may be that most primary care organizations in this analysis are doing an adequate job of monitoring their patients. Lastly, there was a 2-year gap between when the quality measures were collected in 2017 and when the 2019 Primary Care Survey data was collected.

Despite its limitations, this study has implications for primary care organizations, policymakers, and researchers. For primary care organizations and policymakers, this analysis suggests that IT programs and policies to track patient care over time are worthy investments for ensuring that patients receive evidence-based care, such as medication monitoring for antihypertensive therapy. While these results suggest that team-based care may not be associated with higher rates of medication monitoring, given the noted limitations, additional research is necessary to analyze whether team-based care impacts other aspects of comprehensive medication management. For researchers, this work highlights the importance of access to information on the activities team members are responsible for and the structure of care teams. This is particularly vital when using the QCA method, which requires in-depth knowledge about small number of cases to detect meaningful difference among them.

Chapter 3

Are team-based models of primary care associated with better patient experiences?

Introduction

According to the Institute of Medicine, "team-based care" refers to "the provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively with patients and their caregivers—to the extent preferred by each patient—to accomplish shared goals within and across settings to achieve coordinated, high-quality care."[115] Healthcare teams are a way of addressing fragmentation in the clinical setting, such that care is organized around the patient (i.e., "patient-centered") rather than individual providers.[116]

Asking patients about their care experiences is one way of assessing patient-centered care. The Agency for Healthcare Research and Quality (AHRQ) defines such measures as an "integral component of health care quality," elaborating that, "patient experience includes several aspects of health care delivery that patients value highly when they seek and receive care, such as getting timely appointments, easy access to information, and good communication with health care providers."[117]

In recent years, several forces have led to a greater emphasis on measures of patient experience as important quality measures for healthcare organizations.[118] There is growing evidence that positive patient experiences are positively associated with patient safety and clinical effectiveness across a wide range of disease areas, settings, outcome measures, and study designs.[119,120] Furthermore, several policy and financial factors have motivated organizations to

improve patient experiences. CMS and other health care payers have increasingly incorporated patient experience measures into performance-based incentive systems, meaning that improved experience may translate into higher organizational revenue.[121] In addition, due to improved access to information, including online hospital and physician review systems, patients are placing greater emphasis on their experiences in healthcare settings when selecting which providers to visit.[122]

Despite a policy-led shift across primary care to implement models that incorporate care teams and the emergence of patient experience as an important quality measure, there have been inconsistent results on the association between these primary care models and patient experiences of care.[123,124,125] In fact, some have suggested that team-based primary care may even cause disruptions to the trusted relationship between a patient and his or her PCP by splintering care across multiple providers.[126,127] Unlike in acute settings, in primary care settings, patients may have longstanding, trusted relationships with their physicians.[128]

Furthermore, research on patient experience has focused on patient-level drivers of patient experience (e.g., patient age, health, or race) rather than organizational.[129,130,131,132] This has led to a dearth of information around whether practice-level changes to care team organization meaningfully impact patient experiences in those settings.

In the study reported herein, we evaluated the relationship between the proportion of non-physician caregivers per PCPs and patient care experiences among primary care practices participating in the Connecticut SIM project. We used this proportion as a proxy for measuring an organization's commitment to the type team-based care that PCMH models promote; however, we acknowledge and discuss the limitations of this definition of team-based primary care. Patient experience was assessed across four domains: timely care, communication, coordination, and courteous staff. All analyses were conducted using survey data from the SIM project.

Research Questions

In this paper we report analyses assessing whether the proportion of non-physician care givers per PCP (i.e., "team-based models of care") is positively associated with more positive patient care experiences of care in primary care organizations participating in the SIM project. We also evaluate whether the relationship between care teams and patient experiences differs by the patient's health status.

The quality of patient care experiences is particularly critical in primary care settings, which are often patients' first gateway into the healthcare system. Experiences in these settings may dictate a patient's overall relationship with the healthcare system. Furthermore, from a policy perspective there is value in understanding patient experience among primary care practices participating in the SIM project. Given the state and federal commitment to developing patient-centered primary care, and the SIM project's implementation of such models, it is helpful to understand whether greater commitment to care teams led to the desired patient-centered outcomes.

Hypotheses & Rationale

Hypothesis 1: Team-based models of primary care will be positively associated with all four domains of patient care experiences, with the strongest effects observed for the domains of communication and courteous staff.

Rationale: Team-based care in the inpatient setting has been positively associated with better patient experiences; however, less is known about how teams impact patient experiences in

outpatient settings, particularly in primary care.[133] We hypothesize that care teams in which non-physician caregivers work with physicians to care for patients are likely to improve patient experience across all four experience domains (timely care, communication, coordination, and courteous staff).

Compared to a solo practitioner, the presence of a care team means that there are a greater number of caregivers for patients to communicate with, which is most likely to impact the domains of communication and courteous staff. Therefore, we predict that the effect of care teams will be strongest for these two domains.

For the domain of coordination, we predict that non-physician caregivers could improve coordination in some situations, and decrease it in others. For example, the addition of a social worker might improve the patient's connection to non-clinical services to address social determinants of health, such as insecure housing. However, in situations where the number of caregivers has increased but those caregivers do not communicate well amongst each other, coordination may decrease from the patient's perspective. The domain of timely care, which serves as a proxy for patient access to care, will be least affected by the addition of non-physician care team members, as this is most likely to be associated with other organizational characteristics (e.g., access to telehealth or patient panel size).

Hypothesis 2: For patients who are chronically ill, the association between team-based care and patient experiences will be stronger than for healthier patients.

Rationale: We hypothesize that the relationship between the use of teams and patient experience would be stronger for chronically ill patients because patients with chronic health

conditions are impacted more than healthy patients by the presence of additional caregivers.[134] These patients are likely to have a greater number of interactions with the healthcare system, and the additional communication that team members can provide may be more meaningful. Therefore, we predicted the strongest effect would be observed for the communication domain of patient experience, and the weakest would be for timely care.

Methods

Data Sources

The data for these analyses were collected using the 2019 Primary Care Organization Survey and the 2019 Patient Experience surveys (collected using the CG-CAHPS survey), which were part of the SIM Evaluation. The 2019 Primary Care Organization Survey asked primary care practices about organizational characteristics and the CG-CAHPS survey asked patients about their care experiences. The datasets were linked at the organization level, as patients were clustered by organization. Each of the surveys are described in greater detail below.

Primary Care Organization Survey

The SIM evaluation team developed and administered the 2019 Primary Care Organization Survey, a 40-question survey instrument that evaluated four aspects of primary care organizations: 1) organizational characteristics and governance; 2) health information technology; 3) quality improvement; and 4) clinical care delivery.

The Connecticut Office of Health Strategy (OHS), which ran the SIM project, commissioned the survey in early 2019. OHS was interested in evaluating primary care organizations that had participated in SIM programs during the CMMI grant test period (2013-

2019) to understand the organizational changes they had made to achieve success under state-led quality improvement and payment reform initiatives.

To develop the survey, we first compiled a list of potential survey items based on a literature review, conversations with state officials, and an in-depth review of The National Survey of ACOs (NSACO), a longitudinal survey of ACOs first fielded in 2012.[135] Because ACOs and the medical home primary care organizations in the sample share similar goals (e.g., improved quality, reduced costs, and patient-centered care), using these measures of organization attributes was a useful starting point.

The survey items were refined through joint discussions with representatives from OHS, Yale research team members, and researchers from University of Connecticut. The survey was pilot tested with two primary care organizations in CT in September 2019 by conducting a 30-minute interview with the organizations' CEOs. Based on this feedback, our team made changes to the survey instrument to improve ease of answering and interpretability for participants.

We invited primary care networks and providers in Connecticut that were participating in one or more shared savings contracts with commercial, Medicare and/or Medicaid payers to respond. This group included both Advanced Networks (ANs),[5] which predominantly serve commercially insured patients, and Federally Qualified Health Centers (FQHCs),[6] which predominantly serve Medicaid patients. In October 2019, the survey was sent via email to all primary care practices participating in the SIM transformation project, which was 20 ANs and 17

[5] **"Advanced network"** means a provider organization or group of provider organizations that shall include primary care providers within one or more practices with PCMH status or PCMH accreditation, as applicable, but not including a glide path practice, and that complies with the composition specified in section 17b-262-1098 of the Regulations of Connecticut State Agencies. (Definition from eregulations.connecticut.gov)
[6] **Federally Qualified Health Centers** are community-based health care providers that receive funds from the HRSA Health Center Program to provide primary care services in underserved areas. They must meet a stringent set of requirements, including providing care on a sliding fee scale based on ability to pay and operating under a governing board that includes patients. (Definition from https://www.hrsa.gov/opa/eligibility-and-registration/health-centers/fqhc/index.html)

FQHCs in Connecticut. Individuals who were invited to complete the survey on behalf of their organizations were typically CEOs, Chief Operating Officers, or Chief Quality Officers. The practices were identified as participating in SIM by OHS, which provided all contact information for these individuals.

Data were collected via the online survey platform, Qualtrics, from October 2019 to January 2020. We telephoned practices to encourage them to complete the survey over the phone in December 2019. 11 ANs and 12 FQHCs responded to the survey, totaling 23 respondent organizations (62% response rate). Descriptive data were compiled for an internal OHS state report in 2020.

2019 CG-CAHPS survey

Patient surveys were conducted with a probability sample of primary care patients in CT at three different times during the SIM study period (2014-2019). A sample of Medicaid patients and patients covered by three large commercial insurance plans was drawn from each primary care organization (both those with and without risk-based financial agreements) in the state and a separate group of patients who were unaffiliated with an advanced network. Approximately equal numbers of patients (unless constrained by total number of patients) were selected from each primary care network.

Three waves of surveys of were conducted by telephone for Medicaid patients (I; 5/2/17 – 7/17/17; II: 7/27/17 – 10/2/18; III: 7/8/19-10/21/19) and those with commercial insurance (I; 10/19/17 – 2/13/18; II: 11/16/18 – 1/19/19; III: 11/19/19 – 1/21/19). Only the third wave of the surveys were analyzed in this analysis, as they were conducted in a similar timeframe to the 2019 Primary Care Survey.

The Clinician and Group Consumer Assessment of Healthcare Providers and Systems (CG-CAHPS) survey asked primarily about care experiences, augmented with questions about aspects of care most salient to PCMH-designated organizations. The sample was a stratified cluster sample with clustering of patients by primary care network. The final number of respondents for the third wave of the surveys were; Medicaid: 5,875; Commercial: 6,540.

Key Measures

Independent Variable

Team-Based Care: We constructed an ordinal variable to describe the level of team-based care within an organization as low, medium, or high. This was constructed using two steps. First, we calculated the number of clinical support staff[7] per PCPs (employed and affiliated) within an organization using responses to two questions from the Primary Care Organization Survey. These are listed below:

(Q5) Please indicate the number of providers employed and affiliated within your network who are predominantly dedicated to providing primary care:

- *MD / DO____*
- *PA____*
- *APRN____*

(Q28) Please estimate the unduplicated number of staff members by professional category dedicated to primary care. Where a staff member falls into two professional categories (e.g., a CHW serving as Patient Navigator), please attribute to only one.

- *Estimates given for: Care Management/Coordination Registered Nurses (RNs) & Licensed Practical Nurses (LPNs), Care Management/Coordination Social Workers or similar, Licensed Practical Nurses (Clinical), Registered Nurses (Clinical), Medical Assistants, Community Healthcare Workers, Patient Navigators, Health Coaches, Nutritionists, Dieticians, Chronic Disease Educator (e.g., Asthma, Diabetes)*

[7] Clinical support staff includes: Employed & affiliated PAs, employed & affiliated APRNs, Care Management/Coordination Registered Nurses (RNs) & Licensed Practical Nurses (LPNs), Care Management/Coordination Social Workers or similar, Licensed Practical Nurses (Clinical), Registered Nurses (Clinical), Patient Navigators, Chronic Disease Educator (e.g., Asthma, Diabetes)

Next, we used the distribution of these ratios across organizations to define low, medium, and high use of teams in the study organizations. A low level of teams was defined as the 25th percentile and below, a medium level of teams was defined any value above the 25th percentile and below the 75th percentile, and a high level of teams was defined as any ratio at or above the 75th percentile.

Dependent Variables

The dependent variable, patient experience of care, was assessed at the patient level using responses from the 2019 wave of the SIM CG-CAHPS survey. Four summary measures of patient experience were assessed. Each summary measure was calculated using patient responses to multiple survey questions; these are described in **Table 3.1** below. Each measure was calculated on a 0-100 scale, with 100 representing the most positive experience.

Table 3.1 Summary Patient Experience Measures

Measure	Questions Included
Timely Care	*Q6 In the last 6 months, when you contacted this provider's office to get an appointment for care you needed right away, how often did you get an appointment as soon as you needed?* *Q8 In the last 6 months, when you made an appointment for a check-up or routine care with this provider, how often did you get an appointment as soon as you needed?* *Q11 In the last 6 months, when you contacted this provider's office during regular office hours, how often did you get an answer to your medical question that same day?*
Communication	*Q12 In the last 6 months, how often did this provider explain things in a way that was easy to understand?* *Q13 In the last 6 months, how often did this provider listen carefully to you?* *Q14 In the last 6 months, how often did this provider seem to know the important information about your medical history?* *Q15 In the last 6 months, how often did this provider show respect for what you had to say?*
Coordination	*Q14 In the last 6 months, how often did this provider seem to know the important information about your medical history?* *Q18 In the last 6 months, when this provider ordered a blood test, x-ray, or other test for you, how often did someone from this provider's office follow up to give you those results?* *Q26 In the last 6 months, how often did you and someone from this provider's office talk about all the prescription medicines you were taking?*
Courteous Staff	*Q27 In the last 6 months, how often were clerks and receptionists at this provider's office as helpful as you thought they should be?* *Q28 In the last 6 months, how often did clerks and receptionists at this provider's office treat you with courtesy and respect?*

Covariates

Covariates were selected based on both a literature review and theoretical considerations. Patient-level covariates included: patient age, patient physical health status, patient mental health status, and patient race. Organizational-level covariates included: organizational type, hospital affiliation status, and organizational size. These are described below.

There is a large body of literature on patient-driven differences in patient experience. Previous research has shown that patient age is positively associated with patient experience, and that older adults are more likely to have favorable experiences.[136, 137] Health status has also been positively associated with patient experience, with those in better health, on average, reporting higher patient satisfaction levels.[138] Previous research has shown racial differences in patient experience, with several studies showing that non-white patients report lower satisfaction with patient-physician interactions.[139, 140] Additionally, several studies have suggested that Asians rate physician performance less favorably compared to whites.[141, 142]

Covariates also included organizational-level variables. Organizational type was included, as respondent organizations included both Advanced Networks (ANs),[8] which predominantly serve commercially-insured patients, and Federally Qualified Health Centers (FQHCs),[9] which predominantly serve Medicaid patients. Given inherent differences in patient mix, organizational size, and access to specialty caregivers that might differ by hospital affiliation status, hospital

[8] **"Advanced network"** means a provider organization or group of provider organizations that shall include primary care providers within one or more practices with PCMH status or PCMH accreditation, as applicable, but not including a glide path practice, and that complies with the composition specified in section 17b-262-1098 of the Regulations of Connecticut State Agencies. (Definition from eregulations.connecticut.gov)

[9] **Federally Qualified Health Centers** are community-based health care providers that receive funds from the HRSA Health Center Program to provide primary care services in underserved areas. They must meet a stringent set of requirements, including providing care on a sliding fee scale based on ability to pay and operating under a governing board that includes patients. (Definition from https://www.hrsa.gov/opa/eligibility-and-registration/health-centers/fqhc/index.html)

affiliation status was included as a covariate. Lastly, organizational size was included by controlling for the number of employed and affiliated MDs and DOs.

Three additional variables were considered and reported descriptively, but ultimately, not included in regression models (patient gender, organizational financial incentives for PCPs based on CAHPS scores, and a patient's health insurance provider). Patient gender was considered as a covariate and reported descriptively; however, the literature review suggested that gender effects on patient experience / satisfaction are minimal.[143, 144, 145] Therefore, patient gender was not included in regression models.

Organizational financial incentives for PCPs based on CAHPS scores and a patient's health insurance provider were highly correlated with organizational type (AN vs. FQHC) and therefore not included in regression models. ANs were more likely to offer financial incentives for individual PCPs based on CAHPS scores than FQHCs. We also tested differences among payers. There were negligible and inconsistent difference among the three commercial payers in the sample. Differences were observed between patients with commercial insurance and those with Medicaid, but because of the patient mix differences attributable to organizational type, these differences were largely accounted for using that variable. Compared to patients of three commercial insurers, patients with Medicaid reported better patient experiences across all four summary measures. This finding is in line with the prior literature, which has shown that patients with Medicaid insurance report similar or better care experiences compared to both the uninsured and those with commercial health insurance.[146,147,148]

Analysis

Descriptive statistics were used to describe patient demographics and organizational characteristics, as well as overall CG-CAHPS results. Multi-level linear regression models were used to assess the association between primary care teams and patient experiences, controlling for potentially confounding variables.

Multi-level models were used to reflect that fact that patients were clustered within primary care organizations. Models were first run with just a main effect for the use of care teams and then an interaction between care teams and health status was included to investigate whether chronically ill patients were impacted to a greater extent by care teams.

Results

Descriptive Characteristics of Patients & Organizations

A large portion of patients (**Table 3.2**) was female (62.5%). The most common age category was 55-64 (37.5%), and the least common was 75 or older (2.6%). Patients reported both physical and mental health status. Patients generally reported positive physical health, as "Very Good" (34.6%) and "Good" (35.5%) were the most common responses.

Table 3.2 Characteristics of Patients

Characteristic	n (%)
Gender (n = 6357)	
Male	2383 (37.5)
Female	3974 (62.5)
Age (n = 6362)	
18 to 24	251 (4.0)
25 to 34	691 (10.9)
35 to 44	960 (15.0)
45 to 54	1325 (20.8)
55 to 64	2388 (37.5)
65 to 74	584 (9.2)
75 or older	163 (2.6)
Health Status (n = 6353)	
Excellent	878 (13.8)
Very Good	2200 (34.6)
Good	2254 (35.5)
Fair	849 (13.4)
Poor	172 (2.7)
Mental Health Status (n = 5599)	
Excellent	1421 (25.4)
Very Good	1295 (23.1)
Good	2044 (36.5)
Fair	691 (12.3)
Poor	148 (2.6)
Race (n = 6432)	
White	4172 (64.9)
Non-White	2260 (35.1)
Health Insurance Provider (n = 6432)	
Anthem	1185 (18.4)
Connecticare	1254 (19.5)
Medicaid	2982 (46.4)
United Healthcare	1011 (15.7)

The characteristics of the 20 study organizations are shown in **Table 3.3.**

Table 3.3 Organizational Characteristics

Categorical Variables	n (%)
Org. Teams	
Low	5 (25%)
Medium	10 (50%)
High	5 (25%)
Org. Type	
AN	11 (55%)
FQHC	9 (45%)
Hospital Affiliation	
Yes	7 (35%)
No	13 (65%)
Org. CAHPS Incentives	
Yes	8 (40%)
No	12 (60%)

Continuous Variable	Mean (Range)
Organizational Size (# of MDs/DOs)	98 (2-360)

Patient Experiences of Care

Patients generally reported positive healthcare experiences. The mean CG-CAHPs score was above 85% for all four of the outcome measures (**Table 3.4**). "Timely care" had the lowest mean (86.9%) and "Communication" had the highest (93.9%).

Table 3.4 CG-CAHPS Results

Experience Characteristic	Mean (SD)
Timely Care (n = 5479)	86.9 (21.9)
Communication (n = 5891)	93.9 (15.4)
Coordination (n = 5884)	89.2 (19.4)
Courteous Staff (n = 5884)	90.2 (19.4)

Intra-Class Correlation (ICC)

The ICC can be used to describe the relative amount of variance within and between clusters in multi-level models. It is the correlation between two observations within the same cluster and explains the variance attributable to the grouping variable (i.e., organization in this analysis). ICCs for the variables of interest ranged from 1% for Communication to 3% for Coordination (**Table 3.5**). With large sample sizes, even a small amount of clustering can bias standard errors. To account for grouping at the organizational level, multi-level models are appropriate. The unit level reliability might be of interest also.

Table 3.5: ICC Results

	Model 1: Timely Care		**Model 2: Communication**		**Model 3: Coordination**		**Model 4: Courteous Staff**	
	Coefficient	**CI**	**Coefficient**	**CI**	**Coefficient**	**CI**	**Coefficient**	**CI**
ICC	0.02	0.01-0.05	0.01	0.00-0.02	0.03	0.02 -0.06	0.02	0.01-0.05

Regression Results

Multi-level linear regression models were used to assess the relationship between care teams and patient experience **(Table 3.6).** Compared to a low level of teams, a high level of teams was associated with higher patient experience scores for two outcomes: communication (3.03 increase) and courteous staff (4.04 increase). A medium level of teams was associated with higher patient experience for courteous staff (2.58 increase). The effects of medium or high levels of teams for timely care and coordination were not significant.

Compared to FQHCs, the AN organizational type was associated with lower experience scores for both coordination and courteous staff outcomes. Experience scores also differed by hospital affiliation status for the communication and courteous staff outcomes, with patients of primary care groups that were hospital affiliated reporting better experiences. Patient health was negatively associated with experience across all four models, consistent with earlier findings.[149] "Fair" and/or "Poor" patient mental health was also negatively associated with worse experiences for all four of the outcomes modeled.

We next estimated these models with an interactive term between patient health and team-based care (**Table 3.7).** Both medium and high levels of teams had the largest impact on patients in poor health for courteous staff scores. The interactive term was not statistically significant for the other three outcomes (timely care, communication, coordination).

Table 3.6: Multi-Level Regression Results

	Model 1: Timely Care		Model 2: Communication		Model 3: Coordination		Model 4: Courteous Staff	
	Coefficient (SE)	**p-value**	**Coefficient (SE)**	**p-value**	**Coefficient (SE)**	**p-value**	**Coefficient (SE)**	**p-value**
Teams (ref: Low)								
Medium	2.42 (2.14)	0.259	1.18 (0.67)	0.078	1.81 (1.50)	0.277	2.58 (1.12)	0.021*
High	5.01 (3.02)	0.096	3.03 (1.07)	0.005*	2.07 (2.15)	0.338	4.04 (1.67)	0.016*
Org. Size	0.00 (0.01)	0.977	-0.00 (0.00)	0.555	0.00 (0.01)	0.714	0.00 (0.00)	0.468
Org. Type: AN	-1.73 (2.68)	0.519	-1.19 (1.07)	0.266	-5.93 (1.95)	0.002*	-4.67 (1.57)	0.003*
Hospital Affiliated	2.20 (1.98)	0.267	1.71 (0.69)	0.013*	1.86 (1.40)	0.184	3.38 (1.08)	0.002*
Patient Health (ref: Excellent)								
Very Good	-3.61 (1.10)	0.001*	-2.14 (0.76)	0.005*	-2.98 (0.94)	0.002*	-0.99 (0.94)	0.291
Good	-4.93 (1.15)	0.000*	-2.70 (0.80)	0.001*	-3.89 (0.99)	0.000*	-2.25 (0.98)	0.022*
Fair	-5.99 (1.42)	0.000*	-4.44 (0.98)	0.000*	-4.96 (1.22)	0.000*	-2.13 (1.21)	0.078
Poor	-9.32 (2.28)	0.000*	-8.80 (1.60)	0.000*	-8.38 (1.98)	0.000*	-7.17 (1.97)	0.000*
Patient Mental Health (ref: Excellent)								
Very Good	-1.38 (1.02)	0.175	0.10 (0.70)	0.886	-1.83 (0.87)	0.036*	-0.14 (0.87)	0.868
Good	0.11 (0.96)	0.906	-0.65 (0.67)	0.333	-1.06 (0.83)	0.201	-1.00 (0.83)	0.222
Fair	-3.25 (1.29)	0.012*	-3.41 (0.90)	0.000*	-5.12 (1.11)	0.000*	-2.77 (1.11)	0.012*
Poor	-2.18 (2.31)	0.346	-3.38 (1.59)	0.033*	-4.25 (1.97)	0.031*	-3.52 (1.96)	0.072
Constant	91.29 (3.79)	0.000	96.56 (2.04)	0.000	98.49 (2.97)	0.000	93.23 (2.69)	0.000

** p<.05*

Note: Patient demographic variables (race, age, and education) are not shown in Tables, but were included in the models to account for differences in case mix. Results available upon request.

Table 3.7: Multi-Level Regression Results: Interaction

	Model 1: Timely Care		Model 2: Communication		Model 3: Coordination		Model 4: Courteous Staff	
	Coefficient (SE)	**p-value**	**Coefficient (SE)**	**p-value**	**Coefficient (SE)**	**p-value**	**Coefficient (SE)**	**p-value**
Teams/Health (ref: Low Teams / Excellent)								
Medium / Very Good	-0.98 (2.35)	0.675	0.60 (1.61)	0.711	1.70 (2.00)	0.396	-0.44 (1.99)	0.824
Medium / Good	-1.66 (2.31)	0.475	1.41 (1.59)	0.375	0.71 (1.98)	0.722	0.38 (1.97)	0.847
Medium / Fair	-4.42 (2.88)	0.125	-2.39 (1.98)	0.228	-2.98 (2.46)	0.226	0.66 (2.44)	0.786
Medium / Poor	3.23 (5.31)	0.543	2.79 (3.74)	0.455	4.79 (4.64)	0.302	10.46 (4.61)	0.023*
High / Very Good	0.19 (3.68)	0.958	0.55 (2.57)	0.829	-0.08 (3.19)	0.979	-2.40 (3.17)	0.448
High / Good	-0.45 (3.25)	0.890	0.70 (2.27)	0.759	-1.42 (2.81)	0.614	1.21 (2.80)	0.665
High / Fair	-0.84 (3.65)	0.817	-3.30 (2.53)	0.192	-3.79 (3.15)	0.228	2.31 (3.13)	0.461
High / Poor	3.95 (5.82)	0.498	-2.26 (4.09)	0.582	3.88 (5.08)	0.445	11.68 (5.05)	0.021*
Teams (ref: Low)								
Medium	3.79 (2.79)	0.173	0.71 (1.40)	0.610	1.23 (2.14)	0.565	2.30 (1.89)	0.224
High	4.80 (4.08)	0.239	3.47 (2.19)	0.112	2.99 (3.21)	0.351	3.16 (2.91)	0.277
Org. Size	0.00 (0.01)	0.954	0.00 (0.00)	0.534	0.00 (0.01)	0.680	0.00 (0.01)	0.536
Org. Type: AN	-1.98 (2.70)	0.465	-1.19 (1.08)	0.271	-6.26 (1.96)	0.001*	-4.40 (1.61)	0.006*
Hospital Affiliated	2.23 (1.98)	0.261	1.70 (0.68)	0.012*	1.91 (1.40)	0.173	3.38 (1.09)	0.002*
Patient Health (ref: Excellent)								
Very Good	-3.03 (1.97)	0.123	-2.55 (1.35)	0.059	-3.96 (1.68)	0.018*	-0.48 (1.67)	0.773
Good	-3.87 (1.99)	0.052*	-3.65 (1.37)	0.008*	-4.10 (1.70)	0.016*	-2.65 (1.69)	0.115
Fair	-3.60 (2.43)	0.139	-2.47 (1.68)	0.142	-2.77 (2.09)	0.185	-3.00 (2.07)	0.148
Poor	-11.95 (4.54)	0.008*	-9.33 (3.19)	0.003*	-12.32 (3.96)	0.002*	-15.84 (3.93)	0.000*
Patient Mental Health (ref: Excellent)								
Very Good	-1.39 (1.02)	0.174	0.14 (0.70)	0.841	-1.79 (0.87)	0.040*	-0.32 (0.87)	0.716
Good	0.11 (0.96)	0.908	-0.69 (0.67)	0.301	-1.06 (0.83)	0.202	-0.97 (0.82)	0.241
Fair	-3.31 (1.29)	0.010*	-3.39 (0.90)	0.000*	-5.13 (1.11)	0.000*	-2.81 (1.11)	0.011*
Poor	-2.37 (2.31)	0.307	-3.39 (1.59)	0.033*	-4.35 (1.97)	0.028*	-3.89 (1.96)	0.047*
Constant	90.60 (3.98)	0.000	96.71 (2.20)	0.000	98.85 (3.15)	0.000	93.68 (2.89)	0.000

** p<.05*

Note: Patient demographic variables (race, age, and education) are not shown in Tables, but were included in the models to account for differences in case mix. Results available upon request.

Discussion

Measures of patient experience are an increasingly important component of healthcare quality assessments. In this analysis on primary care practices participating in the SIM project, we investigated the impact of team-based primary care on four summary measures of patient experience and found that teams had a small, but statistically significant, impact on two of those outcomes, communication and courteous staff. We observed the strongest association between teams and courteous staff, with a 4.04 increase in patient experience scores associated with a high level of teams and a 2.58 increase associated with a medium level of teams. A high level of teams was also associated with a 3.03 increase in communication scores.

Although there is not a standard method for assessing the practical implications of differences in CAHPS scores, several different approaches have been discussed in the literature.[150, 151] A systemic review by Quigley et al. in 2018 suggested three main approaches, including comparing by: (1) distribution/range of patient experience variable, (2) against external anchor, and (3) a difference in patient experience on one covariate to differences in patient experience on other covariates.[152] Considering the second approach (an external anchor), a 2013 article by Paddison et al. suggested a threshold of 1 point for small, 3 points for medium, and 5 points for large differences on the 0–100 possible score range.[153] Using this approach to interpret the results of this analysis, the difference attributable to high levels of teams would be considered medium for both the courteous staff and communication outcomes. The association between a medium level of teams and courteous staff scores would be considered small. Earlier research has highlighted that CAHPS scores can be difficult to impact, highlighting the practical significance of even small differences.[154]

Teams had no observable effect on timely care at medium or high levels, which suggests that the speed with which care is delivered may be most impacted by other organizational or physician-level characteristics (e.g., access to telehealth has been shown to improve timely access to care).[155] Similarly, there was no association between teams at medium or high levels and coordination scores.

We also evaluated whether the effect of teams differed for chronically ill patients by repeating the multi-level models with an interaction term between patient health and care teams. Differences were observed for the courteous staff outcome, which showed that both medium and high levels of teams had the largest impact on patients in poor health. This may be because they interact with the healthcare system more frequently and the availability of non-physician caregivers has a larger impact on that domain of experience. Further, within some practices, case management services were only available to patients with certain clinical conditions or comorbidities, such that chronically ill patients may have experienced different programs than healthier patients within the same practice.

There were several other limitations in this analysis. Because the data used are cross-sectional, it was not possible to make strong inferences about causality. In addition, the survey administration method differed between the commercial and the Medicaid survey. Patients with commercial insurance (Anthem, Connecticare, or United Healthcare) received the CG-CAHPS survey in the mail, while patients with Medicaid received a phone call during which an interviewer asked them about their healthcare experiences. It was not possible to control for this difference in the analysis, and the differences observed by organizational type (AN vs. FQHC) may be attributable to differences in survey administration, as ANs predominantly serve commercially-insured patients and FQHCs predominantly serve Medicaid-insured patients. In considering which covariates to

include, the literature review revealed several physician-level variables that could not be included in this analysis due to data limitations. Previous analyses have shown that having a female physician is associated with higher patient satisfaction,[156,157,158] and that differences in physician personality and communication style affect patient satisfaction; however, data related to physician personality or communication style were not available in this dataset.[159]

Finally, there are several inherent limitations to the measurement of team-based care in this analysis. "Teams" was defined as a proportion of non-physician caregivers per PCPs; however, there are limits to this definition. In practice, the implementation of teams varies substantially within and across organizations, and structural teams do not necessarily produce collaboration between team members.[160] This may explain why higher levels of teams were not associated with coordination in this analysis. Earlier work on chronic disease management has suggested that patients may prefer provider continuity, and that continuous relationships with providers may be critical for chronically ill patients.[161] We were not able to determine the level of collaboration present among the caregivers or the continuity of a patients' relationship with their care team.

Despite its limitations, we propose several policy and practice implications from this evaluation. Most notably, this analysis suggests that federal and state policy efforts to support the implementation of team-based primary care have a meaningful impact on several domains of patient experience, including communication and courteous staff. This is relevant to state-led SIM projects, as well as other innovative payment and delivery initiatives led by CMMI. As CMS and state governments determine how to support patient-centered primary care, this work suggests that incorporating non-physician caregivers should be a component of future advanced payment models. For primary care practices, this work should serve to reduce concerns that team-based care

disrupts the doctor-patient relationship, as the addition of non-physician caregivers may improve patients' experiences.

Conclusion

The State Innovation Model (SIM) program in Connecticut was a large-scale, state-led health system transformation project that sought to improve care quality, reduce healthcare costs, and enhance patients' care experiences across the state. The program emphasized the unique role of primary care providers in achieving these goals. The three papers presented in this dissertation analyzed a variety of data from the SIM project to explore the impacts of team-based primary care on quality, as defined by three separate dimensions (physician burnout, antihypertensive medication management, and patient experience).

Chapter 1 focused on the relationship between team-based care and the physician workforce by evaluating the relationship between care teams and physician burnout. It found that primary care physicians were more burned out than specialists at the onset of the SIM program in 2014. Additionally, while the presence of teams was associated with reduced physician burnout, physician participation in delivery models that often encourage teams (e.g., PCMHs and ACOs) was not. The analysis found that PCMH participation in 2014 actually increased a physician's likelihood of burnout. The findings of this analysis suggest that while care delivery reform often improves care, it can also cause disruptions that impact the workload of the clinical workforce.

Chapter 2 analyzed the relationship between four organizational characteristics of primary care organizations (organization size & affiliation, payment reform experience, team-based care, and patient tracking and reporting) and medication monitoring for antihypertensive medication. This analysis found that primary care organizations that had a commitment to IT programs, care

management protocols, and policies to track their patient populations were most likely to perform antihypertensive monitoring. Team-based care did not have a significant effect on the likelihood of antihypertensive medication monitoring; however, this analysis may have been limited by a lack of more detailed information on the roles and responsibilities of non-physician caregivers, particularly of pharmacists. This analysis suggested that it may be important to assess the quality or depth of team member collaborations in research on teams.

Finally, Chapter 3 assessed the relationship between team-based primary care and four summary measures of patient experience: timely care, communication, coordination, and courteous staff. This chapter focused on understanding how teams were related to the patient's perceptions of care delivery. The analysis highlighted that while teams may impact some experience-related outcomes, such as communication and courteous staff, they do not necessarily improve the timeliness of care or care coordination. These factors may be more influenced by other organizational characteristics, such as access to telehealth or the quality of clinical care team collaborations, respectively.

Collectively, this dissertation analysis represents a contribution to policymaking bodies, care delivery organizations, and health services researchers. The results of this research highlight that research on team-based care and its impacts must continue to be nuanced and refined. While team-based care may reduce physician burnout and improve certain aspects of patient experience (i.e., communication and courteous staff), it does not universally improve outcomes. In future work on team-based primary care, it may be important to capture the depth of team member collaborations and relationships.

As a comprehensive evaluation of the SIM program, the results of this work can be used to inform future policy-making in and beyond the state of Connecticut. A broad range of

stakeholders, including state and local governments, federal policymaking bodies, payers, and delivery providers continue to seek ways to transform and improve primary care delivery as part of broader health system reform. As such, it is critical to continue building an evidence base to support these efforts.

References

[1] Shi L. The impact of primary care: a focused review. *Scientifica*, *2012*, 432892. https://doi.org/10.6064/2012/432892

[2] Sturmberg, J. P., Martin, C. M., & Katerndahl, D. A. Systems and complexity thinking in the general practice literature: an integrative, historical narrative review. *Annals of family medicine*, 2014, *12*(1), 66–74. https://doi.org/10.1370/afm.1593

[3] Primary Care Collaborative. "Defining the Medical Home," Accessed at: https://www.pcpcc.org/about/medical-home

[4] Schottenfeld L, Petersen D, Peikes D, Ricciardi R, Burak H, McNellis R, Genevro J. Creating Patient-Centered Team-Based Primary Care. AHRQ Pub. No. 16-0002-EF. Rockville, MD: Agency for Healthcare Research and Quality. March 2016.

[5] Swankoski KE, Peikes DN, Palakal M, Duda N, Day TJ. Primary Care Practice Transformation Introduces Different Staff Roles. *Ann Fam Med*. 2020 May;18(3):227-234. doi: 10.1370/afm.2515. PMID: 32393558; PMCID: PMC7213997.

[6] Chamberlain-Salaun J, Mills J, Usher K. Terminology used to describe health care teams: an integrative review of the literature. *J Multidiscip Healthc*. 2013;6:65-74. doi:10.2147/JMDH.S40676

[7] Naylor, M. D., K. D. Coburn, E. T. Kurtzman, et al. Inter-professional team-based primary care for chronically ill adults: State of the science. *Unpublished white paper presented at the ABIM Foundation meeting to Advance Team-Based Care for the Chronically Ill in Ambulatory Settings*. Philadelphia, PA; March 24-25, 2010

[8] Shi L. The impact of primary care: a focused review. *Scientifica*, *2012*, 432892. https://doi.org/10.6064/2012/432892

[9] Young, R. A., Roberts, R. G., & Holden, R. J. The Challenges of Measuring, Improving, and Reporting Quality in Primary Care. *Annals of family medicine*, 2017, *15*(2), 175–182. https://doi.org/10.1370/afm.2014

[10] Harvey, J. How Primary Care Is Transforming Itself. *NEJM Catalyst*. 2017.

[11] Alexander, J. A., Paustian, M., Wise, C. G., Green, L. A., Fetters, M. D., Mason, M., & El Reda, D. K. Assessment and measurement of patient-centered medical home implementation: the BCBSM experience. *Annals of family medicine*, 2013, *11 Suppl 1*(Suppl 1), S74–S81. https://doi.org/10.1370/afm.1472

[12] Naylor, M. D., K. D. Coburn, E. T. Kurtzman, et al. Inter-professional team-based primary care for chronically ill adults: State of the science. *Unpublished white paper presented at the ABIM Foundation meeting to Advance Team-Based Care for the Chronically Ill in Ambulatory Settings*. Philadelphia, PA; March 24-25, 2010

[13] NCQA. Patient-Centered Medical Home. Accessed at: https://www.ncqa.org/programs/health-care-providers-practices/patient-centered-medical-home-pcmh/

[14] Donabedian A. Evaluating the quality of medical care. 1966. *Milbank Q*. 2005;83(4):691-729. doi:10.1111/j.1468-0009.2005.00397.x

[15] Song H, Ryan M, Tendulkar S, Fisher J, Martin J, Peters AS, Frolkis JP, Rosenthal MB, Chien AT, Singer SJ. Team dynamics, clinical work satisfaction, and patient care coordination between primary care providers: A mixed

methods study. *Health Care Manage Rev*. 2017 Jan/Mar;42(1):28-41. doi: 10.1097/HMR.0000000000000091. PMID: 26545206.

[16] Ibid.

[17] Wallace JE, Lemaire JB, Ghali WA. Physician wellness: a missing quality indicator. *Lancet*. 2009 Nov 14;374(9702):1714-21. doi: 10.1016/S0140-6736(09)61424-0. PMID: 19914516.

[18] Song H, Ryan M, Tendulkar S, Fisher J, Martin J, Peters AS, Frolkis JP, Rosenthal MB, Chien AT, Singer SJ. Team dynamics, clinical work satisfaction, and patient care coordination between primary care providers: A mixed methods study. *Health Care Manage Rev*. 2017 Jan/Mar;42(1):28-41. doi: 10.1097/HMR.0000000000000091. PMID: 26545206.

[19] Freudenberger, H. Staff Burnout. *Journal of Social Issues*. 1974. 30, 159-165. http://dx.doi.org/10.1111/j.1540-4560.1974.tb00706.x

[20] Rotenstein LS, Torre M, Ramos MA, et al. Prevalence of Burnout Among Physicians: A Systematic Review. *JAMA*. 2018;320(11):1131–1150. doi:10.1001/jama.2018.12777

[21] Maslach C, Jackson SE. The measurement of experienced burnout. *Journal of Occupational Behaviour*. 1981b;2:99–113.

[22] Shanafelt TD, Boone S, Tan L, et al. (2012) Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med, 172(18):*1377-85. doi:10.1001/archinternmed.2012.3199

[23] Ibid.

[24] Ofei-Dodoo S, Loo-Gross C, Kellerman R. Burnout, Depression, Anxiety, and Stress Among Family Physicians in Kansas Responding to the COVID-19 Pandemic. *J Am Board Fam Med*. 2021 May-Jun;34(3):522-530. doi: 10.3122/jabfm.2021.03.200523. PMID: 34088812.

[25] West CP, Dyrbye LN, Shanafelt TD. Physician burnout: contributors, consequences and solutions. *J Intern Med*. 2018 Jun;283(6):516-529. doi: 10.1111/joim.12752. Epub 2018 Mar 24. PMID: 29505159.

[26] Gundersen L. Physician burnout. *Ann Intern Med*. 2001 Jul 17;135(2):145-8. doi: 10.7326/0003-4819-135-2-200107170-00023. PMID: 11453722.

[27] Misra-Hebert AD, Kay R, Stoller JK. A Review of Physician Turnover: Rates, Causes, and Consequences. *American Journal of Medical Quality*. 2004;19(2):56-66. doi:10.1177/106286060401900203

[28] Buchbinder SB, Wilson M, Melick CF, Powe NR. Estimates of costs of primary care physician turnover. *Am J Manag Care*. 1999 Nov;5(11):1431-8. PMID: 10662416.

[29] Halbesleben JR, Rathert C. Linking physician burnout and patient outcomes: exploring the dyadic relationship between physicians and patients. *Health Care Manage Rev*. 2008 Jan-Mar;33(1):29-39. doi: 10.1097/01.HMR.0000304493.87898.72. PMID: 18091442.

[30] Shanafelt TD, Balch CM, Bechamps G, Russell T, Dyrbye L, Satele D, Collicott P, Novotny PJ, Sloan J, Freischlag J. Burnout and medical errors among American surgeons. *Ann Surg*. 2010 Jun;251(6):995-1000. doi: 10.1097/SLA.0b013e3181bfdab3. PMID: 19934755.

[31] Awa WL, Plaumann M, Walter U. Burnout prevention: a review of intervention programs. *Patient Educ Couns*. 2010 Feb;78(2):184-90. doi: 10.1016/j.pec.2009.04.008. Epub 2009 May 20. PMID: 19467822.

[32] Panagioti M, Panagopoulou E, Bower P, Lewith G, Kontopantelis E, Chew-Graham C, Dawson S, van Marwijk H, Geraghty K, Esmail A. Controlled Interventions to Reduce Burnout in Physicians: A Systematic Review and Meta-analysis. *JAMA Intern Med*. 2017 Feb 1;177(2):195-205. doi: 10.1001/jamainternmed.2016.7674. PMID: 27918798.

[33] Helfrich CD, Dolan ED, Simonetti J, Reid RJ, Joos S, Wakefield BJ, Schectman G, Stark R, Fihn SD, Harvey HB, Nelson K. Elements of team-based care in a patient-centered medical home are associated with lower burnout among VA primary care employees. *J Gen Intern Med*. 2014 Jul;29 Suppl 2(Suppl 2):S659-66. doi: 10.1007/s11606-013-2702-z. PMID: 24715396; PMCID: PMC4070238.

[34] Primary Care Collaborative. "Defining the Medical Home," Accessed at: https://www.pcpcc.org/about/medical-home

[35] Panagioti M, Panagopoulou E, Bower P, et al. Controlled Interventions to Reduce Burnout in Physicians: A Systematic Review and Meta-analysis . *JAMA Intern Med*. 2017;177(2):195–205. doi:10.1001/jamainternmed.2016.7674

[36] Shanafelt TD, Boone S, Tan L, et al. (2012) Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med, 172(18):*1377-85. doi:10.1001/archinternmed.2012.3199

[37] Health Care Quality: How Does Your State Compare?. Content last reviewed April 2018. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/data/infographics/state-compare-text.html

[38] Agarwal SD, Pabo E, Rozenblum R, Sherritt KM. Professional Dissonance and Burnout in Primary Care: A Qualitative Study. JAMA Intern Med. 2020 Mar 1;180(3):395-401. doi: 10.1001/jamainternmed.2019.6326. PMID: 31904796; PMCID: PMC6990959.

[39] Guzzo RA, Dickson MW. Teams in organizations: recent research on performance and effectiveness. *Annu Rev Psychol*. 1996;47:307-38. doi: 10.1146/annurev.psych.47.1.307. PMID: 15012484.

[40] Ibid.

[41] Helfrich, C. D., Dolan, E. D., Simonetti, J., Reid, R. J., Joos, S., Wakefield, B. J., Schectman, G., Stark, R., Fihn, S. D., Harvey, H. B., & Nelson, K. (2014). Elements of team-based care in a patient-centered medical home are associated with lower burnout among VA primary care employees. *Journal of general internal medicine*, *29 Suppl 2*(Suppl 2), S659–S666. https://doi.org/10.1007/s11606-013-2702-z

[42] Aseltine RH., Cleary PD., Schilling EA., Buchanan LS., Havens E., Cosenza C. Physician Perspectives on Care Delivery Reform: Results from a Survey of Connecticut Physicians. UConn Health, Farmington, CT; 2015.

[43] Ibid.

[44] Keeton K, Fenner DE, Johnson TR, Hayward RA. Predictors of physician career satisfaction, work-life balance, and burnout. Obstet Gynecol. 2007 Apr;109(4):949-55. doi: 10.1097/01.AOG.0000258299.45979.37. PMID: 17400859.

[45] Rabatin J, Williams E, Baier Manwell L, Schwartz MD, Brown RL, Linzer M. Predictors and Outcomes of Burnout in Primary Care Physicians. J Prim Care Community Health. 2016 Jan;7(1):41-3. doi: 10.1177/2150131915607799. Epub 2015 Sep 28. PMID: 26416697; PMCID: PMC5932673.
[46] Ibid.

[47] Funk, Michele Jonsson, Westreich Daniel, Wiesen Chris, Stürmer Til, Brookhart M. Alan, Davidian Marie, Doubly Robust Estimation of Causal Effects, *American Journal of Epidemiology*, Volume 173, Issue 7, 1 April 2011, Pages 761–767, https://doi.org/10.1093/aje/kwq439

[48] Austin PC, Stuart EA. Moving towards best practice when using inverse probability of treatment weighting (IPTW) using the propensity score to estimate causal treatment effects in observational studies. Stat Med. 2015 Dec 10;34(28):3661-79. doi: 10.1002/sim.6607. Epub 2015 Aug 3. PMID: 26238958; PMCID: PMC4626409.

[49] Shah K, Chaudhari G, Kamrai D, Lail A, Patel RS. How Essential Is to Focus on Physician's Health and Burnout in Coronavirus (COVID-19) Pandemic?. *Cureus*. 2020;12(4):e7538. Published 2020 Apr 4. doi:10.7759/cureus.7538

[50] Stewart, G. L. A Meta-Analytic Review of Relationships Between Team Design Features and Team Performance. *Journal of Management*. 2006. *32*(1), 29 55. https://doi.org/10.1177/0149206305277792

[51] Peikes DN, Swankoski K, Hoag SD, Duda N, Coopersmith J, Taylor EF, Morrisson N, Palakal M, Holland J, Day TJ, Sessums LL. The Effects of a Primary Care Transformation Initiative on Primary Care Physician Burnout and Workplace Experience. *J Gen Intern Med*. 2019 Jan;34(1):49-57. doi: 10.1007/s11606-018-4545-0. Epub 2018 Jul 17. PMID: 30019124; PMCID: PMC6318185.

[52] Kantor, Elizabeth D et al. "Trends in Prescription Drug Use Among Adults in the United States From 1999-2012." *JAMA*. 2015. vol. 314,17: 1818-31. doi:10.1001/jama.2015.13766

[53] CDC, "Therapeutic Drug Use," 2017. Accessed at: https://www.cdc.gov/nchs/fastats/drug-use-therapeutic.htm

[54] Ibid.

[55] Taché SV, Sönnichsen A, Ashcroft DM. Prevalence of adverse drug events in ambulatory care: a systematic review. *Ann Pharmacother*. 2011 Jul;45(7-8):977-89. doi: 10.1345/aph.1P627. Epub 2011 Jun 21. PMID: 21693697.

[56] Patient-Centered Primary Care Collaborative. The Patient-Centered Medical Home: Integrating Comprehensive Medication Management to Optimize Patient Outcomes RESOURCE GUIDE. 2012. Accessed at: https://www.pcpcc.org/sites/default/files/media/medmanagement.pdf

[57] Lainer, Miriam et al. "Improving medication safety in primary care. A review and consensus procedure by the LINNEAUS collaboration on patient safety in primary care." *The European journal of general practice* vol. 21 Suppl,sup1. 2015. 14-8. doi:10.3109/13814788.2015.1043124

[58] Smith M, Bates DW, Bodenheimer T, Cleary PD. Why pharmacists belong in the medical home. *Health Aff (Millwood)*. 2010 May;29(5):906-13. doi: 10.1377/hlthaff.2010.0209. PMID: 20439879.

[59] Brummel A, Carlson AM. Comprehensive Medication Management and Medication Adherence for Chronic Conditions. J Manag Care Spec Pharm. 2016 Jan;22(1):56-62. doi: 10.18553/jmcp.2016.22.1.56. PMID: 27015052.

[60] Smith M, Giuliano MR, Starkowski MP. In Connecticut: improving patient medication management in primary care. *Health Aff (Millwood)*. 2011 Apr;30(4):646-54. doi: 10.1377/hlthaff.2011.0002. Erratum in: Health Aff (Millwood). 2011 Apr;30(4). doi: 10.1377/hlthaff.2011.0002. Erratum in: Health Aff (Millwood). 2011 Jun;30(6):1217. PMID: 21471485.

[61] Primary Care Collaborative. "Defining the Medical Home," Accessed at: https://www.pcpcc.org/about/medical-home

[62] Poulin, S. M. Connecticut Cardiovascular Disease Statistics Report. Hartford, CT: Connecticut Department of Public Health. 2017. Accessed at: https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/hems/chronic_dis/HeartDisease/2017_CVDStats_CT_8Sept2017final-pdf.pdf?la=en

[63] CDC. "Facts about Hypertension," Accessed at: https://www.cdc.gov/bloodpressure/facts.htm#:~:text=Nearly%20half%20of%20adults%20in,are%20taking%20medication%20for%20hypertension.

[64] Qaseem, A., Wilt, T., Rich T., et al. Pharmacologic Treatment of Hypertension in Adults Aged 60 Years or Older to Higher Versus Lower Blood Pressure Targets: A Clinical Practice Guideline From the American College of Physicians and the American Academy of Family Physicians. *Annals of Internal Medicine*. 2017. 166(6):430-437. doi:10.7326/M16-1785

[65] McDowell, S. E., Thomas, S. K., Coleman, J. J., Aronson, J. K., & Ferner, R. E. A practical guide to monitoring for adverse drug reactions during antihypertensive drug therapy. *Journal of the Royal Society of Medicine*. 2013. *106*(3), 87–95. https://doi.org/10.1258/jrsm.2012.120137

[66] McDowell, S.E., Ferner, R.E. Biochemical Monitoring of Patients Treated with Antihypertensive Therapy for Adverse Drug Reactions. *Drug-Safety*. 2011. 34, 1049–1059. https://doi.org/10.2165/11593980-000000000-00000

[67] Shehab N, Lovegrove MC, Geller AI, Rose KO, Weidle NJ, Budnitz DS. US Emergency Department Visits for Outpatient Adverse Drug Events, 2013-2014. *JAMA*. 2016 Nov 22;316(20):2115-2125. doi: 10.1001/jama.2016.16201. PMID: 27893129; PMCID: PMC6490178.

[68] NCQA. Patient-Centered Medical Home (PCMH). Accessed at: https://www.ncqa.org/programs/health-care-providers-practices/patient-centered-medical-home-pcmh/

[69] Naylor, M. D., K. D. Coburn, E. T. Kurtzman, et al. Inter-professional team-based primary care for chronically ill adults: State of the science. *Unpublished white paper presented at the ABIM Foundation meeting to Advance Team-Based Care for the Chronically Ill in Ambulatory Settings*. Philadelphia, PA; March 24-25, 2010

[70] Guzzo RA, Dickson MW. Teams in organizations: recent research on performance and effectiveness. Annu Rev Psychol. 1996;47:307-38. doi: 10.1146/annurev.psych.47.1.307. PMID: 15012484.

[71] Pany MJ, Chen L, Sheridan B, Huckman RS. Provider Teams Outperform Solo Providers In Managing Chronic Diseases And Could Improve The Value Of Care. *Health Aff (Millwood)*. 2021 Mar. 40(3):435-444. doi: 10.1377/hlthaff.2020.01580. PMID: 33646870.

[72] Reiss-Brennan B, Brunisholz KD, Dredge C, et al. Association of Integrated Team-Based Care With Health Care Quality, Utilization, and Cost. *JAMA*. 2016;316(8):826–834. doi:10.1001/jama.2016.11232

[73] de Barra, Mícheál et al. Pharmacist services for non-hospitalised patients. *The Cochrane database of systematic reviews*. 2018. vol. 9.9 CD013102. doi:10.1002/14651858.CD013102

[74] Mossialos E, Courtin E, Naci H, Benrimoj S, Bouvy M, Farris K, Noyce P, Sketris I. From "retailers" to health care providers: Transforming the role of community pharmacists in chronic disease management. *Health Policy*. 2015. 119(5), 628-639. doi:10.1016/j.healthpol.2015.02.007

[75] Smith M, Bates DW, Bodenheimer T, Cleary PD. Why pharmacists belong in the medical home. *Health Aff (Millwood)*. 2010 May;29(5):906-13. doi: 10.1377/hlthaff.2010.0209. PMID: 20439879.

[76] Greer, N, Bolduc, J, Geurkink, E., et al. Pharmacist-led chronic disease management: a systematic review of effectiveness and harms compared with usual care. *Ann Intern Med*. Epub ahead of print 26 April 2016.

[77] Nkansah N, Mostovetsky O, Yu C, Chheng T, Beney J, Bond CM, Bero L. Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns. *Cochrane Database of Systematic Reviews*. 2010. Issue 7. Art. No.: CD000336. DOI: 10.1002/14651858.CD000336.pub2.

[78] Omran, D, Majumdar, SR, Johnson, JA., et al. Pharmacists on primary care teams: effect on antihypertensive medication management in patients with type 2 diabetes. *Journal of the American Pharmacists Association*. 2015. 55: 265–268.

[79] Carter BL, Ardery G, Dawson JD, James PA, Bergus GR, Doucette WR, Chrischilles EA, Franciscus CL, Xu Y. Physician and pharmacist collaboration to improve blood pressure control. Arch Intern Med. 2009 Nov 23;169(21):1996-2002. doi: 10.1001/archinternmed.2009.358. PMID: 19933962; PMCID: PMC2882170.

[80] Dartmouth. "National Survey of Accountable Care Organizations (NASCO)," Accessed at: https://sites.dartmouth.edu/nsaco/

[81] CT.gov. HealthscoreCT. Accessed at: https://portal.ct.gov/healthscorect?language=en_US

[82] FQHC.org. What is an FQHC? Accessed at: https://www.fqhc.org/what-is-an-fqhc

[83] National Quality Forum, Annual Monitoring for Persistent Medications. "Measure Search: 2371."

[84] AHRQ. Types of Health Care Quality Measures. Content last reviewed July 2015. Agency for Healthcare Research and Quality, Rockville, MD. Accessed at: https://www.ahrq.gov/talkingquality/measures/types.html

[85] Kane, H., Lewis, M. A., Williams, P. A., & Kahwati, L. C. Using qualitative comparative analysis to understand and quantify translation and implementation. *Translational behavioral medicine*. 2014. *4*(2), 201–208. https://doi.org/10.1007/s13142-014-0251-6

[86] Rihoux Benoît, & Ragin, C. C. *Configurational comparative methods: qualitative comparative analysis (QCA) and related techniques*. 2009. Los Angeles: Sage.

[87] Ibid.

[88] Hanckel, B., Petticrew, M., Thomas, J., & Green, J. Protocol for a systematic review of the use of qualitative comparative analysis for evaluative questions in public health research. 2009. *Systematic reviews*, *8*(1), 252. https://doi.org/10.1186/s13643-019-1159-5

[89] Whitaker RG, Sperber N, Baumgartner M, Thiem A, Cragun D, Damschroder L, Miech EJ, Slade A, Birken S. Coincidence analysis: a new method for causal inference in implementation science. *Implement Sci*. 2020 Dec 11;15(1):108. doi: 10.1186/s13012-020-01070-3. Erratum in: *Implement Sci*. 2021 Jan 12;16(1):11. PMID: 33308250; PMCID: PMC7730775.

[90] Ragin, C. C. *Redesigning social inquiry: fuzzy sets and beyond*. 2008. Chicago: University of Chicago Press.

[91] Ibid.

[92] Ibid.

[93] Thygeson NM, Peikes D, Zutshi A. Mixed Methods: Fuzzy Set Qualitative Comparative Analysis and Configurational Comparative Methods: Powerful Methods to Study and Refine Patient-Centered Medical Home Models. Rockville, MD: Agency for Healthcare Research and Quality. February 2013. AHRQ Publication No. 13-0026-EF.

[94] Hanckel, B., Petticrew, M., Thomas, J. *et al*. Protocol for a systematic review of the use of qualitative comparative analysis for evaluative questions in public health research. *Syst Rev*. 2019. 8, 252https://doi.org/10.1186/s13643-019-1159-5

[95] Thygeson NM, Peikes D, Zutshi A. Mixed Methods: Fuzzy Set Qualitative Comparative Analysis and Configurational Comparative Methods: Powerful Methods to Study and Refine Patient-Centered Medical Home Models. Rockville, MD: Agency for Healthcare Research and Quality. February 2013. AHRQ Publication No. 13-0026-EF.

[96] Ragin, C. C. *Redesigning social inquiry: fuzzy sets and beyond*. 2008. Chicago: University of Chicago Press.

[97] Ragin, Charles C. and Sean Davey. 2016. *Fuzzy-Set/Qualitative Comparative Analysis 3.0*. Irvine, California: Department of Sociology, University of California.

[98] Ragin, C. C. *Redesigning social inquiry: fuzzy sets and beyond*. 2008. Chicago: University of Chicago Press.

[99] Ragin, C. Qualitative Comparative Analysis WORKSHOP. 2015. Accessed at: https://gpc.stanford.edu/sites/g/files/sbiybj8226/f/stanfordqcaworkshop2015.pdf

[100] Ragin, C. USER'S GUIDE TO Fuzzy-Set / Qualitative Comparative Analysis. July 2017. Accessed at: http://www.socsci.uci.edu/~cragin/fsQCA/download/fsQCAManual.pdf

[101] NCQA. NCQA PCMH Recognition: Concepts. Accessed at: https://www.ncqa.org/programs/health-care-providers-practices/patient-centered-medical-home-pcmh/pcmh-concepts/

[102] Thygeson M., N., Solberg, L. I., Asche, S. E., Fontaine, P., Gregory Pawlson, L., & Scholle, S. H. Using fuzzy set qualitative comparative analysis (fs/QCA) to explore the relationship between medical "homeness" and quality. *Health services research*. 2012. 47(1 Pt 1), 22–45. https://doi.org/10.1111/j.1475-6773.2011.01303.x

[103] Alexander, J. A., Paustian, M., Wise, C. G., Green, L. A., Fetters, M. D., Mason, M., & El Reda, D. K. Assessment and measurement of patient-centered medical home implementation: the BCBSM experience. *Annals of family medicine*. 2011. 11 Suppl 1(Suppl 1), S74–S81. https://doi.org/10.1370/afm.1472

[104] Shortell, S. M., Wu, F. M., Lewis, V. A., Colla, C. H., & Fisher, E. S. A taxonomy of accountable care organizations for policy and practice. *Health services research*. 2014. *49*(6), 1883–1899. https://doi.org/10.1111/1475-6773.12234

[105] Smith, M. Primary Care Pharmacist Services Align With Payment Reform and Provider "Joy of Practice". *Annals of Pharmacotherapy*, 2019. 53(3). https://doi.org/10.1177/1060028018807398

[106] Ragin, C. C. *Redesigning social inquiry: fuzzy sets and beyond*. 2008. Chicago: University of Chicago Press.

[107] Ibid.

[108] Sheehy, TJ&Thygeson, NM. Physician Organization Care Management Capabilities Associated with Effective Inpatient Utilization Management: A Fuzzy Set Qualitative Comparative Analysis. *BMC Health Services Research*. 2014;14(1):1.

[109] Wagemann C. and Schneider C. STANDARDS OF GOOD PRACTICE IN QUALITATIVE COMPARATIVE ANALYSIS (QCA) AND FUZZY-SETS. 2007. Accessed at: http://www.compasss.org/wpseries/WagemannSchneider2007.pdf

[110] Ibid.

[111] Reiss-Brennan B, Brunisholz KD, Dredge C, Briot P, Grazier K, Wilcox A, Savitz L, James B. Association of Integrated Team-Based Care With Health Care Quality, Utilization, and Cost. *JAMA*. 2016 Aug 23-30;316(8):826-34. doi: 10.1001/jama.2016.11232. PMID: 27552616.

[112] Carter BL, Ardery G, Dawson JD, James PA, Bergus GR, Doucette WR, Chrischilles EA, Franciscus CL, Xu Y. Physician and pharmacist collaboration to improve blood pressure control. Arch Intern Med. 2009 Nov 23;169(21):1996-2002. doi: 10.1001/archinternmed.2009.358. PMID: 19933962; PMCID: PMC2882170.

[113] Pestka D., Frail C., Sorge L., Funk K., McClurg M, Sorensen T. The practice management components needed to support comprehensive medication management in primary care clinics. JACCP Journal of the American College of Clinical Pharmacy. Oct. 2019. https://doi.org/10.1002/jac5.1181.

[114] Devers, K., Lallemand N., Burton R., Kahwati L., McCall N., Zuckerman S., September 2013. The Urban Institute. Accessed at: https://www.urban.org/sites/default/files/publication/24261/412969-Using-Qualitative-Comparative-Analysis-QCA-to-Study-Patient-Centered-Medical-Homes.PDF

[115] Naylor, M. D., K. D. Coburn, E. T. Kurtzman, et al. Inter-professional team-based primary care for chronically ill adults: State of the science. *Unpublished white paper presented at the ABIM Foundation meeting to Advance Team-Based Care for the Chronically Ill in Ambulatory Settings*. Philadelphia, PA; March 24-25, 2010

[116] Schottenfeld L, Petersen D, Peikes D, Ricciardi R, Burak H, McNellis R, Genevro J. Creating Patient-Centered Team-Based Primary Care. AHRQ Pub. No. 16-0002-EF. Rockville, MD: Agency for Healthcare Research and Quality. March 2016.

[117] AHRQ, "What is Patient Experience?" Accessed at: https://www.ahrq.gov/cahps/about-cahps/patient-experience/index.html

[118] Agency for Healthcare Research and Quality, "Section 2: Why Improve Patient Experience?," Content last reviewed February 2020, Rockville, MD. Accessed at: https://www.ahrq.gov/cahps/quality-improvement/improvement-guide/2-why-improve/index.html

[119] Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. *BMJ Open*. 2013;3(1):e001570. Published 2013 Jan 3. doi:10.1136/bmjopen-2012-001570

[120] Zolnierek, Kelly B. Haskard and M. Robin Dimatteo. "Physician communication and patient adherence to treatment: A meta-analysis." *Medical Care*. 2009. Vol. 47. No. 8 pg. 826-834. Web.

[121] Agency for Healthcare Research and Quality, "Section 2: Why Improve Patient Experience?," Content last reviewed February 2020, Rockville, MD. Accessed at: https://www.ahrq.gov/cahps/quality-improvement/improvement-guide/2-why-improve/index.html

[122] Moore G, Quelch J, and Boudreau E. Choice Matters: How Healthcare Consumers Make Decisions (and Why Clinicians and Managers Should Care), New York: Oxford University Press, 2018.

[123] Wen J, Schulman KA. Can team-based care improve patient satisfaction? A systematic review of randomized controlled trials. PLoS One. 2014 Jul 11;9(7):e100603. doi: 10.1371/journal.pone.0100603. PMID: 25014674; PMCID: PMC4094385.

[124] Nembhard IM, Buta E, Lee YSH, Anderson D, Zlateva I, Cleary PD. A quasi-experiment assessing the six-months effects of a nurse care coordination program on patient care experiences and clinician teamwork in community health centers. *BMC Health Serv Res*. 2020 Feb 24;20(1):137. doi: 10.1186/s12913-020-4986-0. PMID: 32093664; PMCID: PMC7038598.

[125] Swankoski KE, Peikes DN, Morrison N, Holland JJ, Duda N, Clusen NA, Day TJ, Brown RS. Patient experience during a large primary care practice transformation initiative. Am J Manag Care. 2018 Dec;24(12):607-613. PMID: 30586494.

[126] Schottenfeld L, Petersen D, Peikes D, Ricciardi R, Burak H, McNellis R, Genevro J. Creating Patient-Centered Team-Based Primary Care. AHRQ Pub. No. 16-0002-EF. Rockville, MD: Agency for Healthcare Research and Quality. March 2016.

[127] Wagner EH, Reid RJ. Are continuity of care and teamwork incompatible? *Medical Care* 2007;45(1):6-7.

[128] Dorr Goold S, Lipkin M Jr. The doctor-patient relationship: challenges, opportunities, and strategies. *J Gen Intern Med*. 1999;14 Suppl 1(Suppl 1):S26-S33. doi:10.1046/j.1525-1497.1999.00267.x

[129] Rahmqvist M. Patient satisfaction in relation to age, health status and other background factors: a model for comparisons of care units. *International journal for quality in health care: journal of the International Society for Quality in Health Care*, 2001. *13*(5), 385–390. https://doi.org/10.1093/intqhc/13.5.385

[130] Ibid.

[131] Martin AE, D'Agostino JA, Passarella M, Lorch SA. Racial differences in parental satisfaction with neonatal intensive care unit nursing care. *J Perinatol*. 2016 Nov;36(11):1001-1007. doi: 10.1038/jp.2016.142. Epub 2016 Sep 1. PMID: 27583386; PMCID: PMC5079824.

[132] Murray-García JL, Selby JV, Schmittdiel J, Grumbach K, Quesenberry CP Jr. Racial and ethnic differences in a patient survey: patients' values, ratings, and reports regarding physician primary care performance in a large health maintenance organization. Med Care. 2000 Mar;38(3):300-10. doi: 10.1097/00005650-200003000-00007. PMID: 10718355.

[133] Will KK, Johnson ML, Lamb G. Team-Based Care and Patient Satisfaction in the Hospital Setting: A Systematic Review. *J Patient Cent Res Rev*. 2019;6(2):158-171. Published 2019 Apr 29. doi:10.17294/2330-0698.1695

[134] Meyers DJ, Chien AT, Nguyen KH, Li Z, Singer SJ, Rosenthal MB. Association of Team-Based Primary Care With Health Care Utilization and Costs Among Chronically Ill Patients. JAMA Intern Med. 2019 Jan 1;179(1):54-61. doi: 10.1001/jamainternmed.2018.5118. PMID: 30476951; PMCID: PMC6583420.

[135] Dartmouth. "National Survey of Accountable Care Organizations (NASCO)," Accessed at: https://sites.dartmouth.edu/nsaco/

[136] Rahmqvist M. Patient satisfaction in relation to age, health status and other background factors: a model for comparisons of care units. *International Journal for Quality in Health Care*. Volume 13, Issue 5, 1 October 2001, Pages 385–390, https://doi.org/10.1093/intqhc/13.5.385

[137] Xiao H, Barber JP. The effect of perceived health status on patient satisfaction. *Value Health*. 2008 Jul-Aug;11(4):719-25. doi: 10.1111/j.1524-4733.2007.00294.x. Epub 2007 Dec 17. PMID: 18179667.

[138] Ibid.

[139] Barr DA. Race/ethnicity and patient satisfaction. Using the appropriate method to test for perceived differences in care. *J Gen Intern Med*. 2004 Sep;19(9):937-43. doi: 10.1111/j.1525-1497.2004.30415.x. PMID: 15333058; PMCID: PMC1492522.

[140] Martin AE, D'Agostino JA, Passarella M, Lorch SA. Racial differences in parental satisfaction with neonatal intensive care unit nursing care. *J Perinatol*. 2016 Nov;36(11):1001-1007. doi: 10.1038/jp.2016.142. Epub 2016 Sep 1. PMID: 27583386; PMCID: PMC5079824.

[141] Murray-García, Jann L. MD, MPH*; Selby, Joe V. MD, MPH†; Schmittdiel, Julie MA†; Grumbach, Kevin MD†; Quesenberry, Charles P. Jr PhD‡ Racial and Ethnic Differences in a Patient Survey, *Medical Care:* March 2000 - Volume 38 - Issue 3 - p 300-310

[142] Haviland MG, Morales LS, Reise SP, Hays RD. Do health care ratings differ by race or ethnicity? *Jt Comm J Qual Saf*. 2003 Mar;29(3):134-45. doi: 10.1016/s1549-3741(03)29016-x. PMID: 12635429.

[143] Hall JA, Dornan MC. Patient sociodemographic characteristics as predictors of satisfaction with medical care: a meta-analysis. Soc Sci Med. 1990;30(7):811-8. doi: 10.1016/0277-9536(90)90205-7. Erratum in: Soc Sci Med 1990;30(12):following 1368. PMID: 2138357.

[144] Sitzia J, Wood N. Patient satisfaction: a review of issues and concepts. *Soc Sci Med*. 1997 Dec;45(12):1829-43. doi: 10.1016/s0277-9536(97)00128-7. PMID: 9447632.

[145] Tucker JL. The moderators of patient satisfaction. *J Manag Med*. 2002;16(1):48-66. doi: 10.1108/02689230210428625. PMID: 12069351.

[146] Rudowitz R, Garfield R, Hinton E. 10 Things to Know about Medicaid: Setting the Facts Straight. *Kaiser Family Foundation*. 2019. Accessed at: https://www.kff.org/medicaid/issue-brief/10-things-to-know-about-medicaid-setting-the-facts-straight/

[147] Roohan PJ, Franko SJ, Anarella JP, Dellehunt LK, Gesten FC. Do commercial managed care members rate their health plans differently than Medicaid managed care members?. *Health Serv Res*. 2003;38(4):1121-1134. doi:10.1111/1475-6773.00166

[148] Blumenthal D, Rasmussen PW, Collins SR, Doty MM. Does Medicaid Make a Difference? Findings from the Commonwealth Fund Biennial Health Insurance Survey, 2014. Issue Brief (Commonw Fund). 2015 Jun;19:1-9. PMID: 26159008.

[149] Ibid.

[150] Lied TR, Sheingold SH, Landon BE, Shaul JA, Cleary PD. Beneficiary reported experience and voluntary disenrollment in Medicare managed care. *Health Care Fin Rev*. 2003;25(1):55-66.

[151] Quigley DHD, Elliott MN, Metodij CM, Hays RD. Quantifying Magnitude of Differences in Patient Experiences with Healthcare Measures. *Health Serv Res*. 2018;53(2).

[152] Ibid.

[153] Paddison, C. A. , Elliott M. N., Haviland A. M., Farley D. O., Lyratzopoulos G., Hambarsoomian K., Dembosky J. W., and Roland M. O.. Experiences of Care among Medicare Beneficiaries with ESRD: Medicare Consumer Assessment of Healthcare Providers and Systems (CAHPS) Survey Results. *American Journal of Kidney Diseases*. 2013 61 (3): 440–9.

[154] Nembhard IM, Buta E, Lee YSH, Anderson D, Zlateva I, Cleary PD. A quasi-experiment assessing the six-months effects of a nurse care coordination program on patient care experiences and clinician teamwork in community health centers. *BMC Health Serv Res*. 2020 Feb 24;20(1):137. doi: 10.1186/s12913-020-4986-0. PMID: 32093664; PMCID: PMC7038598.

[155] Donelan K, Barreto EA, Sossong S, Michael C, Estrada JJ, Cohen AB, Wozniak J, Schwamm LH. Patient and clinician experiences with telehealth for patient follow-up care. *Am J Manag Care*. 2019 Jan;25(1):40-44. PMID: 30667610.

[156] Derose KP, Hays RD, McCaffrey DF, Baker DW. Does physician gender affect satisfaction of men and women visiting the emergency department? *J Gen Intern Med*. 2001 Apr;16(4):218-26. doi: 10.1046/j.1525-1497.2001.016004218.x. PMID: 11318922; PMCID: PMC1495193.

[157] Bertakis KD, Franks P, Azari R. Effects of physician gender on patient satisfaction. *J Am Med Womens Assoc (1972)*. 2003 Spring;58(2):69-75. PMID: 12744418.

[158] Prasad T, Buta E, Cleary PD. Is Patient-Physician Gender Concordance Related to the Quality of Patient Care Experiences? *J Gen Intern Med*. 2021 Oct;36(10):3058-3063. doi: 10.1007/s11606-020-06411-y. Epub 2021 Jan 19. PMID: 33469761; PMCID: PMC8481522.

[159] Duberstein P, Meldrum S, Fiscella K, Shields CG, Epstein RM. Influences on patients' ratings of physicians: Physicians demographics and personality. *Patient Educ Couns*. 2007 Feb;65(2):270-4. doi: 10.1016/j.pec.2006.09.007. Epub 2006 Nov 27. PMID: 17125958.

[160] Chesluk BJ, Holmboe ES. How teams work--or don't--in primary care: a field study on internal medicine practices. *Health Aff (Millwood)*. 2010 May;29(5):874-9. doi: 10.1377/hlthaff.2009.1093. PMID: 20439874.

[161] Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)*. 2001 Nov-Dec;20(6):64-78. doi: 10.1377/hlthaff.20.6.64. PMID: 11816692.