Title
From Practice Culture to Patient Outcomes: Improving Primary Care Through Interdisciplinary Health Care Teams

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Publication Date
2013

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

From Practice Culture to Patient Outcomes:

Improving Primary Care Through Interdisciplinary Health Care Teams

A dissertation submitted in partial satisfaction of the

requirements for the degree of Doctor of Public Health

by

Sherry M. Grace

2013

ABSTRACT OF THE DISSERTATION

From Practice Culture to Patient Outcomes:

Improving Primary Care Through Interdisciplinary Health Care Teams

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Sherry M. Grace

Doctor of Public Health

University of California, Los Angeles, 2013

Professor Hector P. Rodriguez, Chair

Background: In 2011, a large integrated healthcare organization implemented a primary care team redesign in five pilot practices to improve the delivery of patient-centered chronic illness care and augment the physician-medical assistant dyads by adding two new primary care team roles for each practice – a nurse care manager (NCM) and a patient health coach (PHC). This work examines three aspects of implementing the care team redesign:

1) The facilitators and barriers of implementation,
2) The impact of the team redesign on practice climate,
3) The relationship between fidelity of implementation (FOI) and intervention

effectiveness in terms of improved patient outcomes.

Methods: Three separate approaches were used to examine the aspects of implementing care teams including conducting 22 key-informant interviews of care teams members at the five pilot practice implementing the practice team redesign, conducting a longitudinal practice climate survey among 542 clinicians and staff, and using a convergent mixed-methods approach to determine the degree of FOI and its associated impact the on changes in outcomes of diabetes care for each site.

Results: Facilitators and barriers of implementing the care team redesign differed due to flexible protocols in program implementation, intended to allow each practice to best fit the redesign to suit local needs. Successful practices (n=2) reported increased team communication and functioning as a result of high physician engagement and local leadership facilitation. Overall practice climate of pilot practices improved, though improvements were not significantly different than non-pilot practices. Finally, FOI was a consistent predictor of improvements in diabetes care outcomes across the sites, particularly for practices with the highest and lowest FOI ranks. Despite a general association between FOI ranking and patient outcomes, underlying patient characteristics, including patient age and co-morbidities, influenced both FOI and change in diabetes outcomes over time, suggesting that patient complexity may mitigate the care team redesign's effect on improving patient outcomes.

Conclusions: When implementing primary care teams across practice networks, standardized scope of practice of personnel, common quality improvement priorities, and shared performance metrics may be helpful in improving implementation experiences, practice climate, patient outcomes and disseminating effective redesign strategies.

The dissertation of Sherry M. Grace is approved.

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2013

DEDICATION

This work is dedicated to my wonderful, loving, and ever-supporting parents.

To my mother, Nadrine Grace, and her constant reassurances of *"You've got this, kid"* – I am forever indebted to you for providing me with the moral support I needed throughout this process, especially being 2,309 miles away from home. You are my rock.

To my father, Nabil Grace, and his constant reminders of *"Hena fi eh? Mo5, mesh me7alabeya!"* Dad, from an early age you have taught me the importance of hard work and dedication. Your wisdom and encouragement has propelled me forward in my academic career to a height I never knew I would reach. I am who I am today because of you.

I love you both. Thank you.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

HCP	Health Care Partners
NCM	Nurse Care Manager
PHC	Patient Health Coach
PCMH	Patient Centered Medical Home
FOI	Fidelity of Implementation

ACKNOWLEDGEMENTS

First, I give thanks to God for every condition, concerning every condition, and in every condition.

In setting out to complete this dissertation, the task seemed nothing short of daunting. In retrospect, the experience has been nothing short of blessed.

There is much to be said about the relationship between a supportive mentor and a smooth dissertation process. Dr. Hector Rodriguez, words cannot express the amount of gratitude I have for your guidance and support throughout this work – both academic and moral. I will forever be thankful for your kindness, patience, knowledge, and mentorship; this finished product would truly not have been possible with you.

To Dr. Rich, Dr. Vargas-Bustamante, Dr. Inkelas, and Dr. Chin: for all of your time spent in providing feedback and support, I am sincerely grateful. This manuscript has only been enriched by your thoughtful guidance.

To all the delightful and incredibly brilliant statistical consultants at UCLA Statistical Consulting Group, I am sincerely and truly thankful for your assistance. A special thank you to Joni Ricks – you helped me transform data files from meaningless numbers to meaningful statistics. For all the hours you spent with me in the lab, watching the spinning wheel in STATA *not* return results, I thank you.

Maryann and Candace, my West Coast Family: You have provided me with more moral support than I suspect the two of you will ever really know. From the bottom of my heart, thank you for taking me in as family and making me as one of your own.

To Tony: For being my official sounding board and an endless source of confidence, comfort, prayers, and love – thank you. While the completion of this work marks the end of my "leisurely mornings," I willingly part from it and look forward to the next chapter of life with you.

Though the majority of my family and moral support lives across the country, I am eternally grateful for their ability to provide comfort and strength as though they lived only mere minutes away. Mina Grace – the best brother a younger sister could ever ask for – thank you for all those words of encouragement over the years. To all of my wonderful family: all the motivation and ambition I have is a tribute to the love, support, and guidance you have given me these past 27 years. You are my foundation. For all the love, comfort, strength, and wisdom, I thank you.

If I have seen further it is by standing on the shoulders of giants.

- Bernard of Chartres

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PUBLICATIONS

Kominski GF, McCullough JC, Grace SM, Martinez AE. *Evaluation of the California Healthcare-Associated Infection Prevention Initiative (CHAIPI)*. Los Angeles, CA: UCLA Center for Health Policy Research, 2011

CHAPTER ONE: Introduction

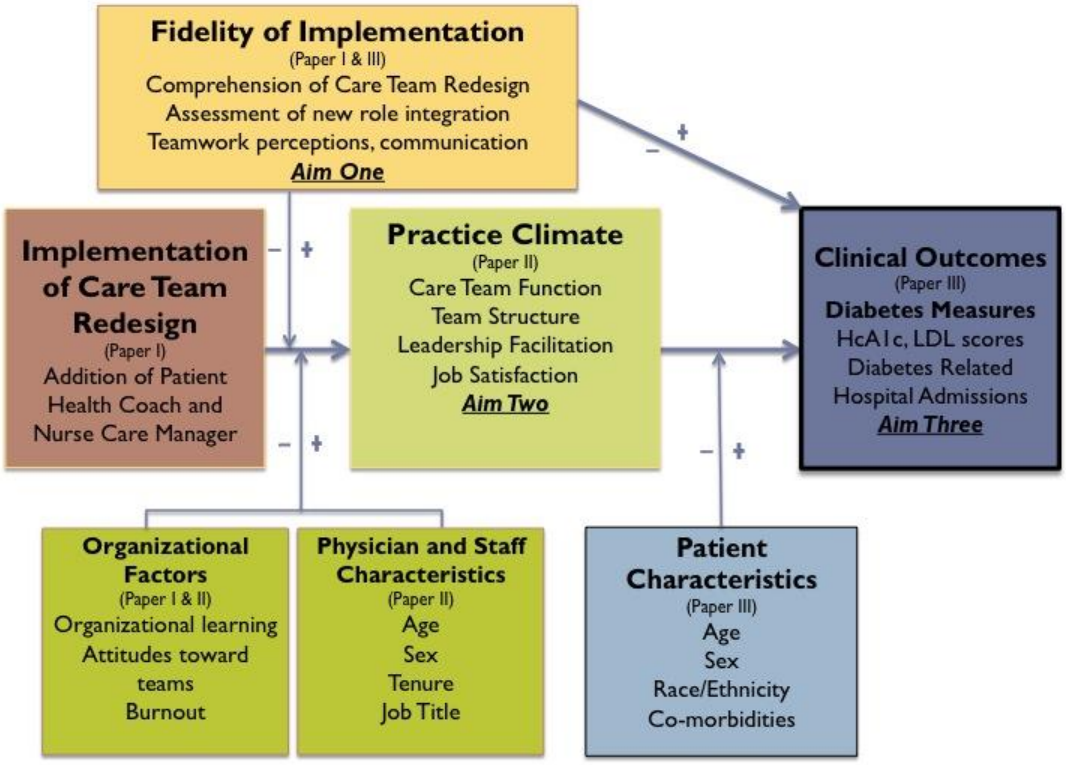
In its current state, primary care is in desperate need of innovation. Despite the fact that primary care has always been considered the first line of defense in the prevention and treatment of chronic conditions, estimates suggest that currently 133 million Americans suffer from at least one chronic illness, accounting for 75% of total healthcare expenditures[1,2]. Combining these figures with the fact that a majority of Americans seek treatment for chronic conditions in primary care offices, it seems the ideal setting to innovate how to better deliver care[3].

Incorporating interdisciplinary care teams into routine primary care has long held the appeal of promoting a continuous and coordinated system health system. Care teams have been attributed to improving quality of care, patient satisfaction and health outcomes, and work place satisfaction, and also reducing unnecessary healthcare costs while maintaining quality[4-9]. As a result, primary care practices are beginning to adopt interdisciplinary care teams as part of patient-centered medical home (PCMH) implementation. Despite the appeal and added benefit however, translating interdisciplinary care team from theory to practice is a complex task, subject to many barriers.

Recently, five primary care practices belonging to a larger healthcare organization implemented a care team redesign intended to augment teamwork, practice culture, and patient outcomes by incorporating two new team members at each of the five practice sites – registered nurse care managers (NCMs) and patient health coaches (PHCs). The purpose of this project is to assess the various aspects of implementing interdisciplinary care teams, including the barriers and facilitators of implementing teams into routine practice, the influence of teams on improving practice climate and clinical outcomes, and the methods to assess team adoption. The conceptual model below establishes the parameters of this dissertation.

The first aim of this study qualitatively explores the impact of implementing the care team redesign at each of the five pilot sites. Understanding the impact of the team redesign locally at each of the sites will help establish a better understanding to the degree of which each site adopted and adapted the redesign as necessary. The second aim quantitatively assesses the practice climate at each of the five pilot sites, along with 28 other primary care practice sites belonging to the same healthcare organization.

Figure 1.1 - Conceptual Model



Specifically, the second study seeks to understand the impact of the redesign on practice climate, given specific organizational factors and physician and staff characteristics. The third aim uses a mixed-methods approach to evaluate the relationships between how well the care team redesign was implemented, otherwise known as the fidelity of the intervention (FOI), in relation to improved clinical outcomes, while taking into account patient characteristics.

While the conceptual model suggests there are various variables that may influence the overall goal of improving practice climate and clinical outcomes, this study posits that a solid understanding of the redesign, along with a strong fidelity of implementation can positively influence the overall practice climate, resulting in improved clinical outcomes. Alternatively, however, the model also suggests that despite both positive comprehension of the care team redesign and FOI, patient characteristics may negatively influence clinical outcomes, regardless if the redesign improved overall practice climate.

Given that care teams are considered the cornerstone of the PCMH, the ultimate goal of this study is to identify pragmatic ways in which healthcare organizations can begin to adopt and implement successful and functional care teams into routine practice. The results of these three aims will contribute to the current literature the benefits of care teams on practice climate, the facilitators and barriers to successful integration into primary care settings, and the impact successful integration can have on patient outcomes.

CHAPTER TWO: Flexible Implementation and Integration of New Team Members to Support Patient-Centered Primary Care

Background

Despite advancements in chronic care management, only fewer than half the approximated 133 million Americans with chronic illnesses are receiving appropriate treatment[1,2]. In 2003, the Institute of Medicine identified increasing physician demands due to a higher prevalence of complex and chronic conditions contributes to the U.S. health care system's shortcomings in providing patient-centered chronic care management[1,10]. In response, primary care practices are beginning to adopt interdisciplinary primary care teams as part of patient-centered medical home (PCMH) implementation. Team approaches are viewed as the key to efficiently meet the increased demand for primary care, while fulfilling its core function – providing patients with continuous, comprehensive, and well-coordinated care[10-15].

Involving non-physician clinicians, such as nurse care managers, health coaches, and social workers as part of interdisciplinary primary care teams is an effective approach to improving preventative care goals, including routine cancer screenings and immunization needs, and improving the quality and outcomes of chronic illness care[16-24]. Integrating new team members into routine care processes, however, is a complex social change that has proved to be challenging for primary care practice stakeholders, despite evidence suggesting that interdisciplinary teams yield substantial benefits[25-29]. Few studies have examined the experiences of primary care practices as they operationalize new team members to improve patient-centered care[30-32]. We examine the facilitators and barriers of implementing a flexible PCMH team redesign intended to augment existing physician-medical assistant (MA) dyads by incorporating two new team members at each of five practice sites – registered nurse care managers (NCMs) and patient health coaches (PHCs). Implementation experiences were assessed approximately

one year after the redesign's implementation. Physician and staff survey data from the pilot sites and other regional primary care practices were analyzed to contextualize the interview findings.

Methods

Twenty-two semi-structured key informant interviews were conducted among primary care physicians (n=6), NCMs (n=5), PHCs (n=5), and MAs (n=6) at five pilot sites implementing the care team redesign as part of PCMH implementation. Our goal of interviewing a range of team members at each pilot practice site was to clarify local strategies and processes used to integrate new roles. Participants' experiences implementing the redesign was assessed, and their perceived value, comprehension, and integration of the new team roles. The participants' perspectives on team structure, processes, trainings, and leadership facilitation of the redesign was also elicited.

Interviews

Interviews were conducted between July and August 2012, approximately one year after the redesign's implementation. To elicit a range of responses, a random quota sampling approach was used to recruit one practice member per care team role at each site. This reduced potential selection bias and reassured participants that they were not being singled out for any reason. Of the 34 individuals invited to participate in an interview, 22 agreed (response rate=65%). Responsiveness differed across pilot sites (range: 44-100%). The final participants included one care team member role per pilot site. Physicians were the most difficult informants to recruit (54% vs. 65% overall). Interviews lasted approximately thirty to sixty minutes. Primary reasons for non-participation was a lack of response (n=10) to invitations. The interviews were conducted in-person, recorded digitally with the verbal consent of each participant, and

transcribed. The research study was approved by the UCLA South General Campus Institutional Review Board (IRB#12-000658).

The interview guide was based on a review of PCMH implementation literature, team effectiveness research[12,21], and unstructured interviews of organization's leadership stakeholders. A codebook was developed based on the key informant interview guide that guided the coding process, delineating coding practices to ensure consistency. Coding was compared for consistency between two researchers (SMG, HPR) during regular team meetings where discrepancies were resolved. To examine patterns of care team implementation, the analysis features of Dedoose were used[33]. The most consistent responses and important practice site variation were noted. Patters and frequencies of code occurrence and co-concurrences were examined, along with identifying consistencies and differences in implementation experiences across pilot practices.

Survey

To contextualize the implementation interview results and understand whether the pilot practice experience of redesign might generalize to other practices experiences of undertaking role integration, a web-based survey of primary care clinicians and staff was conducted during November 2012 (71% response rate), and includes an analytic sample of 77 PCPs and 324 staff from the 5 pilot practices and 28 other practices in the geographic region. The survey assessed the primary care practice climate of the 33 practices and their team experiences[34-37]. To assess differences between pilot and non-pilot practice sites, we stratified the survey responses by site status (pilot respondents (n=71) vs. non-pilot respondents (n=329)) and used chi-square statistics to compare differences in team and practice characteristics.

Results

Respondent Characteristics

Clinician and staff respondents from the five pilot sites reported similar team characteristics as respondents from the 28 non-pilot sites (Table 2.1). Compared to non-pilot sites, pilot practice members were more likely to include registered nurses (54.6% vs. 35.3%) and social workers (47.1% vs. 17.7%) as part of their care team definition, however.

Table 2.3 summarizes major themes from the implementation experiences of pilot practices, including details about the specific quality improvement priorities adopted by each practice. In order to help facilitate the implementation of new care team roles, pilot sites were given outlined details each role's responsibility, training documents, and a resource manual that identified ways in which the new roles may be used to improve patient care (Table 2.1). Analyses of key informant interviews revealed the following major implementation issues: inconsistent care team membership definitions, team communication, new role integration, and overall perceptions of the care team redesign.

Inconsistent Care Team Membership Definitions

Despite pilot site stakeholders' efforts to introduce new care team member roles into routine practice, NCMs and PHCs were not always considered core members of most respondents' teams. Instead, respondents generally described the new roles as auxiliary resources available to any clinician or staff member, but not as members of their own care team (Table 2.4). When team membership was elicited among participants, approximately half of respondents defined their team as only consisting of a physician and two assigned MAs (n=10). In contrast, NCMs or PHCs (n=7) identified themselves as belonging to each of the care teams in their practice sites. Physicians reported the widest spectrum of team membership by either including

the entire practice staff, incorporating the new team roles, or by limiting the boundaries of their team to the traditional PCP-MA dyad.

Informants that included the new roles as part of team composition often reported more structured communication among team members relative to other informants, such as the implementation experiences of sites A and D (Table 2.3). Structured communication not only increased the likelihood respondents would include new roles as part of their team definition, but also helped existing team members recognize the added value each new member could bring to the practice.

Care Team Communication and Training

Respondents from three pilot practices reported participating in routine weekly/monthly team meetings to coordinate care for complex chronically ill patients. In lieu of regular face-to-face meetings, many respondents reported frequent use of electronic task queues available in the electronic health record to facilitate communication and efficiently coordinate care for complex patients. Some physicians expressed skepticism of including new care team members as part of managing chronic illness care because inclusion would require additional communication and coordination among practice members (Table 2.4). One physician stated, *"I don't see the big picture of this (redesign). I heard XXX saying that we'll have our own team, and (the NCM) will be somewhere outside of my team. I was too embarrassed to ask, how are we going to make sure that we're communicating? I got the sense that XXX didn't know either."* Few physicians took a proactive approach to improving team communication, although some noted scheduling ad hoc meetings as needed with NCMs to discuss specific complex cases. Most physicians indicated that more structured communication was needed, especially to ensure follow-up on care coordination efforts with NCMs.

All pilot staff and clinicians participated in a team communication-training workshop, which aimed to motivate teamwork and impart effective team collaboration techniques. Many respondents reported the training as useful (n=18), especially among MAs and PHCs who cited that their communication among physicians and fellow MAs improved after implementing the training's techniques. Some respondents reported that while the training was beneficial, more immediate patient care obligations sometimes prevented individuals from applying the training's communication techniques.

New Roles Integration and Comprehension

Nurse Care Manager

Participants at all practice sites responded positively to the inclusion of a NCM on the team. Prior to the redesign, physicians were perceived as spending more time coordinating care for patients during office visits. Respondents (n=20) considered the NCM role as added value to routine practice, citing NCMs facilitated more time between physicians and patients. Physicians, however, reported ambiguity with respect to the appropriate tasks to delegate to the NCMs; some commented that increased communication and team meetings could help mitigate the uncertainty in delegating care management responsibilities.

Patient Health Coach

The PHC was the least clearly understood team member role among interview participants. Three pilot sites reported poor/mixed impressions of the PHC's integration (Table 2.3). PHCs were often seasoned MAs from the pilot practices and often reverted to their previous MA roles when practice demands were high. Physicians and MAs respondents were the most unaware of the PHC's responsibilities, frequently defining the role as the NCM's personal assistant. Some respondents reported never having interacted with the PHC, and thus were

unaware of their specific duties and responsibilities (Table 2.4). Most physicians and NCMs perceived that PHCs were assigned tasks that were narrow in scope, often clerical tasks.

Many respondents (n=9), including PHCs, reported being unaware of the PHC responsibilities at the beginning of the practice redesign, stating that there was little direction regarding how to use the new resources beyond their job description. PHCs cited confusion about the NCM and the PHC's responsibilities when physicians assigned non-clinical tasks. Others PHCs reported discrepancies between the job description and the actual work they were doing, where job descriptions had detailed more responsibilities and in reality, the work was considered to be more clerical in nature.

The relationship between NCMs and PHCs varied across the pilot sites. Two NCMs sought to guide the PHC to be self-motivated and independent, encouraging PHCs to take initiatives counseling patients and scheduling follow-up visits without prompt (n=2). Other NCMs chose to assign each task to the PHC, as one NCM explained, *"When the staff sees me assigning (the PHC) clinical tasks – and because I'm a registered nurse – it encourages them to go to (the PHC) with questions instead of me."* While PHCs reported a range of working relationships with NCMs, most PHC respondents (n=4) felt strongly supported by the practice's local leadership. Most interview participants indicated that regular communication with NCMs would help assess job performance and provide necessary feedback.

Implementation Experiences

Respondents were optimistic about the impact of the team redesign on improving patient care for patients with chronic illnesses. Sites A, C, and E had physician buy-in, scheduled structured communication, and implementation guidelines cited as strong facilitators to a successful care team implementation (2.3). Interview participants from these practices reported

that consistent presence of physician leaders in the practice helped facilitate a sense of teamwork. Physician champions of the redesign tended to have more inclusive team definitions, understood the scope of the new roles, and were more willing to identify ways of incorporating new roles into routine practice. Both NCMs and PHCs reported that highly supportive physicians often facilitated more frequent, structured communication among the team members, engendering confidence among individuals adopting their new roles.

Most respondents noted that the protocols in operationalizing the team redesign were loosely specified. Practices integrated the new roles to best meet local needs and many believe that this resulted in unique team dynamics and different implementation experiences across pilot sites. Respondents indicated that the flexible implementation protocols developed at the corporate level were both a facilitator and barrier to effectively using the NCM and PHC positions. Some physicians commented that due to loosely specified protocols, local sites began to innovate ways to fully maximize the benefit each new role could bring to patient care. However, with the ability to innovate came the worry of under-utilizing new roles due to a lack of vision of the roles' full potential. Flexible implementation protocols also resulted in different clinical improvement priorities for each pilot site, where two sites identified top clinical priorities as monitoring and coordinating patient discharge, while others cited medication reconciliation and decreasing inpatient bed days as top priorities (Table 2.3).

When asked to advise non-pilot sites on how to implement the team redesign, many respondents cited the need for more specific protocols to aid teams in operationalizing the new roles. One physician commented, "*Wait for the manual. If you were a coach, you'd say, here are six easy plays in basketball. Let's run these first to find out if we can even communicate on the court. Then we'll get fancy. I believe that before anybody tries the (team redesign), they should*

start with these six things to get teamwork going." Respondents stated that more support from leadership, in terms of providing further detail on ways to operationalize roles, would have benefited local sites into quicker adoption of the new care team members.

Table 2.1 – Responsibilities and Training Processes of the New Primary Care Team Members

Nurse Care Manager	
Role & Responsibilities	• Responsible for ensuring the continuity of care in both inpatient and outpatient settings • Identify and assist with the follow-up of high-risk patients in acute care settings, skilled nursing facilitates, custodial and ambulatory settings • Coordinate treatment plans with the care team and triage interventions appropriate to the skillset of the team members • Work in coordination with the care team and in conjunction with PCP as a care team leader, demonstrating accountability with patient management • Maintain effective communication with physicians, hospitalists, extended-care facilities, patients, and families
Training Documents	
Scenario Trainings	Six detailed patient-care scenarios based on real-life events that detail the following: • Specific expectations of each team member role • Delineated steps to remediation of each scenario by the NCM and PHC • Trainings guidelines for completing each step • Follow-up discussion questions of each task to ensure comprehension
Patient Health Coach	
Role & Responsibilities	• Assist the care team leader in disease management of target populations • Engage in patient advocacy, empowering patients to take charge or leadership in their healthcare needs • Ensure all patients understand their disease process and treatment plan by serving as an expert in selected chronic diseases • Work in collaboration with the NCM to support and coach patients in order to provide and receive ongoing follow-up information as it relates to patient care and health status • Serve as a liaison between patient and clinician to encourage patient's engagement in *"Life Planning"*
Training Documents	
Scenario Trainings	Identical to NCM scenario trainings (above)
Duty List	Detailed Instructions on conducting expected responsibilities, including the following: • Providing patient education • Obtaining lab results, pharmacy updates, and any hospital admission details • Motivational interviewing

Table 2.2– Pilot and Non-Pilot Practice Site Team Characteristics

	Pilot Sites	Non-Pilot Sites	P-value
Sites (n)	5	28	
Respondents (n)	71	329	
Perceived Team Membership			
PCP (% always)	84.9	81.6	
Physician Assistant	26.1	20.3	
Nurse Practitioner	24.7	21.3	
Registered Nurse	54.6	35.3	**0.000**
Licensed Vocational Nurse	62.3	69.8	
Medical Assistant	85.7	87.0	
Clerk/Receptionist	80	84.4	
Health Educator	23.9	19.3	
Pharmacist	16.8	18.6	
Social Worker	47.1	17.7	**0.000**
Nutritionist	18.2	16.2	
Team Meetings			
Never/Yearly (%)	5.66	7.6	
Quarterly	9.4	3.8	**0.019**
Monthly	55.6	57.7	
Biweekly/Weekly	19.8	22.0	
Daily	9.43	8.9	
Practice Atmosphere			
Calm (%)	13.3	16.6	
Busy	65.8	65.2	
Hectic, Chaotic	20.8	18.2	
Likelihood to leave practice within 2 years			
None/Slight (%)	46.2	47.4	
Moderate	8.4	14.5	
Likely/Definitely	45.4	38.0	
Respondent Characteristics			
Age (mean, SD)	40.6 (11.3)	39.4 (11.5)	
Gender (% male)	21.2	16.9	
Race/Ethnicity			
White (non-Latino)	9.4	15.3	
Latino (any race)	55.9	46.5	
Black	4.7	8.5	
Asian /Pacific Islander	21.2	13.3	
Other	5.5	9.8	
Job Title			
Primary Care Physician (%)	19.7	20.1	
LVN/RN	7.6	9.8	
Medical Assistant	58.3	61.2	
Clerk/Receptionist	10.2	8.9	

Table 2.3 – Summary of New Care Team Member Integration Experiences by Pilot Site

	Site A	Site B	Site C	Site D	Site E
Team Membership Inclusive of New Roles[1]	Most	Some	Most	Some	Some
Routine Structured, Team Meetings[1]	Most	Most	Most	Some	Few
General Impressions of NCM Integration[2]	Positive	Positive	Positive	Positive	Positive
General Impressions of PHC Integration[2]	Positive	Positive	Negative	Negative	Mixed
Leadership Support and Facilitation[1]	Most	Mixed	Most	Mixed	Negative
Clinical Improvement Priority	Patient Discharge Follow-up and Coordination	Decreasing Inpatient Bed Days	Patient Discharge Follow-up and Coordination	None Specified	Medication Reconciliation
Overall Pilot Redesign Perceptions[2]	Positive	Positive	Mixed	Mixed	Positive

Note: Categorization decisions are based on a pattern analysis of responses within practices.

1 Most= ≥60% of informants at the site reported; Some= 30-60% of informants at the site reported; Few ≤ 30% of informants at the site reported

2 Positive= >50% of informants at the site reported primarily positive impact; Negative= >50% of informants at the site reported primarily negative impact; Mixed = 50% of informants shared no cohesive perspective about the impact of the care team redesign

Table 2.4– Major Redesign Issues and Example Quotes Illustrating Common Implementation Dynamics

Redesign Theme	Summary	Example Quotation
Inclusive team membership	Most informants did not include the new care team members as part of "their" team. Rather, they viewed the new care team members as common resources available for general use by all practice members	"I have two medical assistants on my team, where one person handles the phone and the other MA vitals the patient. The NCM is sometimes somewhere out there, kind of tangential. Very helpful, but yet tangential, somewhere out there."
Care team communication	Individuals reported structured communication was infrequently built into the daily workflow. Physicians cited the most need for increased care team communication as part of the redesign	"The NCM does an outstanding job, but I just don't get any feedback. I would like more communication when she sees my patients. Throughout the day, I'm working so fast and so is she, so I don't really have the time to stop her and ask, 'what about this or that patient?' It would be a great thing to design more constant feedback to close that communication loop."
Nurse Care Manager integration	All respondents identified that the NCM had been well integrated into routine practice	"The NCM has been very, very helpful. There are some problems in the way this (care team) is designed, but in terms of her help, she has just been immensely helpful for those complicated patients who need that extra set of eyes on them. The NCM is my extra set of eyes."
Patient Health Coach integration	Most respondents had difficulty defining the role of the PHC, including what their daily responsibilities entailed. Among physicians, the PHC role was the least understood	"I don't have a vision of what the PHC does. I'm not directly involved in either directing much activity with her, nor am I counseling her, nor has my feedback been elicited. I don't feel I'm really involved with her at all, which is unfortunate. I think there are things that I thought we, as doctors, were going to get more directly from her."
NCM-PHC relationship	The relationship between the care manager and the patient coach ranged among all five sites, where some care managers preferred the patient coach to be independent, while others preferred to delegated all responsibilities	"There's too much going on here, so (the PHC) needs to be able to work independently, and not always be told what to do. The role needs a person that, even if they have a template of questions to ask patients, they need to know what to do with the answers the patients give them. You have to have that skill set, too. They are medical assistants, so they don't necessarily have to assess, but they have to know what to ask or bring to the care manager."
PHC task delegation	Many respondents described a hesitancy in discerning which tasks were appropriate to delegate due to PHC, often citing a lack of clinical training and credentials as a barrier	"It's ambiguous and I've had a hard time figuring out exactly what's the best way to utilize the patient coach. They do add value because as an extension of myself, and that's how I see her, is to do those things within her scope but their scope is so wide because they are already able to do so many things as medical assistants."
Leadership support and facilitation	Many respondents preferred more support from leadership, such as creating better structure to the overall design	I would rather have something structured to begin with, and have the flexibility of changing it when things don't work. I'd prefer that than having no structure and telling us to figure it out, because we got a lot of things already to figure out.

Discussion

The implementation experiences of the pilot practices underscore that a shared understanding of individual team member roles and responsibilities is crucial for effectively integrating new members onto primary care teams[7,38-40]. In primary care, the clinical scope of practice of clinicians may overlap considerably, so roles and responsibilities need to be well defined among interdisciplinary team members[19,41,42]. Clear role definitions help to clarify individual expectations, which with a clear vision of each role's purpose, practice site leaders can then adapt the role to best suit local needs[43,44]. Additionally, including new members as part of existing teams reinforces a key team attribute; team members must see themselves and be seen by others as an intact social entity[43], especially considering that members will differ in education, qualifications, and status, thereby influencing individual performance and team participation.

Our study found that interview participants from pilot practices with overall positive perceptions of the redesign, including incorporating and understanding the scope of the new roles when describing teams, reported more routine communication and influenced other teamwork related factors (Table 2.3). This is specifically relevant as the redesign introduced two new roles that independently communicate with patients, influence behavior, and coordinate care – tasks that require routine communication among the team to keep each member aware of progress made. Establishing routine structured communication for teams appears to facilitate continuity of care and improve coordination – both of which keep physicians better informed on the status of their patients. Well-informed physicians appear not only communicate more effectively with patients, but also increase patient confidence and satisfaction[8,26,45]. Effective communication has been shown to be crucial to the functioning of interdisciplinary teams as it minimizes duplication of effort among team members whose may overlap in their scope of practice[19,46,47]. Our findings

are consistent with previous research that demonstrated shifting from a physician-focused primary care model to an interprofessional team-based model is a very challenging organizational change[9,48-50]. We found that respondents who reported positive experiences of the team redesign reported local physician leadership investment in improving teamwork and communication.

Our findings emphasize that flexible implementation protocols and local practice culture created unique team dynamics – especially with regard to the working relationship of PHCs and NCMs – and these differences shaped different clinical improvement priorities across the pilot practices. Standardization of improvement priorities and performance measures may help teams benchmark performances against one another, regardless of local adaptations to team implementation. While standardization of the redesign was strongly recommended by respondents, flexibility was also viewed as critical for practice stakeholders to adapt to the changes. Clarifying the strategic intent of the practice redesign could also help local sites tailor the redesign as necessary to fit their needs, while adhering to the intended team roles. Few interorganizational or peer learning opportunities were available to pilot participants. Future redesign efforts might test the impact of structured learning opportunities, including peer networks and improvement collaborative on the effective integration of new primary care team members into routine practice.

Our results should be viewed in light of important limitations. The respondents' views may not reflect all clinicians and staff who participated in the team redesign. Respondents were randomly selected to participate, however, in order to reduce potential biases from recruiting volunteers. The pilot sites included in the team redesign also resemble other practices in the region, suggesting that the range of implementation experiences we observed could generalize to

a diverse range of primary care practices. The interviews were conducted approximately one year after implementation, reflecting a possible adjustment period for new team members. In spite of this limitation, a one-year implementation assessment reflects a timeframe that stakeholders would expect some level of routine integration of new team members into primary care[9,51].

Conclusion

Interdisciplinary primary care teams are tasked with not only improving chronic care outcomes, but also with identifying gaps in care that can improve upon preventative care goals, thereby reducing overall patient mortality. Ensuring teams are equipped to address the challenges of managing complex, chronically ill patients requires both internal facilitation, including physician buy-in and facilitated communication, and external support by organizational leadership, including standardized improvement foci and flexible, yet detailed implementation guidance[48,52,53]. We found that flexible implementation protocols provided the pilot sites with significant discretion to integrate the new NCM and PHC roles to best-fit local needs[54]. This same flexibility, however, sometimes created ambiguous expectations of new member responsibilities and their contributions to the team, resulting in inconsistent implementation of key features of the redesign across the pilot practices. When implementing a complex primary care team redesign, a standardized scope of practice for individual roles and common clinical improvement priorities would be more effective in facilitating teamwork and disseminating best redesign practices.

CHAPTER THREE: Impact of Primary Care Teams on Practice Culture

Background

Integrating inter-professional teams into routine primary care practice may hold promise for delivering integrated and well-coordinated care to patients with chronic illnesses and is a strategy that is viewed as essential to transforming the U.S. health care system by many health care organizations. For example, over a decade ago, the Institute of Medicine identified interdisciplinary care teams as a core component of the 21st century's New Health System[10]. In spite of this, the complexity of successfully implementing team-based approaches to primary care has challenged many delivery system stakeholders[1,15]. Primary care practices are increasingly adopting inter-professional care team approaches as part of the patient-centered medical home (PCMH) to help improve the quality of chronic illness care, patient self-management, and health outcomes. Team-based care models of primary care have the potential to support patients in ways that individual physicians could not do alone[12,18,25,38,55,56]. Integrating team-based approaches in routine primary care is an intricate social change influenced by organizational, team, and patient factors, such as organizational support and features of the redesign, resources available to clinicians and staff, relationships among team members, and patient engagement[21,43]. Primary care teams appear especially challenging to integrate, as clinicians and staff are expected to have the skills and knowledge to continuously manage a wide range of patient medical, behavioral, and social issues[15].

In 2011, five primary care practices belonging to a large integrated physician organization implemented a care team redesign intended to augment teamwork and practice culture by incorporating two new team members at each of five practice sites – registered nurse care managers (NCMs) and patient health coaches (PHCs). At the onset of the care team redesign

implementation, all pilot sites received increased support by way of trainings and workshops from both local and organizational leaders within the physician organization. We examined the experiences of practice climate, including clinician and staff experiences of team structure, team functioning, team members' skills and knowledge, readiness for change, and leadership facilitation among the five pilot practices relative to 28 other primary care practice sites in the geographic region. The primary objective in this study was to compare changes in practice climate over time between clinicians and staff from pilot and non-pilot practices. There are few longitudinal studies characterizing the experiences of clinicians and staff as they implement care teams into routine practice and fewer that assess the effect of a team redesign on multiple dimensions of practice climate over time[12,57]. Evidence suggests that team interventions may help improve team relationships and climate over time[58,59]. Research also indicates that implementing a team redesign is a complex social change and stakeholders may not experience improvements in practice climate[59,60]. While previous evidence suggests that improving team structure and team functioning can result in higher quality chronic disease management, the impact of redesigning primary care teams on clinician and staff experiences of team structure, team functioning, perceptions of skills and knowledge, readiness for change, and leadership facilitation remain unclear. Overly aggressive team interventions might also disrupt practice climate, which may negatively affect professional satisfaction and increase physician burnout[36,61]. Recognizing the organizational and social complexity of implementing a care team redesign, we posit that in the face of a primary care redesign, clinicians and staff from pilot practices will experience improvements over time in practice climate, especially with regard to clinician and staff experiences of team structure, compared to non-pilot group practices.

Methods

Practice Climate Survey

To assess primary care practice climate, we developed a survey instrument consisting of select questions from existing clinician and staff surveys, including the TeamSTEPPS Teamwork Perceptions Questionnaire[35], the Team Diagnostic Survey (TDS) [34], the TransforMed Clinician and Staff Questionnaire[62], and the Organizational Readiness for Change Assessment[37] (Appendix A). The survey instrument was intended to assess important aspects of practice climate, including clinician and staff experiences of team structure, team functioning, perceptions of skills and knowledge, readiness for change, and leadership facilitation. Questions referenced current team experiences, using a 5-point response scale ranging from "strongly disagree" to "strongly agree." Based on the unweighted average of all item responses, composite scores were transformed to a scale ranging from 0 to 100 points, with higher scores indicating more favorable team experiences; a score of 0 represents almost strongly disagree, 25 represents disagree, 50 represents neither agree nor disagree, 75 represents "agree", and 100 strongly agree. Composite scores were developed using the half-scale rule[63], which requires respondents to respond to at least half of the items comprising the composite in order to qualify for a score calculation.

We performed exploratory factor analyses on all completed survey responses, treating responses as categorical, using a promax rotation. We determined the optimal number of factors based on magnitude of Eigen values, shape of the scree plot, and the fit for each composite measure. We dropped items with redundant content, weak loadings on all factors (<0.40), or high loadings (>0.30) on two or more factors. We then performed confirmatory factor analysis in the confirmation sample. We created scales based on the final factor solution, considered the variation explained by each factor, and concluded with five composite measures of practice site

culture and teamwork: team structure, team functioning, staff readiness for change, skills and knowledge, and leadership facilitation.

Team structure (α=0.89) and team functioning (α=0.81) were assessed using previously validated measures of situation monitoring, mutual support, and team structure questions from AHRQ-TeamSTEPPS Teamwork Perceptions Questionnaire[35]. Staff readiness for change (α=0.84) was assessed using questions from the team task design subscale of the Team Diagnostic Survey (TDS)[34] and the adaptive reserve scale from the TransforMed Clinician and Staff Questionnaire[62]. We assessed respondents' perceptions of their team members' skills and Knowledge (α=0.76) using validated questions from the TDS survey. Finally, leadership facilitation (α=0.94) was assessed using the leadership behavior and change culture subscale of the Organizational Readiness for Change Assessment instrument[37]. Appendix A includes a mapping of the survey questions to each of the five composite measures.

Survey Administration

The survey was administered twice, first in October 2011 and again in November 2012, to all primary care clinicians and staff including physicians, nurses (registered nurses, and licensed practical and vocational nurses), medical assistants, clerks/receptionists, and other staff (social workers, referral coordinators, and patient liaisons). Surveys were administered among 33 practices, 5 of which represented pilot sites implementing the care team redesign. The leadership of the physician organization selected the five pilot practices out of 28 others because they were perceived to represent a range of implementation readiness. All clinicians and staff received a personal electronic invitation to voluntarily participate in the practice climate survey via the Internet (http://www.surveymonkey.com). Organizational leadership allowed for a 20-minute block of time during a workday during the survey implementation period to provide clinicians

and staff with uninterrupted time to complete the survey. In both waves of the survey, a second, third and fourth survey invitation were sent to non-respondents 2, 3, or 4 weeks respectively, after the initial invitation. Each data collection effort proceeded over a period of 5 weeks.

Analysis

To assess whether differences in team characteristics between pilot and non-pilot practice practices existed at baseline, we stratified the survey responses by pilot status (pilot respondents (n=56) vs. non-pilot respondents (n=274)) and used chi-square statistics to compare differences. To compare changes in experiences of practice climate over time among pilot sites and non-pilot practices, we specified three-level mixed-effects multilevel regression models (XTMIXED, STATA 11) predicting each of the practice climate composite measures. These models accounted for the clustering of observations within individual respondents over time and the clustering of respondents within practice sites using respondent and practice random effects. To examine the extent to which differences between pilots and non-pilots experienced different changes over time for each of the five team composite measures, the models included terms to capture the: 1) overall differences between pilot and non-pilot sites respondents, 2) changes over time, and 3) differences in changes over time between pilots and non-pilot sites.

To evaluate differences in changes over time by occupation across the practice sites, we used the predicted estimates from the multilevel regression models used for the primary analysis and stratified the estimates by job title, pilot status, and survey wave to compare differences between job-titles at each respective practice site over time.

Finally, to clarify whether the changes in practice climate between pilot sites and non-pilot sites respondents over time were due to higher response rates to the second wave of the survey, we conducted a sensitivity analysis restricting our respondent sample to those individuals

present in both survey waves, or dual-respondents, only. We assessed the results of this sensitivity analysis by looking at the same three aims mentioned above for each of the composite measures. Variables including respondent age, job title, and race/ethnicity were included as control variables to account for respondent differences in both analyses.

Table 3.1 – Baseline (2011) Team Characteristics Among Pilot and Non-Pilot Sites

	Pilot Sites	**Non-Pilot Sites**	**P-value**
Sites (n)	5	28	
Respondents (n)	56	274	
Occupation			
PCP (%)	25.0	20.4	.447
Nurses (RN/LVN/LPN)	5.4	10.6	.228
Medical Assistant	57.1	58.0	.406
Clerk/Receptionist	8.9	8.0	.749
Other	3.5	2.9	.774
Practice Tenure			
>5 Years (%)	58.8	46.0	.096
3-5 Years	29.4	26.2	.634
1-2 Years	9.8	23.6	**.028**
<1 Year	2.0	4.2	**.000**
Likelihood to leave practice within 2 years			
None/Slight (%)	7.8	18.8	.088
Moderate	5.9	13.8	.144
Likely/Definitely	86.3	67.4	**.039**
Respondent Characteristics			
Age (mean, SD)	41.8 (10.3)	40.2 (11.3)	.841
Gender (% male)	26.8	17.5	.108
Race/Ethnicity			
White (non-Latino)	8.9	14.2	.287
Latino (any race)	53.6	44.5	.216
Black	3.6	8.4	.214
Asian /Pacific Islander	21.4	12.4	.088
Other	12.5	20.4	.168

Table 3.2 – Practice Climates Changes over Time, Pilot vs. Non-Pilot Respondents

	Team Structure			Team Functioning			Readiness for Change			Skills and Knowledge			Leadership Facilitation**		
	2011	**2012**	**Change Over Time**	**2011**	**2012**	**Change Over Time**	**2011**	**2012**	**Change Over Time**	**2011**	**2012**	**Change Over Time**	**2011**	**2012**	**Change Over Time**
Pilots	78.0	79.3	**1.3**	75.7	77.7	**2.0**	77.6	77.7	**0.1**	48.0	53.6	**5.6**	77.4	76.9	**-0.5**
Non-Pilots	76.2	75.8	**-0.4**	71.0	71.4	**0.4**	73.0	71.0	**-2.0**	52.6	53.3	**0.7**	71.8	68.9	**-2.9**

Note: All results are adjusted for job title, age, race and ethnicity and account for the clustering of observations within respondents over time and respondents within sites.

*** P < 0.05 compared between survey years between pilot sites and non-pilot sites*

Table 3.3 – Changes in Practice Climate Over Time by Occupation and Pilot Status

			PCP	PCP Change Over Time	RN[1]	RN Change Over Time	MA	MA Change Over Time	Clerk	Clerk Change Over Time
Team Structure	**2011**	**Pilots**	78.2		80.5		77.4		77.6	
		Non-Pilots	76.3		78.7		75.6		75.7	
	2012	**Pilots**	79.5	**1.3**	81.8	**1.3**	78.9	**1.5**	78.8	**1.2**
		Non-Pilots	76.1	**-0.2**	78.3	**-0.4**	75.3	**-0.3**	75.4	**-0.3**
Team functioning	**2011**	**Pilots**	77.2		77.4		74.8		76.0	
		Non-Pilots	72.4		72.7		70.1		71.3	
	2012	**Pilots**	79.1	**1.9**	79.4	**2.0**	76.8	**2.0**	78.0	**2.0**
		Non-Pilots	72.4	**0**	73.1	**0.4**	70.4	**0.3**	71.7	**0.4**
Readiness for Change	**2011**	**Pilots**	77.3		81.8		76.6		80.5	
		Non-Pilots	72.6		77.1		71.9		75.9	
	2012	**Pilots**	77.3	**0**	81.8	**0**	76.6	**0**	80.6	**0.1**
		Non-Pilots	70.7	**-1.9**	75.2	**-1.9**	70.0	**-1.9**	73.9	**-2**
Skills and Knowledge	**2011**	**Pilots**	46.7		53.2		48.0		45.9	
		Non-Pilots	51.4		57.7		52.6		50.6	
	2012	**Pilots**	52.4	**5.7**	58.8	**5.6**	53.7	**5.7**	51.6	**5.7**
		Non-Pilots	52.1	**0.7**	58.4	**0.7**	53.3	**0.7**	51.2	**0.6**
Leadership Facilitation	**2011**	**Pilots**	75.5		79.4		76.9		83.1	
		Non-Pilots	69.9		73.8		71.3		77.5	
	2012	**Pilots**	75.0	**-0.5**	78.9	**-0.5**	76.4	**-0.5**	82.6	**-0.5**
		Non-Pilots	66.9	**-3.0**	70.9	**-2.9**	68.4	**-2.9**	74.6	**-2.9**

Note: Predicted estimates drawn from multilevel regression analyses

[1] Nurse respondents from non-pilot sites were largely nurse supervisors, whereas at pilot sites, nurse respondents were nurse care managers

Table 3.4 – Changes Over Time on Five Dimension of Primary Care Practice Climate, Dual Respondents

	Team Structure			Team functioning			Readiness for Change			Skills and Knowledge			Leadership Facilitation**		
	2011	**2012**	**Change**	**2011**	**2012**	**Change**	**2011**	**2012**	**Change**	**2011**	**2012**	**Change**	**2011**	**2012**	**Change**
Pilots	76.51	76.15	-0.36	75.51	74.90	-0.61	76.55	75.82	-0.73	48.45	54.49	6.04	74.61	74.94	0.33
Non-Pilots	75.17	75.03	-0.14	71.16	71.28	0.12	73.52	71.29	-2.23	53.28	51.98	-1.3	71.83	68.18	-3.65

**Regression analysis limited to dual-respondents only, n=188*

***P < 0.05 compared between survey years between pilot sites and non-pilot sites*

Figure 3.2 – Changes in Composite Measures Over Time by Pilot and Non-Pilot Sites of Team Functioning

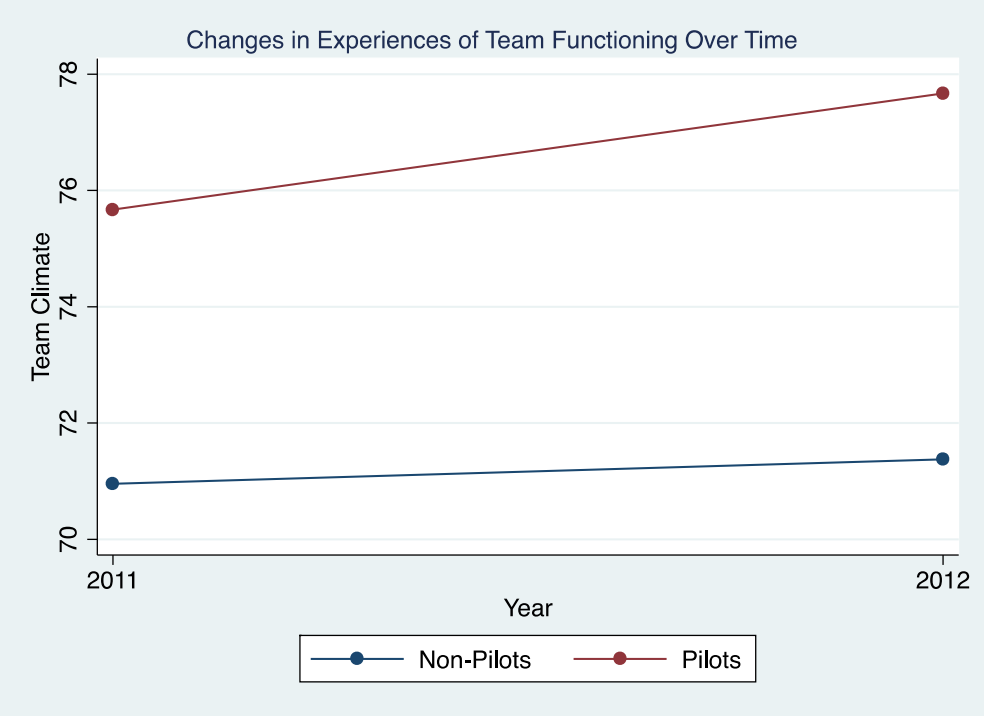


Figure 3.3 – Changes in Composite Measures Over Time by Pilot and Non-Pilot Sites of Team Structure

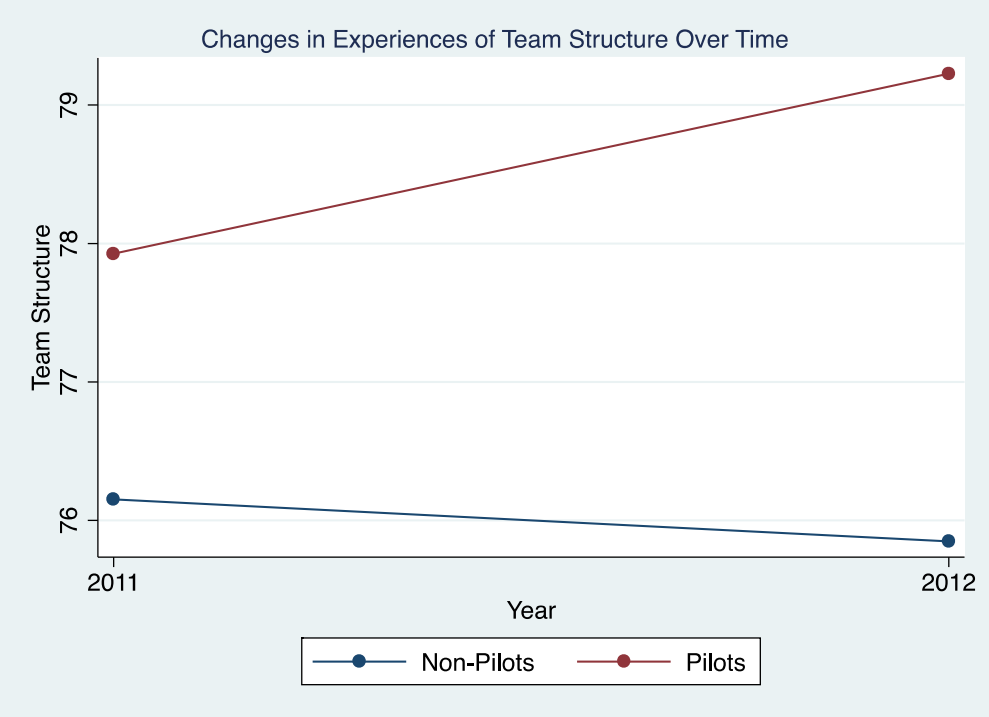


Figure 3.4 – Changes in Composite Measures Over Time by Pilot and Non-Pilot Sites of Readiness for Change

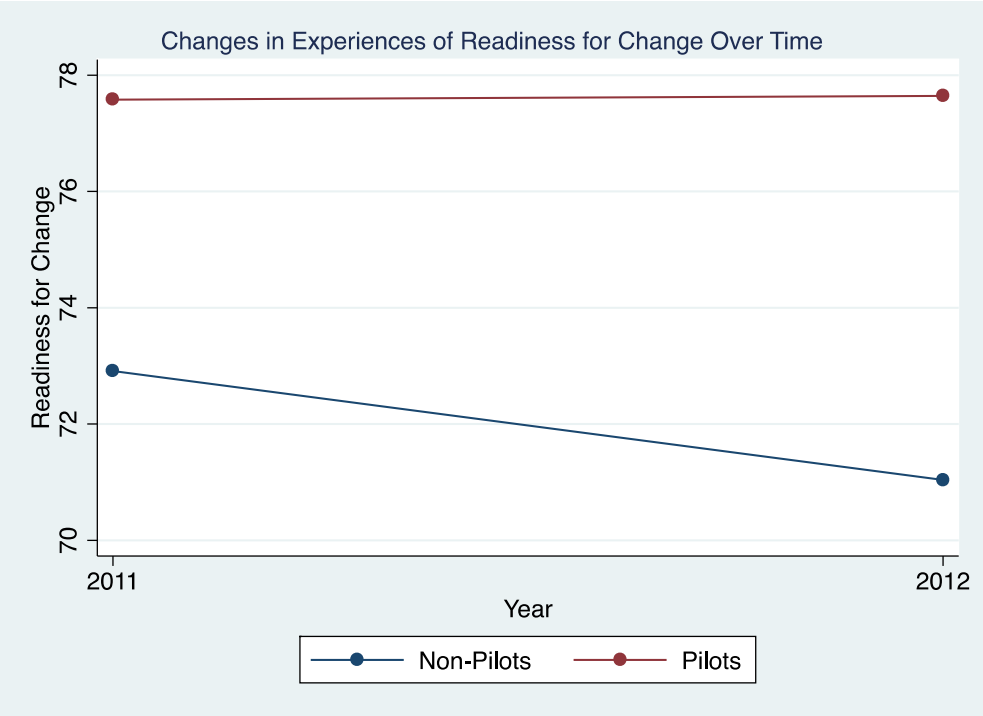


Figure 3.5 – Changes in Composite Measures Over Time by Pilot and Non-Pilot Sites of Skills and Knowledge

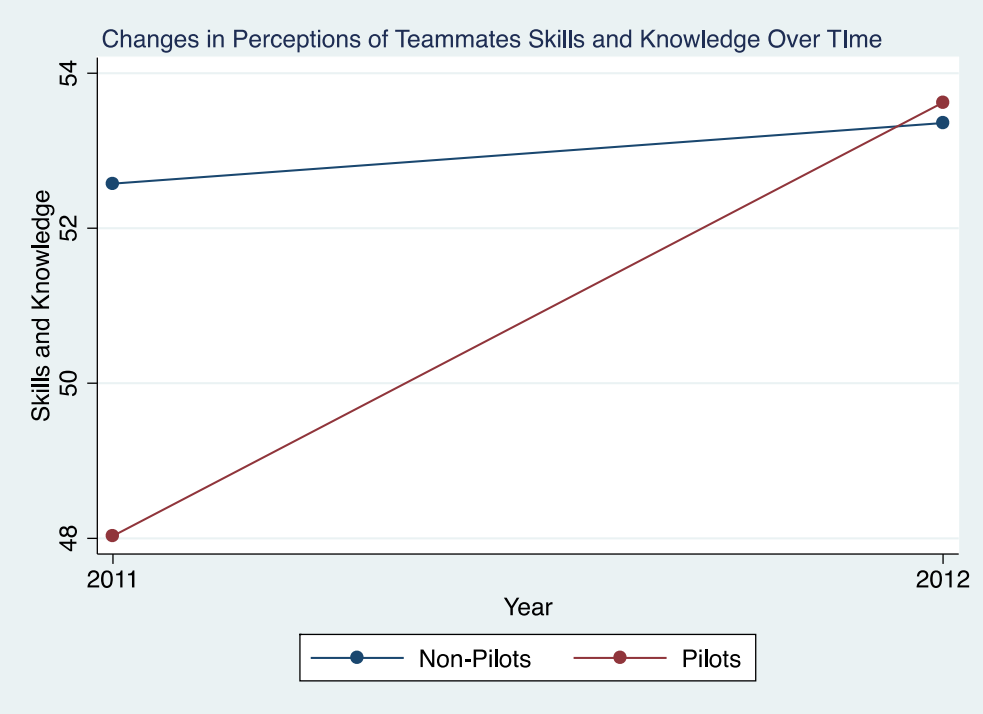
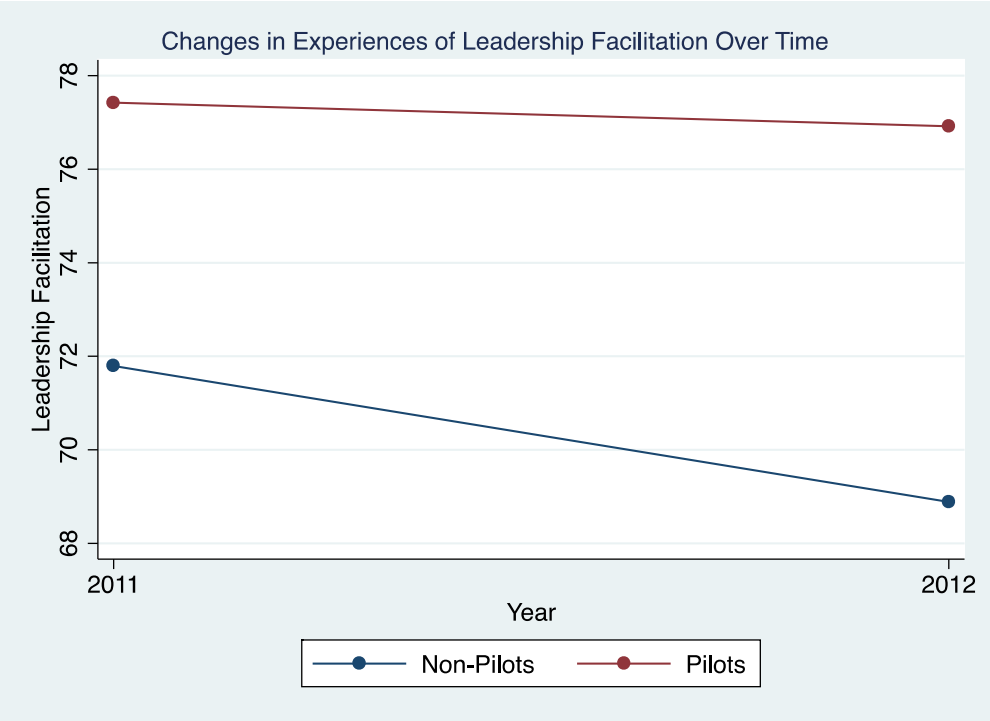


Figure 3.6 – Changes in Composite Measures Over Time by Pilot and Non-Pilot Sites of Leadership Facilitation



Results

Respondent Characteristics

A total of 331 and 401 respondents completed surveys in 2011 and 2012, respectively, resulting in overall response rates of 51% and 70%. Our overall analytic sample included 542 responses, including completed surveys from primary care physicians (n=146), registered nurses (n=68), medical assistants (n=439), and clerks/receptionists (n=68). Of the 542 completed surveys, 188 dual-respondents completed surveys in both 2011 and 2012 survey waves, including physicians (n=31), registered nurses (n=24), medical assistants (n=117), and clerks/receptionists (n=16).

Respondents from the five pilot sites reported similar team characteristics as respondents from the 28 non-pilot sites during the baseline year (2011) (Table 3.1). Compared to pilot sites, however, a higher proportion of non-pilot respondents reported shorter tenure at the practice at baseline, while pilot practice respondents were more likely than non-pilot respondents to report a high likelihood of leaving their practice within two years (83.6% vs. 67.4%).

Differences in Practice Climate Changes Over Time by Pilot Status

Changes in experiences across the five practice climate composite measures for pilots and non-pilot respondents are detailed in Table 3.2. After adjusting for respondent characteristics, pilot site respondents reported better overall practice climate experiences compared to non-pilots on four of the five composite measures, which included team structure, team functioning, readiness for change, and leadership facilitation. Pilot practice respondents reported improved team structure (78.0 in 2011 vs. 79.3 in 2012), team functioning (75.7 vs. 77.7), readiness for change (77.6 vs. 77.7), and perceptions of skills and Knowledge (48.0 vs. 53.6) over time. Non-pilot sites respondents reported worse team structure (76.2 vs. 75.8), and readiness for change (73.0 vs. 71.0), over time. Respondents from both pilot and non-pilot sites reported worse

experiences of leadership facilitation over time. Despite the improved practice climate reported by pilot site respondents, none of the differences were statistically significant ($p<0.05$) compared to changes among non-pilot respondents over time. Leadership facilitation was the only measure to result in differential changes between pilot and non-pilot sites, where non-pilot practice respondents reported worse leadership facilitation over time than pilot practice respondents (a decline in leadership by 2.9 and 0.5 points, respectively). Figure 3.1 depicts the changes in each of the core practice climate measures over time for pilot and non-pilot practices.

Occupational Differences in Practice Change over Time by Pilot Status

Longitudinal changes on the practice climate measures were similar for primary care physicians, registered nurses, medical assistants, and clerks and similar patterns were observed for pilot and non-pilot respondents. Among the occupations, nurses reported better experiences on a majority of teamwork composite measures, except for *leadership facilitation*, where clerks reported better experiences at both pilots and non-pilots (Table 3.3).

Sensitivity Analysis

The changes in experiences among dual-respondents from both pilots and non-pilots sites over time on all five team composite measures are shown in Table 3.4. In general, restricting the sample to dual respondents attenuated the small improvements observed among pilot respondents over time. A notable exception was for the "skills and knowledge" composite; pilot respondents reported a 6.0 point improvement over time relative to non-pilot respondents who reported a 1.3 decrease.

Discussion

Our study of an integrated health care organization's primary care team redesign among five pilot practices underscores that the integration of new team members and providing implementation support does not always translate into improvements in practice climate. We

found that pilot and non-pilot site participants had fairly stable experiences of *team structure*, *team functioning, skills and knowledge,* and *readiness for change* over time. Importantly, our sensitivity analysis restricting the comparisons to respondents to both survey waves found that team members' skills and knowledge improved among pilot respondents compared to non-pilot respondents. Previous research suggests that in attempting to implement a practice change as complex as creating functional primary care teams through the addition of new team roles, clinicians and staff run the risk of experiencing burnout and eroding practice climate[64,65]. Recognizing that achieving team redesign is a complex change, stable experiences of specific composite measures highlight that while the redesign did not significantly increase experiences of practice climate, it is noteworthy that the experiences of practice climate did not deteriorate.

The lack of change over time observed in our study may indicate that an organization's ability to improve primary care team member experiences may require an adjustment in concrete aspects of practice climate, including addressing perceptions of team members' skills and knowledge and leadership facilitation. For example, experiences of leadership facilitation worsened over time among respondents at both pilot and non-pilot sites. Previous research supports the notion that leadership facilitation is key to influencing improvements in care team functioning[66,67], as organizational leadership is looked to provide direction, ensure role clarity, and facilitate transition from one care team model to another. In order to continue improving team functioning, organizational leadership may need to establish clear clinical goals and consistent quality metrics to assess team performance as part of the redesign and to ensure active participation by all team members, support innovation among the teams, and engender better experiences of teamwork[66].

There are limitations to our study. First, we had 51% and 70% response rates for waves 1 and 2, respectively. Non-response may bias our findings since different respondents are represented in each survey wave. Our over time analysis, however, linked individual responses over time and controlled for certain factors such as job title, age, and race and ethnicity which have been shown to be associated with job satisfaction, team performance, and team effectiveness[68,69]. Moreover, our sensitivity analyses results, which restricted results to dual respondents, were generally consistent with the unrestricted findings. Second, pilot sites had higher baseline practice climate and the changes over time may not generalize to practices with lower practice climate at baseline. The fact that practice climate did not improve over time for potentially higher functioning practices, however, underscores the difficulty of improving team functioning and practice climate. In spite of resources for redesign, even practices with high readiness for change face may challenges improving practice climate in midst of a team redesign. Finally, our survey assessed the experiences and perceptions of clinicians and staff at the onset of the care team redesign and again one year later, which may be insufficient to detect practice climate changes. A one-year time period, however, reflects a timeframe that stakeholders would expect to observe improvements.

Conclusion

Transforming primary care teams to support patient-centered chronic illness care can be a difficult change for practice stakeholders and these changes do not necessarily translate into more functional practice environments. Although our study found that pilot sites implementing the care team redesign did not report significant improvements in teamwork over time, our results also suggest that pilot sites respondents did not experience deterioration of teamwork or practice climate over time. Importantly, implementing a primary care team redesign does not

necessarily lead to worse clinician and staff experiences of practice climate. Generating a positive change from a care team transformation may require more intensive leadership support and facilitation for all primary care team members. Merely redesigning teams is not enough to improve clinician and staff experiences of team structure, team functioning, perceptions of skills and knowledge, readiness for change, and leadership facilitation. Efforts to continually support teams from practice and organizational leadership, by establishing clinical goals and quality metrics that engender more teamwork and assessment of individual performance, may be needed to accelerate meaningful improvements in primary care practice climate. Interdisciplinary primary teams are viewed as an important resource to efficiently meeting the increased care demands, which involves improving patient-centered chronic illness care and preventive care. Team experiences did not deteriorate as practices implemented a complex care team redesign. This is noteworthy and suggests that while practice change can be challenging, clinicians and staff appear to be resilient and may embrace areas of opportunity to augment clinical and quality metric goal.

CHAPTER FOUR: The Impact of Implementation Fidelity on the Effectiveness of Integrating Team-Based Primary Care

Background

The appeal of implementing evidence-based interventions into routine practice is that they are *"tried and true"* approaches, which reduces risk to organizations. Policy leaders and stakeholders expect a return on their investments when implementing evidence-based interventions, including improved patient and organizational outcomes. The extent to which intervention implementation does yields intended results depend on contextual factors, such as the compatibility of the intervention to the organizational culture, complexity of the intervention, availability of organizational resources, leadership facilitation, staff engagement and adherence, and an organization's receptiveness for change[70-72]. Beyond these factors, when considering the complexities that accompany the transition of an evidence-based intervention from theory into practice, it is also important to assess how the intervention was implemented and how this impacts the effectiveness of interventions.

Fidelity of implementation (FOI) is defined as the degree to which an intervention is successfully implemented per its intended design[73,74]. An assessment of FOI is critical for appropriately interpreting an intervention's results[75]. FOI assessment may be especially important in healthcare delivery settings, where interventions are often adapted in order to better suit practice culture and resources[76,77]. Though intervention flexibility is necessary to disseminate evidence-based practices[78], understanding the individual components that comprise an intervention and clarifying the extent to which core intervention components are adhered to in a manner that facilitates achieving the intervention's intended goals[79]. Without FOI assessment, evidence-based interventions might be deemed as ineffective because of poor FOI rather than the effectiveness of the intervention itself[74,80].

Recently, Keith and colleagues developed a methodology to measure both fidelity of implementation and the association between FOI and intervention effectiveness [74]. Our study seeks to employ a similar approach to examining a primary care team redesign implemented at five pilot sites. The redesign intended to improve chronic care outcomes and teamwork by incorporating two new team members into routine care at each practice – registered nurse care managers (NCMs) and patient health coaches (PHCs). The role of the NCM was designed to ensure the continuity of care in both inpatient and outpatient settings by working in conjunction with the care team and PCP as a care team leader, whereas the PHC's responsibilities consisted of assisting the care team in disease management of a target population by engaging in patient advocacy, empowering patients to take care or leaderships in their healthcare, and by serving as an expert educator in selected chronic diseases. Interprofessional primary care teams hold the potential to improve patient outcomes compared to single physician care[12,18,25,38,55,56], facilitating adoption in a variety of forms and clinical settings[15,40,56,81]. The integration of team-based approaches in routine primary care is often an intricate social change influenced by organizational, team, and individual factors. Previous work has qualitatively and quantitatively assessed the clinician and staff experiences of the practice redesign and changes in practice climate over time and found that pilot practices varied in their implementation of the redesign and that, on average, primary care practice climate did not improve in the pilot sites over time. We examine three additional aspects of the primary care team redesign: 1) each pilot site's FOI to each of the care team redesign components, 2) the overall FOI for each pilot site, 3) and the relationship between FOI and redesign effectiveness, in terms of improved diabetic patient outcomes. There are few studies that characterize the FOI among clinicians and staff implementing a care team redesign, and fewer that assess the effect of FOI on the clinical

impacts of practice redesign in primary care settings[74,82]. We posit that pilot sites with the highest degree of FOI will achieve the greatest patient improvements on the diabetes care outcomes that were the focus of the redesign.

Methods

Study Design

To examine the redesign implementation processes and changes on diabetes care outcomes, we use a convergent mixed-methods approach[83,84]. First, we used analysis drawn qualitatively from key-informant interviews and clinician and staff surveys used to assess participants' experiences of new role integration, overall impressions of care team redesign, and practice culture. The results from the qualitative analysis were used to quantitatively describe the FOI rankings per individual component of the redesign, along with overall FOI of each of the five pilot sites. Secondly, we quantitatively analyzed clinical quality health outcomes across all five pilot sites, as defined by the Healthcare Effectiveness Data and Information Set (HEDIS), which represents and defines the quality of care and targeted clinical outcomes for appropriate preventive care services. Clinical quality outcomes results were used to test the association between FOI rankings and redesign effectiveness.

Intervention Setting

The care team redesign was implemented with five primary care practices of larger physician organization. Senior leadership selected these five practices out of 28 because they were perceived to represent a range of implementation readiness. Though all practice stakeholders were given the same redesign protocols to integrate new care team roles, stakeholders were also given discretion and flexibility to integrate the redesign to best-fit local needs. To contextualize the differences and similarities in practice climate relative to each pilot

site, we conducted a web-based survey of primary care clinicians and staff during November 2012 (71% response rate), which included an analytic sample of 77 PCPs and 324 staff from the 5 pilot practices and 28 other practices in the geographic region. The intent of the survey was to assess each primary care practice's climate and their care team experiences[34-37]. For these analyses, we stratified the survey data by pilot site and used *t* tests statistics to compare differences and similarities in practice culture and teamwork.

Data Collection: Qualitative

Key informant interviews of interview of clinicians and staff from pilot sites were conducted in person at each of the five pilot practices between July and August 2012, approximately one year after the redesign's implementation. To elicit a range of responses, a random quota sampling approach was used to recruit one practice member per care team role at each site. We outreached to 34 individuals, of which 22 (response rate=65%; 4-5 participants per practice) participated in an interview. The final participants included one care team member role per pilot site, including primary care physicians, NCMs, PHCs, and medical assistants. Due to multiple volunteers with similar job-titles, this study analyzed one unique individual per job title by pilot site, resulting in the review of twenty interviews. Each interview was conducted in-person, recorded digitally with the verbal consent of each participant, and later electronically transcribed. The interview guide was based on a review of PCMH implementation literature, fidelity of implementation research[74], team effectiveness research[12,21], and unstructured interviews of organization's leadership stakeholders.

Data Collection: Quantitative

In order to assess the effectiveness of the care team redesign, we used encounter-level data for patients enrolled within each of the five pilot sites retrieved from the organization's electronic health record. These data included patient information on gender, age group, identified

comorbidities (including any diagnoses codes related to heart disease, respiratory diseases, and mental illnesses), Body Mass Index (BMI), blood pressure (BP), hemoglobin A1c (HbA1c) scores, LDL-C levels, and Patient Health Questionnaire (PHQ-9) depression screening results. Of 10,883 patients with a diabetes diagnosis (defined as any patient with a ICD-9 diagnosis code of or within 250.00-.93, 357.2, 362.01-.07, 366.10-.19, and 648.00-.04) we restricted the sample to 10,206 diabetic patients of at least 18 years of age and with at least one physician encounter between January 1, 2010 and December 31, 2012. Since the care team redesign was implemented in 2011, using patient data from 2010 allowed for a baseline estimate of each site's performance on the diabetes care outcome measures prior to the implementation of the care team redesign. The diabetes care outcome measures were based on the HEDIS' definitions for comprehensive diabetes care and included HbA1c scores, blood pressure, LDL-C levels[85], and phq-9 depression screening results[86].

Data Analysis: Qualitative

In 2011, five primary care practices of a large integrated physician organization implemented a care team redesign that aimed to integrate two new team members at each practice onto existing teams of primary care physicians, including internists and family practitioners, and medical assistants. These new roles included registered NCMs and PHCs. Assessment of the redesign was based on the following six general components and experiences as reported by clinicians and staff:

I. **High integration of NCMs and PHCs as a members of each of the practice's care teams:** As part of the team design, existing staff were made aware of the new team roles and their intended contributions. All participants were asked to identify the individuals that comprised the new team to indicate the degree of uptake among all staff. When considering that within primary care, the clinical scope of practice among the individual team members

may overlap; thereby, ensuring that all redesign participants can accurately identify individual team members helped to clarify role expectations and understanding of the redesign[19,41,42].

II. **Care teams have routine structured team meetings that include the NCM and PHC:** A key feature of the care team redesign involved creating regularly scheduled, structured bimonthly or monthly meetings that incorporated the new team members and physicians to discuss complex care treatment plans of high-risk patients. Regular communication not only indicated proper uptake of the redesign, but also was seen to help existing team members recognize the added value each new team role could bring to the practice.

III. **Specific actions are taken to improve awareness of NCM roles as part of the care of complex and chronically ill patients:** The primary role NCM was designed to ensure the continuity of care in both inpatient and outpatient settings by working in conjunction with the care team and PCP as a care team leader, facilitating in the follow-up of high risk patients, and coordinating and overseeing treatment plans. Successful integration included existing care team members' understanding of the responsibilities and the appropriate use of NCM and PHC team members.

IV. **Clear communication and understanding of the distinctions of the PHC and NCM roles and their relationships to one another:** The patient health coach's role was designed to complement that of NCM, by incorporating responsibilities that included assisting the care team in disease management of a target population, engaging in patient advocacy, empowering patients to take leadership in their healthcare, serving as an expert educator in selected chronic diseases, and providing and receiving ongoing follow-up information to relay back to the care team on patient progress. Analogous to integration of

the NCM into routine practice, successful integration was identified by team members' solid understanding of the PHC's responsibilities and proper usage in coordinating patient care.

V. **Provision of care team communication trainings:** Midway through the redesign process, all pilot staff, new team members, and clinicians were provided with the opportunity to attend team communication-training workshops, which aimed to motivate teamwork and impart effective team collaboration techniques. This also served to identify and mitigate any potential communication barriers between existing team members and new team roles.

VI. **Strong leadership support and facilitation of the care team implementation:** Senior and local leadership supported teams and the transition of new team roles into routine practice by providing details training documents, including scenario training simulations and delineated duties and responsibilities for both roles. The perceptions and benefits of the trainings were assessed among participants in order to qualify its perceived value and the overall impression of leadership support.

A codebook was developed based on the key informant interview guide that guided the coding process, delineating coding practices to ensure consistency. Coding was compared for consistency between two researchers (SMG, HPR) during regular team meetings where discrepancies were resolved. Using the analysis feature of Dedoose[33], each interview was first analyzed to examine patterns of care team implementation and secondly, to examine the degree of uptake of the six-outlined redesign components; integral to the research presented in this paper is the latter. We examined the frequencies of both positive and negative assessments of the six-redesign components per each key-informant interview.

To translate qualitative findings from the key-informant interviews into FOI rankings, we analyzed each coded transcript by job title and then by pilot site, where individuals were scored based on the extent to which each of the six core redesign components was addressed (Appendix A). Using the respondent scores, an overall summary score was calculated for each pilot site by averaging the individual scores. As one of the objectives of the analysis is to clarify the relationship of FOI to redesign effectiveness, we ranked the pilot sites (from 1 to 5) based on their average FOI score to determine the level of FOI relative to other sites.

Data Analysis: Quantitative

To assess differences between diabetic patients across the pilot sites, we stratified the patient data by site status and used chi-square and *t*-test statistics to compare differences in patient characteristics for categorical and continuous measures. To assess the relationship between FOI and the effectiveness of the care team redesign, we estimated two-level mixed-effects multilevel regression models (XTMIXED, STATA 11.2) for each of the diabetes care continuous outcome measures. These models accounted for the clustering of observations within individual respondents over time within each pilot site location using random practice effects. Following Keith et. al[74], each pilot site's FOI rank was used in the model as a dummy variable, where the site with the highest FOI ranking (rank=1) served as the reference group. Each mixed effects model included terms to capture the differences over time, and the differences among the sites, and the differences in changes over time among the pilot sites. Covariates included patient gender, age, total number of office visits, and total number of clinical co-morbidities.

As the HEDIS' criteria for comprehensive diabetes care includes cut-offs to indicate whether a patient is considered "controlled" or "uncontrolled," we created a 0,1 variable defined as whether each patient's clinical measure was within the control range (coded as "0") or uncontrolled (coded as "1"). We performed a secondary sensitivity analysis using logit models

to assess the relationship between FOI and redesign effectiveness to see how the results differed from the main results, which used continuous outcome measures rather than cut-points defining control. For these logit models, we accounted for clustering of observations within individual respondents using the 'vce' (cluster) command, which allows for estimations of the regression coefficients after controlling for clustering in order to give unbiased standard errors[87]. While the main multi-level regression model analyzed whether clinical outcomes improved on a continuous scale, the goal of this sensitivity analysis was to assess whether the redesign increased the likelihood of patients to improve their clinical scores from "uncontrolled" to "control" as defined by HEDIS. Control is defined as a HbA1c scores of <9%, a systolic BP < 140 mmHg and a diastolic BP < 90 mmHg, LDL-C of <100 mg/dL, and PHQ-9 score <9.0. The same dependent variables and patient-level covariates were used in these models. The research study was approved by the UCLA South General Campus Institutional Review Board (IRB#11-002347 and IRB#13-000813).

Table 4.1 – Baseline (2010) Patient and Pilot Site Characteristics

	A	B	C	D	E	P-value
Number of Patients	3,369	3,009	1,489	1,148	1,191	
Gender (% Male)	43%	61%	54%	52%	66%	**<0.001**
Age						
18-30	1%	1%	1%	2%	6%	**<0.001**
31-45	8%	4%	8%	11%	19%	**<0.001**
46-64	26%	18%	29%	41%	39%	**<0.001**
65-75	35%	37%	33%	27%	20%	**<0.001**
76-85	21%	32%	22%	15%	12%	**<0.001**
85+	8%	9%	7%	4%	4%	**<0.001**
Baseline Health Characteristics						
Average No. of comorbidities (n)	1.6	1.8	1.3	1.1	1.0	**<0.001**
Heart Disease[1]	38%	30%	20%	21%	17%	**<0.001**
Respiratory Disease[2]	24%	20%	14%	15%	12%	**<0.001**
Mental Illness[3]	23%	27%	22%	20%	21%	**<0.001**
BMI (Normal, BMI ≥18.5 and ≤25)	17%	15%	19%	17%	16%	**<0.001**
BMI (Overweight, BMI ≥26 and ≤30)	24%	18%	25%	21%	21%	**<0.001**
BMI (Obese I & II, BMI ≥31 and ≤40)	21%	17%	23%	23%	24%	**<0.001**
BMI (Obese III, BMI ≥41))	24%	37%	17%	27%	26%	**<0.001**
Patients Uncontrolled HEDIS Measures (%)[5]						
Blood Pressure – Systolic (> 140 mmHg)	46%	42%	32%	38%	31%	**<0.001**
Blood Pressure – Diastolic (> 90 mmHg)	20%	28%	13%	24%	22%	**<0.001**
HbA1c (>9%)	53%	48%	49%	47%	49%	**<0.001**
LDL (>100 mg/dL)	57%	74%	59%	60%	65%	**<0.001**
PHQ-9 (>9.0)[6]	93%	91%	96%	97%	88%	**<0.001**
Site Characteristics						
Job Titles						
Primary care physician (n)	4	4	4	3	2	
Registered Nurse Care Manager	1	1	1	1	1	
Medical Assistant	11	12	12	6	4	
Patient Health Coach	1	1	1	1	1	
Care Team Supervisors	0	1	1	1	1	
Local Practice Climate[4]						
Team Structure	79.5	70.7	77.1	82.5	89.0	**0.0026**
Team Functioning	76.2	72.0	77.3	78.3	84.5	0.0913
Readiness for Change	80.1	73.2	75.9	76.3	86.4	**0.0277**
Teams' Skills & Knowledge	57.1	42.9	51.2	44.2	56.0	0.1054
Leadership Facilitation	79.0	75.3	75.7	77.3	86.4	0.3536

[1]Heart Disease comorbidities include aortic aneurysm, cardiac dysrhythmias (afib), angina, atherosclerosis, myocarditis, heart failure, hypertension, ischemic heart disease, and acute myocardial infarction
[2]Repiratory Disease comorbidities include chronic obstructive pulmonary disease (COPD), asthma, and emphysema
[3]Mental Illness comorbidities include anxiety, depression, episodic mood disorders, and psychoses
[4]Responses based on Clinician and staff survey that assessed local practice culture, estimates are adjusted for job titles, age, race and ethnicity, survey year, and the clustering of respondents by pilot site
[5]These results are unadjusted for age, gender, and comorbidities
[6]A phq-9 score of >9 represents moderate to severe depressions

Table 4.2 – FOI Ranking for Each Pilot Site & Redesign Component Scoring

Pilot Site	FOI Scores[1] for Individual Redesign Components[2]							
	I	**II**	**III**	**IV**	**V**	**VI**	**Average FOI**	**FOI Rank**
A	5	4	4	5	4	5	4.5	**1**
B	2	4	5	4	4	3	3.7	**2**
C	4	5	5	0	4	4	3.5	**3**
D	3	3	5	2	3	3	3.2	**4**
E	3	2	5	3	2	2	3	**5**
Variance	*1.3*	*1.3*	*0.2*	*3.7*	*1.3*	*0.3*		

[1]Scores based on the following rubric: 1 = No compliance/lack of understanding of redesign among key-informants/lack of perception of leadership (0%), 2 = Low compliance/poor understanding/negative perception (25%), 3 = Compliant/average understanding/indifferent perception (50%), 4 = High compliance/majority understanding/good perception (75%), 5 = Committed/full understanding/excellent perception (100%)

[2]I = Individuals define team membership as inclusive of new roles, II = Pilot sites participate in routine structured, team meetings, III = Individual perceptions and understanding of NCM integration into routine practice, IV = Individual perceptions and understanding of PHC integration into routine practice, V = Provision of care team communication trainings, VI = Leadership support and facilitation

Table 4.3 – Clinical Metrics by Year and Pilot Site

Clinical Metric			Year			Change
	FOI RANKING	SITE[2]	2010	2011	2012	2012-2010
BP_S	1	A	137 (.25)	136 (.24)	134 (.24)	-2.7
	3	C	132 (.36)	132 (.36)	131 (.37)	-1.3***
	4	D	133 (.43)	134 (.42)	132 (.43)	-0.4***
	2	B	131 (.27)	133 (.26)	132 (.27)	0.3***
	5	E	130 (.42)	130 (.42)	133 (.41)	2.6***
BP_D	1	A	76 (.14)	76 (.13)	74 (.14)	-1.8
	2	B	77 (.16)	77 (.15)	76 (.15)	-1.8***
	4	D	76 (.25)	76 (.24)	74 (.25)	-1.6*
	3	C	75 (.21)	75 (.21)	74 (.20)	-1.4***
	5	E	77 (.24)	77 (.24)	78 (.23)	1.0**
HbA1c	1	A	7.1 (.03)	7.0 (.03)	7.0 (.03)	-0.1
	4	D	7.1 (.05)	7.1 (.05)	7.0 (.05)	-0.1
	3	C	6.8 (.04)	6.8 (.04)	6.8 (.04)	0.0*
	2	B	6.8 (.03)	6.8 (.03)	6.8 (.03)	0.0*
	5	E	6.5 (.05)	6.5 (.05)	6.5 (.04)	0.0*
LDL	2	B	101.3 (.74)	97.5 (.73)	94.9 (.74)	-6.5**
	3	C	101.0 (.84)	97.2 (.83)	94.7 (.84)	-6.3*
	4	D	98.3 (1.01)	94.9 (1.00)	93.7 (1.01)	-4.6
	1	A	99.2 (.57)	96.6 (.56)	94.7 (.56)	-4.5
	5	E	101.3 (.99)	100.1 (.97)	98.0 (.96)	-3.3
PHQ-9	3	C	7.1 (.43)	6.4 (.23)	5.5 (.25)	-1.7*
	4	D	6.6 (.69)	6.4 (.56)	5.5 (1.07)	-1.1
	2	B	6.2 (.24)	5.4 (.19)	5.2 (.19)	-0.9
	5	E	6.0 (.32)	5.6 (.33)	5.1 (.31)	-0.9
	1	A	5.6 (.25)	5.6 (.19)	5.1 (.18)	-0.5

Note: ***Refers to p-value <0.000, **p-value <0.010, *p-value <0.050

[2] Site A served as reference group for all reporting years since it had the highest FOI Rank (1)

Table 4.4 – Likelihood Patients' Clinical Metrics to be Uncontrolled by Year and Pilot Site

Clinical Metric			Year			Change
	FOI RANKING	SITE[2]	2010	2011	2012	2012-2010
BP	2	B	36%	29%	25%	-30%*
	1	A	28%	24%	21%	-24%
	4	D	28%	26%	25%	-10%**
	3	C	21%	19%	20%	-7%
	5	E	23%	22%	27%	16%***
HbA1c	5	E	47%	35%	31%	-35%*
	1	A	53%	45%	41%	-23%
	3	C	52%	42%	42%	-20%*
	2	B	50%	43%	43%	-14%***
	4	D	50%	42%	43%	-14%
LDL	3	C	59%	51%	50%	-15%**
	5	E	61%	59%	53%	-14%**
	1	A	57%	53%	50%	-12%
	4	D	60%	56%	55%	-8%
	2	B	75%	72%	71%	-5%***
PHQ-9	1	A	93%	88%	85%	-8%
	2	B	93%	88%	86%	-7%
	5	E	83%	82%	77%	-7%***
	4	D	97%	94%	98%	1%***
	3	C	95%	82%	97%	2%***

[1] ***Refers to p-value <0.000, **p-value <0.010, *p-value <0.050

[2] Site A served as reference group for all reporting years since it had the highest FOI Rank (1)

Results

At baseline, the diabetic patient case-mix for each of the pilot sites varied considerably, indicating that each pilot site had significantly different proportions of gender ($p<0.001$), age ($p<0.001$), number of comorbidities (range 1.0 – 1.8, p-value <0.001), and health statuses among patients between each site (Table 4.1). With respect to age, at baseline pilot sites A, B, and C had a significantly greater proportion of older adults than pilot sites D and E. The sites ranged in their total number of diabetic patients (range: 3,369 -1,148). At baseline, across pilot sites a majority of diabetic patients HbA1c scores (p-value<0.001), LDL-C levels (p-value<0.001) and PHQ-9 scores (p-value <0.001) were considered "uncontrolled," whereas a smaller proportion of patients were considered to have "uncontrolled" blood pressure (p-value<0.001). Based on the clinician and staff survey results, Sites A and E had the best overall practice climates, though the sites were not statistically different from the top performing pilot site for the team functioning, perceptions of team members' skills and knowledge, and leadership facilitation measures.

Table 4.2 summarizes the FOI scores by each redesign component and the overall FOI score for each of the five pilot sites. A more detailed discussion of the analysis of the care team redesign and the qualitative key-informant interviews can be found elsewhere[88]. Appendix A presents a summary of the scoring of each key informant interview based on participants' experiences of the redesign's components.

Relationship between FOI and Care Team Redesign Effectiveness

The relation of FOI and practice-level changes on the HEDIS diabetes care outcome measures over time is presented in Table 4.3. Overall, all pilot sites improved their LDL-C and PHQ-9 scores over time. After adjusting for patient characteristics, the pilot site with the highest FOI Score (Site A) was found to have the greatest clinical improvement over time on three of the HEDIS measures, including blood pressure (134/74 mmHg) and HbA1c scores (7.0 mg/dL). By

contrast, the pilot site with the lowest FOI Score (Site E) had the smallest clinical outcome improvements over time for three of the outcome measures – blood pressure (133/78 mmHg, p-value<0.001), HbA1c scores (5.1%, p-value<0.010), and LDL-C scores (98.00 mg/dL). For this practice, a few of the site's outcome measures deteriorated over time by a statistically significant level. Moreover, all pilot sites were able to decrease blood pressure (both systolic and diastolic) among diabetics over time except for Site E (the lowest FOI).

Sites B and C (FOI Ranking 2 and 3 respectively) had modest improvements on the outcome measures that were statistically significant over time, thought these practices achievements were inconsistent with the practice's relative FOI. Site D clinical improvements (FOI Rank 4) were consistent with the site's FOI, achieving relatively modest improvements over time, as expected.

Overall, the effect of a high FOI rank and improved clinical outcomes was moderately correlated; Site A (FOI Rank 1) did achieve the largest clinical improvements over time relative to the other pilot sites with lower FOI rankings, though not always. Site E (FOI Rank 5), however, did consistently represent the smallest amount of clinical improvement, if any improvement occurred at all.

Sensitivity Analysis

Table 4.4 presents the results of the logistic regression analyses which assessed the extent to which the proportion of the diabetic patient population being controlled or uncontrolled changed over time. Overall, over time all sites improved patient control of HbA1c scores (range: -35% to -14%) and LDL-C levels (range: -15% to -5%). Site A (FOI Rank 1) achieved the greatest improvement among all the pilot sites with regards to one of the clinical metrics, where patients were less likely to be considered out of "control" over time regarding PHQ-9 scores (-

8% change over time). Site A also had consistently higher rankings on the remaining clinical measures relative to the remaining pilot sites.

Discussion

Our study found a moderate relationship between FOI rankings and practice-level improvements on diabetes care outcome measures over time, especially among pilot sites FOI ranked highest (Site A) and lowest (Site E). For example, Site E (FOI Rank 5) consistently reported the smallest amount of clinical improvement over time, if any improvement was observed, demonstrating a consistent relationship between the lowest FOI rank and predicted redesign effectiveness. Site A (FOI Rank 1) consistently improved on all clinical outcomes over time as expected, while also reporting the highest clinical improvements relative to the other pilot sites on all measures with two exceptions: LDL-C and PHQ-9 outcomes. This could be due to the site's higher proportion of older diabetic patients and the difficulty in improving these clinical outcomes among an older age group[89,90], though we did control for patients' age over time. This suggests that the underlying patient characteristics of a practice may need to be considered along with FOI rankings when predicting implementation effectiveness based on FOI rankings. For example, while Site E (FOI Rank 5) made great strides in improving their patients' HbA1c clinical outcomes, a result that may also be due to the fact at baseline Site E also had a great opportunity to improve. Furthermore, the results of PHQ-9 should be interpreted with caution, however, since the majority of eligible patients screened positive, suggesting that the redesign primarily focused on a higher proportion of depressed patients and approximately only 1/8 of the eligible population had sufficient PHQ-9 encounter-level data. However, while the data has low coverage, we did restrict the regression to patients who were screened in multiple years.

Our results suggest that evaluating the relationship between FOI and intervention effectiveness may be best suited for sites that represent extreme experiences (FOI Rank 1 vs. 5), and may not be as effective for those sites ranked in the middle. For example, over time Sites B, C, and D (FOI Rank 2, 3, and 4 respectively) had neither the greatest nor the worst improvements in clinical outcomes, which may be expected given their raw FOI scores were similar to one another. In the rare instances where these three pilot sites achieved the greatest improvement for a diabetes care outcome measure, such as Site B's improvement in LDL-C scores over time, the greater improvements may again be attributable to the underlying characteristics of the site and a high baseline values that engendered the greatest room for improvement over time. This indicates that in addition to FOI and organizational factors, underlying patient characteristics of medically complex population (including chronic diseases and multiple comorbidities) may also influence intervention effectiveness. We controlled for patient characteristics when comparing sites, however, unmeasured variables of patient complexity might account for differences in site-level changes over time.

Keith and colleagues have suggested the FOI measure to be a valid predictor of intervention effectiveness[74], whereas our results presented mixed findings of the FOI's utility. Given the flexible implementation protocols given to practice stakeholders to integrate the care team redesign to best-fit local needs, evaluating FOI in this context allowed a rare opportunity to observe the utility of the FOI metric in a fluid organizational context. Previous FOI research has underscored the need to conduct further research that evaluates organizational variables that may differ across practice sites, such as leadership facilitation, practice culture, and readiness for change[7,74,82,91]. We observed that by incorporating these variables through the results of the clinician and staff survey, Site A (FOI Rank 1) and E (FOI Rank 5) both had relatively high

quality practice climates, suggesting that patient characteristics may impact the effectiveness of a care team redesign on improving diabetic patient outcomes.

The results of our study should be viewed in light of important limitations. First, the key-informant interviews were conducted using a semi-structured interview guide, so there was not completely optimal coverage of every redesign component. Each interview transcript was coded and thoroughly analyzed, however, to improve qualitative interpretation from the similar questions posed to all informants. Second, the interview responses on which the FOI rankings were based upon may not fully represent the range of perspectives of all clinicians and staff within each practice site, though all respondents were randomly selected within role to participate to reduce any potential biases from recruiting different participants. In terms of our regression analysis of clinical data, the data did not include patient characteristics, such as race, ethnicity and socioeconomic status, which may be correlated to patient outcomes and FOI. Finally, despite the observed improvements on the diabetes care outcome measures over time, the timeframe may have been insufficient to measure the gains of moving patients from "uncontrolled" to "controlled" on the measures. In light of our results, however, a 12-month time period may reflect adequate time in which stakeholders may observe slight improvements, encouraging further support of the care team redesign from regional and corporate organizational leadership.

Conclusion

Redesigning primary care teams, while simultaneously striving to improve patient outcomes is central to team-based primary care team models. Integrating new team members is a complex social change that is inhibited by many factors, including FOI. We followed Keith et. al's approach to fidelity assessment and demonstrated that FOI assessment can be used to assess how well a primary care team redesign is implemented, which may be of particular interest to

organizational leadership seeking a quantifiable metric to compare multiple practices sites on implementation milestones and identify the facilitators and barriers in implementation experiences. While our study found only a moderate association between FOI ranking and patient outcomes, we also found that underlying patient complexity can also influence expected relationships of FOI and measures of implementation effectiveness. The fact that FOI was generally related to expected patient outcome improvements suggests FOI may be a practical metric for evaluating practice redesigns and improving FOI to achieve intended gains of complex organizational changes.

CHAPTER FIVE: CONCLUSION

Of the current 133 million Americans living with chronic illnesses, fewer than half receive the appropriate treatment[1]. Interdisciplinary care teams hold the promise of improving this figure, through the coordination of care among multiple team members who each possess a unique skillset that collectively work to improve patient health. This study explored a care team redesign from three separate aspects: qualitatively through key informant interviews that aimed to assess how well the redesign was understood and implemented at each of the local sites, quantitatively though a longitudinal clinical and staff survey that explored the influence of the care team redesign on practice climate between pilots and non-pilots sites, and lastly through a mixed-methods approach that evaluated implementation fidelity and its relationship to improved patient outcomes.

The results of this study underscore the fact that implementing care teams into routine practice is a complex task. While the care team redesign was purposefully intended to be flexible in order to give practice stakeholders significant discretion to integrate new care team roles to best fit local needs, the flexibility also created ambiguous expectations of the redesign, resulting in the inconsistent implementation of key features of the redesign in some pilot sites. In the instances where care team members had structured learning opportunities, achieving improvements in practice climate through the team redesign was challenging. However, it is important to note, that despite all the changes implemented, clinicians and staff from pilot practices did not report worse experiences of practice climate over time. This indicates primary care team redesign may not harm working relationships. Fidelity of implementation proved to be a consistent predictor of improvements in diabetes care among the highest and lowest FOI pilot sites. Despite a general association between FOI ranking and patient outcomes, underlying patient characteristics, including patient age and co-morbidities, influenced both FOI and change

in diabetes outcomes over time. This suggests that patient complexity may mitigate the care team redesign's effect on improving patient outcomes.

Future efforts of implementing care teams would benefit from ensuring teams are well defined, with a clear division of labor and responsibilities among all team members. Too much flexibility in a care team design may create ambiguity concerning the responsibilities of each team member. To mitigate this ambiguity, creating a standardized scope of practice, common quality improvement priorities, and shared performance metrics may help further improve the care team redesign. Furthermore, the results of this study encourage stakeholders may to promote the implementation of teams given the fact that, despite its difficulty, care teams may not necessarily lead to worse clinician and staff experiences of practice climate. Generating a positive change from a care team transformation, however, may require more intensive support from stakeholders – perhaps from a less flexible care team design. Finally, given the relationship found between FOI and patient outcomes suggests it to be an efficient metric to evaluate how well a practice redesign is integrated. Assessing FOI may be of particular interest to organizational leadership seeking a metric to compare practices and to target technical assistance to maximize overall patient outcomes stemming from redesign efforts.

Interdisciplinary care teams in primary care have the potential to improve the quality of care and health outcomes among chronically ill patients. Though care teams are wrought with many barriers and organizational challenges to fully implement, the potential of functional and effective care teams to improve patient outcomes and quality of care outnumbers any amount of organizational barriers. With effective trainings, clear team role definitions, and leadership support, care teams can effectively manage chronic illnesses while still fulfilling the core

principles of primary care: providing patients with continuous, comprehensive, and well-coordinated care.

APPENDICES

Appendix A – Primary Care Practice Climate Survey: Composite Measures and Item Content

Composite Measure	Item Content
Team Structure *Mean = 75; SD = 18.1* *5 Items* *α = 0.89*	**Please indicate how much you agree or disagree with the following statements about your practice…** *…Staff assist fellow staff during high workload* *...Staff understand their roles and responsibilities* *…The practice has clearly articulated goals* *...The practice operates at a high level of efficiency* *…Staff effectively anticipates each other's needs.*
Team functioning *Mean = 71.3; SD = 17.1* *5 Items* *α = 0.81*	**Please indicate how much you agree or disagree with the following statements about your practice…** *…Staff resolve their conflicts, even when the conflicts have become personal* *…Feedback between staff is delivered in a way that promoted positive interactions and future change.* *…Staff request assistance from fellow staff when they feel overwhelmed* *…The skills of staff overlap sufficiently so that work can be shared when necessary* *…The practice makes efficient use of resources (e.g., staff supplies, equipment, information)*
Readiness for Change *Mean = 71.6; SD = 16.8* *6 Items* *α = 0.84*	**Please indicate how much you agree or disagree with the following statements about your team…** *…When something comes up that team members do not know how to handle, it is easy to obtain the training or technical advice they need* *…After the practice makes changes to improve the patient care process, we check to see if the changes worked* *…Most people in this practice are willing to change how they do things in response to feedback from others* *…People in this practice have the information that they need to do their jobs well* *...Most of the people who work in our practice seem to enjoy their work* *…This practice learns from its mistakes*
Skills and Knowledge *Mean = 51.9; SD = 26.9* *3 Items* *α = 0.76*	**Please indicate how much you agree or disagree with the following statements about your team…** *...Some members of your team do not carry their fair share of the overall workload* *…Some members of your team lack the knowledge and skills that they need to do their parts of the team's work* *…There is a lot of unpleasantness among members of your team.*
Leadership	**Senior leadership and management in your practice...**

Mean = 70.1; SD = 19.1 *7 Items* *α = 0.94*	*...Reward clinical innovation and creativity to improve patient care* *...Solicit opinions of clinical staff regarding decisions about patient care* *...Seek ways to improve patient education and increase patient participation in treatment.* *...Make sure that we have the time and space necessary to discuss changes to improve care* *...Strongly support practice change efforts* *...Promote an environment that is an enjoyable place to work* *...Create an environment where things can be accomplished*

Note: Response scale ranges from 0 to 100 points, with higher scores indicating more favorable team experiences; a score of 0 represents almost strongly disagree, 25 represents disagree, 50 represents neither agree nor disagree, 75 represents "agree", and 100 strongly agree

Appendix B – Level of Redesign Commitment By Component for Each Key Informant

Site A

	Physician	Nurse Care Manager	Patient Health Coach	Medical Assistant
I	Compliant	Compliant	Compliant	Compliant
II	Low Compliance	Compliant	Compliant	Compliant
III	Poor Understanding	Full Understanding	Full Understanding	Full Understanding
IV	Full Understanding	Full Understanding	Full Understanding	Full Understanding
V	Good Perception	Excellent Perception	Excellent Perception	Excellent Perception
VI	Poor Understanding	Full Understanding	Full Understanding	Full Understanding

Site B

	Physician	Nurse Care Manager	Patient Health Coach	Medical Assistant
I	Low Compliance	Low Compliance	Compliant	Low Compliance
II	Low Compliance	Compliant	Compliant	Compliant
III	Full Understanding	Full Understanding	Full Understanding	Full Understanding
IV	Full Understanding	Lack of Understanding	Full Understanding	Full Understanding
V	Excellent Perception	Poor Perception	Excellent Perception	Poor Perception
VI	Full Understanding	Poor Understanding	Full Understanding	Full Understanding

Site C

	Physician	Nurse Care Manager	Patient Health Coach	Medical Assistant
I	Low Compliance	Compliant	Compliant	Compliant
II	Compliant	Compliant	Compliant	Compliant
III	Full Understanding	Full Understanding	Full Understanding	Full Understanding
IV	Lack of Understanding	Lack of Understanding	Lack of Understanding	Lack of Understanding
V	Excellent Perception	Excellent Perception	Poor Perception	Excellent Perception
VI	Full	Poor	Poor	Full

	Understanding	Understanding	Understanding	Understanding

Site D

	Physician	Nurse Care Manager	Patient Health Coach	Medical Assistant
I	Low Compliance	Compliant	Compliant	Low Compliance
II	Low Compliance	Compliant	Low Compliance	Compliant
III	Full Understanding	Full Understanding	Full Understanding	Full Understanding
IV	Lack of Understanding	Lack of Understanding	Excellent Understanding	Lack of Understanding
V	Poor Perception	Good Perception	Good Perception	Poor Perception
VI	Poor Understanding	Full Understanding	Poor Understanding	Full Understanding

Site E

	Physician	Nurse Care Manager	Patient Health Coach	Medical Assistant
I	Compliant	Compliant	Low Compliance	Low Compliance
II	Compliant	Low Compliance	Low Compliance	Low Compliance
III	Full Understanding	Full Understanding	Full Understanding	Full Understanding
IV	Full Understanding	Poor Understanding	Full Understanding	Poor Understanding
V	Poor Perception	Poor Perception	Good Perception	Poor Perception
VI	Poor Understanding	Full Understanding	Full Understanding	Poor Understanding

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