2012

An examination of the relationship between the external environment and care coordination

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AN EXAMINATION OF THE RELATIONSHIP BETWEEN THE EXTERNAL ENVIRONMENT AND CARE COORDINATION

by

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A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy

BIRMINGHAM, ALABAMA

2012

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ABSTRACT

This study addressed a gap in the care coordination literature by exploring the factors predictive of care coordination, with particular attention to the external environment. The first paper of this dissertation conducted a systematic review of empirical studies that looked at the predictors of care coordination. Based on the 22 papers that fulfilled the inclusion criteria, the evidence to support the relationships between care coordination and factors that are predictive of care coordination was shown to be weak to moderate depending on the types of factors you look at. This study has revealed a significant inconsistency in how predictors of care coordination were operationalized across studies. The second paper of this dissertation used the resource-dependence theory to examine the association between the external environment and care coordination activities. Data for this study were merged from Health Tracking Physician Survey (2008) conducted by Center for Studying Health System Change (CSHSC), Area Resource File (2008), American Medical Association (AMA), American Health Planning Association (AHPA) and Dartmouth Atlas (2008). The findings of our study indicated that several environmental factors, including the per capita income, fluctuations in HMO penetration and poverty levels, and the presence of malpractice crisis were significantly associated with selected care coordination activities, such as the level of communication and level of difficulty in obtaining needed medical and non-medical services. Finally, the third paper of this dissertation examined the mediating role of reimbursement and health information

technology (HIT) availability on the relationship between the external environment and care coordination. Results of the structural equation modeling (SEM) showed that HIT availability and reimbursement for communication significantly mediated the relationship between the measures of the external environment and physician' reported level of communication. The findings of this dissertation are useful for both practitioners and researchers. Future research should strive to incorporate a unified definition of care coordination, simultaneously analyze multiple levels of predictors and apply it in different healthcare settings. The practitioners (e.g., providers and payers) should consider the possibility that an organization's external environment may influence the effectiveness of its care coordination activities.

Keywords: care coordination; external environment; physician

DEDICATION

To my loving parents, Olena and Vasyl, who inspired me to pursue my dreams and always supported my decisions. To my amazing and very patient husband, Sergey, who always finds a way to put a smile on my face and find a positive in every situation. To my brother, Denis, who always provides me with tremendous support. To my friends, especially the ones who are in Ukraine, for believing in me and sustaining our friendship despite us being a thousand miles apart.

ACKNOWLEDGEMENTS

I express my sincere gratitude to Dr. Larry Hearld for serving as my dissertation chair and guiding me through the dissertation process. His enormous patience and support were invaluable. I always felt that I was a top priority could stop by his office at any time to discuss a "burning" question. He has helped me to develop critical thinking skills and to become an independent researcher. I will be forever thankful for his mentorship and colleagueship.

I am also especially grateful for the generous help and guidance from Dr. Nir Menachemi. He taught me vital skills that I am using in my everyday research and showed me the impact that one's research can make on people's lives. Thank you for giving me numerous research opportunities and allowing me to strengthen my research skills. Thank you for believing me and being patient with the "Eastern European blonde".

I would like to express my deep appreciation to Dr. S. Robert Hernandez for selecting me for the doctoral program and for supporting me throughout my doctoral education. I am very grateful for his insight and expertise in organizational theories and their applications. He always advocated for the doctoral students and provided opportunities for our emerging research through funding and advice.

I would like to thank Dr. Morrisey for bringing the perspective of the economist into my dissertation. His thorough comments and suggestions have greatly improved my research and have highlighted the diverse perspectives of the research question.

I express my sincere gratitude to Dr. Stephen O'Connor for his great attention to the details of my dissertation research. I greatly benefited from assisting him with *Journal of Healthcare Management* as I learned the key points that are most relevant in

accepting a publication. Thank you for providing me with numerous teaching opportunities and showing me the science of teaching.

I would also like to thank Martha Hilley and Stacye Fraser for the time and effort they put into assisting me throughout this doctoral program. I am also thankful to all of the doctoral students who believed in me and always assured me that I will succeed.

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LIST OF ABBREVIATIONS

AHPA American Health Planning Association

AMA American Medical Association

ARF Area Resource File

CAHPS consumer assessment of healthcare providers and systems

CFA confirmatory factor analysis

CSHSC Center for Studying Health System Change

CON certificate of need

HIT health information technology

HMO health maintenance organization

HTPS Health Tracking Physician Survey

EHR electronic health record

EMR electronic medical record

IMG international medical graduate

OLS ordinary least squares regression

PCP primary care provider

RCT research clinical trial

SEM structural equation modeling

USA United States of America

INTRODUCTION

The prevalence of chronic conditions continues to rise, and almost 157 million Americans are estimated to have one chronic condition by 2020 (Bodenheimer, Chen, & Bennett, 2009; Wu & Green, 2000). Furthermore, nearly 78% of health care expenditures are related to the treatment of chronic conditions (DeVol, Bedroussian, & Charuworn, 2007). Managing care for these patients is difficult due to the fact that they receive care from several providers in different settings (Peikes, Chen, Schore, & Brown, 2009). Recent Medicare statistics indicate that, on average, individuals with one chronic condition had 11 home care visits, 8 physician visits, had taken 22 prescription drugs, and 34% of them were hospitalized (Anderson & Knickman, 2001). This situation adds complexity to health care service delivery and creates challenges for health professionals to effectively work together to deliver high quality patient care. Consequently, increasing interest is given to concepts that hold promise in improving the quality of care by reducing the fragmentation of the existing healthcare system and improving patients' ability to navigate the system. One such concept is care coordination.

The overall goal of care coordination is to provide support to patients and their families in their efforts to receive effective health care and to integrate diverse elements of the healthcare system into a harmonious operation (Stille & Antonelli, 2004). The concept of care coordination is frequently used in the literature and commonly defined as the "deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services" (McDonald et al., 2007). It is a complex and multidimensional concept that may encompass structural aspects of care delivery (i.e. what care is provided

and when); the process of care delivery (i.e. how care is delivered); the philosophical aspects of care delivery (i.e. why care is delivered in a particular manner); and interpersonal aspects of care delivery (i.e. who delivers care to whom) (Ehrlich, Kendall, Muenchberger, & Armstrong, 2009). The National Quality Forum (2006) has taken into consideration the underlying complexity of care coordination and developed a framework that aimed to measure care coordination (National Quality Forum, 2006). This framework encompasses five domains: 1. the establishment of the source of "usual" care for the patient; 2. the development of a plan of care and follow-up; 3. the maintenance of on-going communication with all parties involved in patient's care; 4. the use of standardized and integrated electronic information systems to coordinate care; 5. the availability of effective transitions between healthcare settings. This framework indicates that care coordination involves several different activities that may be performed by various healthcare personnel.

Unfortunately, evidence suggests that existing care coordination programs vary widely in the activities they consist of (Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997; Wolff & Boult, 2005). For instance, Wolff and colleagues reviewed a sample of care coordination programs and identified the nine most common components, including patient evaluation, individual care planning, and evidence-based decision-making or coordination across multiple conditions with only a few models incorporating all of them (Wolff & Boult, 2005). At the same time, scholars argue that care coordination programs should not contain all activities, but should be setting and patient specific (Von Korff et al., 1997). However, additional empirical research is warranted to support this view.

Although no single model of care coordination is seen to be universally applicable across patient populations (McDonald et al., 2007), previous research has documented several clinical and economic benefits associated with numerous care coordination interventions (Gilbody, Whitty, Grimshaw, & Thomas, 2003; Knight et al., 2005; McAlister, Stewart, Ferrua, & McMurray, 2004; Norris et al., 2002; Peikes et al., 2009; Shojania et al., 2006; Windham, Bennett, & Gottlieb, 2003). Specifically, increasing evidence indicates the effectiveness of care coordination at improving health outcomes among individuals with chronic illnesses in both the outpatient (Knight et al., 2005; McAlister et al., 2004; Norris et al., 2002) and inpatient settings (Peikes et al., 2009). More generally, research suggests that the benefits of care coordination apply to healthy individuals as well, by increasing overall patient satisfaction with care (Donahue, Ashkin, & Pathman, 2005), improving maternity outcomes (Nason, Alexander, Pass, & Bolland, 2003) and rates of breast and cervical cancer screenings (O'Malley, Mandelblatt, Gold, Cagney, & Kerner, 1997). In addition, research has shown that care coordination can reduce spending and decrease hospital admissions and overall length-of-stay (Bielaszka-DuVernay, 2011). Furthermore, it was shown that inadequate care coordination could lead to increased adverse events (Forster, Murff, Peterson, Gandhi, & Bates, 2003), hospital readmissions (Peikes et al., 2009), and unnecessary emergency visits (Christakis, Mell, Koepsell, Zimmerman, & Connell, 2001).

Despite these benefits, there is great variation in the degree of care coordination that occurs among providers (Bodenheimer, 2008; Kripalani et al., 2007; O'Malley & Reschovsky, 2011). For instance, research has shown that seventy percent of primary care providers reported sending notifications about their patient's history and reasons for

consultations to specialists, whereas only thirty five percent of specialists said that they received such notifications (O'Malley & Reschovsky, 2011). Similarly, in a study of communication between referring pediatricians and consultants, specialists reported receiving communication regarding only half of initial referrals (Stille, McLaughlin, Primack, Mazor, & Wasserman, 2006).

Unfortunately, relatively little attention has been paid to understanding the factors that are predictive of the provider's engagement in care coordination, with the majority of previous studies looking at the clinical and financial outcomes of care coordination interventions instead (Peikes et al., 2009). Although it is important to mention previous studies that assessed the role of selected factors predictive of care coordination, such as health information technology (HIT) (Graetz et al., 2009; O'Malley, Grossman, Cohen, Kemper, & Pham, 2010) or provider's training in care coordination activities (Patterson, Muenchberger, & Kendall, 2007). For instance, Graetz and colleagues reported that primary care clinicians who use EHR for more than six months were more likely than physicians without EHR to report timely access to complete patient information, and be in agreement on treatment goals with other involved clinicians, which were the selected as specific aspects of care coordination (Graetz et al., 2009).

One factor that may be associated with variation in care coordination is the external environment. The external environment is usually conceptualized as a source of resources (Pfeffer & Salancik, 2003; Thompson, 1967) and information (Duncan, 1972). Particular attention should be paid to the external environment given that most care coordination activities require ongoing interaction with an organization's environment through information and resource exchange. Some management theory suggests that

organizations must continuously adjust to their environment in order to survive (Dess & Beard, 1984). Importantly, organizations that succeed in aligning themselves with their environment are able to pursue their strategies more effectively (Thompson, 1967; Venkatraman & Camillus, 1984). Because organizations operate in different environments, they pursue distinctive strategies and activities in order to align themselves to the peculiarities of their environment. Care coordination could be considered one of an organization's activities employed in order to better align itself with its environment. Therefore, one could argue that depending on the characteristics of the environment, healthcare organizations pursue different strategies that are reflected in variations in care coordination. For instance, organizations operating in relatively scarce resource environments might not engage in care coordination activities, as they might require allocation of resources away from core activities (e.g., delivery of patient care).

To date, a limited number of studies have examined the association between the external environment and care coordination. For instance, researchers found that certain socio-demographic characteristics of the surrounding community (Rodriguez, von Glahn, Rogers, & Safran, 2009) and practice location may influence a provider's engagement in care coordination activities (Gupta, O'Connor, & Quezada-Gomez, 2004). To our knowledge, no study has attempted to systematically examine the association between the external environment and care coordination.

Overview of the dissertation

This dissertation consists of three papers that: 1) systematically reviews the empirical literature that analyzes predictors of care coordination to identify gaps that

could be addressed by future research; 2) examines the relationship between the external environment and care coordination controlling for several organizational characteristics; 3) analyzes the mediating role of health information technology (HIT) availability and reimbursement for care coordination activities (communication with patients and other providers) in relation to the external environment and care coordination.

The first paper presents a systematic review of the empirical studies that have examined the predictors of care coordination. Additionally, this paper classifies the predictors based on the perspective taken - patient or provider. This paper draws upon a previously developed conceptual framework of care coordination (Davies, 2006) and resource-dependence theory to systematically classify how predictors of care coordination were used in previous empirical research. Despite growing interest in care coordination from different healthcare actors (Institute of Medicine, 2008), the existing literature primarily focused on developing definitions of care coordination (Ehrlich et al., 2009) or classifying the strategies that have been employed to coordinate care in the primary care setting (Davies et al., 2008) and had several limitations (e.g. types of care coordination programs included) that may have affected the conclusions drawn and left a considerable gap in our knowledge on the factors that are predictive of care coordination. Thus, the care coordination literature may benefit from a literature review that takes a more comprehensive approach by including all types of empirical studies (e.g., experimental and observational study design) and synthesizing the literature according to the setting in which care coordination was assessed. These findings will be useful for developing a research agenda on care coordination and providing a conceptual framework that could be applied to different healthcare settings. Additionally, this paper

synthesizes the literature based on two different perspectives - patient and provider- in order to explore whether these actors diverge in their perceptions of the factors that promote or hinder care coordination. These findings may be of use to health services researchers in the development of future care coordination interventions, as they may reveal the most influential factors for different stakeholders as well as differences in perceptions that may require more nuanced interventions.

The second paper utilizes resource-dependence theory to examine the relationship between the physician's external environment and care coordination. The findings of this study may be used by policy makers to more effectively allocate their resources to promote selected care coordination activities, such as physician communication with patients and other providers, and enable physicians to obtain needed medical and non-medical services. Additionally, a better understanding of a physician's external environment may be used in the development of future campaigns aimed at improving care coordination by providing additional support through financial or human resources to physicians located in environments less conducive to care coordination.

The third paper aims to enhance our understanding of the factors that may mediate the relationship between the external environment and care coordination. Recognizing that a variety of different mediating factors may intervene between the external environment and care coordination, this paper focuses on the potential mediating role of reimbursement for communication and health information technology (HIT) availability. The findings of this study have several implications for healthcare managers, policy makers and researchers. By understanding how these factors (HIT and reimbursement for communication) mediate the relationship between the external

environment and care coordination, managers may be able to customize their organization's response to the external environment in ways to foster better care coordination. Policy makers may consider the additional benefits of policies aimed at increasing physician' reimbursement for communication and implementation of HIT in medical practices that would be reflected in higher levels of communication among physicians. Finally, researchers may use the findings to develop future studies that would look at other aspects of these mediating relationships (different types of care coordination activities) or other mechanisms that may mediate the relationship between the external environment and care coordination.

THE PREDICTORS OF CARE COORDINATION: A SYSTEMATIC REVIEW OF THE LITERATURE

by

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In preparation for *Medical Care Research & Review*

Format adapted for dissertation

ABSTRACT

Care coordination is a potentially transformative approach to improve quality and efficiency in the American healthcare system, although little is known about the factors that are predictive of care coordination. A systematic review was conducted of the empirical studies that looked at the predictors of care coordination. Database searches yielded 1,293 candidate articles, of which 22 fulfilled the inclusion criteria. The evidence to support the relationships between care coordination and factors that are predictive of care coordination is weak to moderate depending on the types of factors examined. This is due, in part, to significant inconsistency in how predictors of care coordination are operationalized across studies. Most studies have focused on one level of predictors only and fail to consider multiple levels at which care coordination may occur. The policy and practice implications of the scarcity of research are discussed.

Keywords: care coordination, predictors of care coordination, systematic review

INTRODUCTION

The American healthcare system is facing an increasing number of chronically ill patients who are at higher risk of receiving poorer care due to the fragmented nature of communication and information exchange among multiple providers involved in their care (Peikes, Chen, Schore, & Brown, 2009). Care coordination, defined as the "deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care"(McDonald et al., 2007), is viewed as a promising approach that is able to address the deficiencies of the current health care system (Bielaszka-DuVernay, 2011) and improve patient outcomes (Donahue, Ashkin, & Pathman, 2005; Nason, Alexander, Pass, & Bolland, 2003). Despite a growing push for care coordination from different healthcare actors (Institute of Medicine, 2008), there is great variation in the extent to which providers engage in care coordination activities (Bodenheimer, 2008), which may adversely affect quality of care and contribute to increasing healthcare expenditures. Therefore, the identification of factors that promote or hinder care coordination are likely to be an important part of improving quality and curbing healthcare costs in the years to come. The purpose of this study was to perform a systematic review of the literature to identify these factors.

NEW CONTRIBUTION

Previous systematic reviews have focused on developing definitions of care coordination (Ehrlich, Kendall, Muenchberger, & Armstrong, 2009; McDonald et al., 2007) or identifying strategies used to coordinate care within primary care or at the

interface between primary care and other services (Davies et al., 2008; Ehrlich et al., 2009). This review builds upon these reviews in several ways to provide a better understanding of the factors that facilitate or impede care coordination. First, previous reviews employed a wide range of care structures and processes, such as multidisciplinary care, integration, or chronic disease management that are closely related but not necessarily the same as care coordination. Conflating these concepts obscures a more nuanced understanding of the factors that may facilitate or impede care coordination specifically, so this review will focus specifically on care coordination and factors that are predictive of it. Second, previous reviews took a rather narrow focus with respect to the types of care coordination programs considered. Specifically, previous reviews have focused on randomized control trials (Davies et al., 2008) that concentrate on health issues considered important enough for a major research investments (e.g., people with complex care needs) and often create an artificial environment for care that may not accurately represent "usual" healthcare delivery situations. Furthermore, these reviews looked at unique clinical conditions, such as mental health or patients with heart failure (McDonald et al., 2007), that affect the range of settings and coordination issues considered. This review will take a more comprehensive approach by including all types of studies (e.g., RCTs, observational studies) and synthesizing the literature according to the setting in which care coordination was assessed. Finally, the review will organize and synthesize the literature based on two different perspectives - patient and provider - to assess whether factors that promote or hinder care coordination are viewed similarly by different actors in the health care delivery process. Such a distinction is important because the identification of similar factors across perspectives might point toward more

attention to these factors as most influential on care coordination, while differences may reveal a need for more nuanced interventions.

CONCEPTUAL FRAMEWORK

The review is structured around three different levels of care coordination (Davies et al., 2008). The micro-level reflects individual patient' and provider' attributes (e.g., education, age or cultural background) and behaviors (e.g., patients' non-compliance to recommended treatment) that may influence the manner in which care coordination is carried out (Figure 1). For instance, previous research has shown that diabetic patients with a graduate level degree reported higher levels of engagement in coordination of their care than patients with only a high school diploma (Bodenheimer, 2008).

The meso-level refers to the organizational context (Davies et al., 2008) that surrounds organizational members. For purposes of this review, the meso-level can be further divided into two types of characteristics: structural characteristics and organizational process characteristics (Figure 1). Structural characteristics are stable characteristics of the organization that facilitate the process of health care delivery (Davies et al., 2008; Donabedian, 1980), including features like ownership type, size, or availability of health information technology (HIT). Organizational process characteristics are the activities that an organization undertakes in the pursuit of its objectives (Davies et al., 2008; Donabedian, 1980), including leadership, team involvement, and the use of HIT for the provision of care.

The macro-level represents the external environment and includes the availability of resources and information external to an organization that are necessary for performing

organizational activities (Figure 1). For this review, the macro-level is further divided into three dimensions: complexity, munificence, and dynamism (Dess & Beard, 1984). Environmental complexity reflects the number of different elements that need to be taken into consideration when making strategic decisions (e.g., level of competition) (Dess & Beard, 1984; Hsieh, Clement, & Bazzoli, 2010; Zinn, Proenca, & Rosko, 1997). Munificence is a measure of resource abundance in the environment (e.g., availability of specialists in a market) (Dess & Beard, 1984; Miller, 1987; Trinh & O'Connor, 2000; Zinn et al., 1997). Finally, dynamism captures the rate of change and thus uncertainty in the environment (e.g., level of managed care penetration) (Dess & Beard, 1984; Justin Tan & Litsschert, 1994; Miller, 1987; Zinn et al., 1997).

To be effective, care coordination needs to take place across the continuum of care, in all healthcare settings. However, the types of care coordination activities that need to take place are likely to differ across settings. For instance, discharge planning may be a key coordination activity for hospitals, but may play a smaller role in physician practices. Similarly, providers operating in different healthcare settings deal with distinct types of patients with diverse needs and are subjected to distinct professional and industry norms that may influence the type of factors that are most important for care coordination. Therefore, the review will also organize and synthesize the literature based on four different healthcare settings: hospitals, physician practices, nursing homes and others.

INSERT FIGURE 1 ABOUT HERE

METHODS

The National Library of Medicine's PubMed, CINAHL, ABI/INFORM, and Business Source Premier databases were searched for relevant publications. These databases were selected due to their extensive coverage of medical and science literature (Boaz, Ashby, & Young, 2002) and thus are reflective of extant literature on predictors of care coordination. The searches took place in January-February 2012. Searches were based on the key words "care coordination", "coordination of care", "coordinating care" and "coordinated care" (attempts to link these key words to MeSH terms were unsuccessful). The abstracts of the identified studies were examined according to the following inclusion criteria: 1) English-language publications; 2) peer-reviewed papers; 3) published between 1965 and 2012; 4) empirical studies (qualitative or quantitative), including clinical trials and case reports that examined factors that may facilitate or hinder care coordination. Because the review focused on empirical research, letters, editorials, executive summaries of governmental reports, opinion letters as well as theoretical analyses were excluded.

SEARCH STRATEGY

Relevant studies were identified through a two-step procedure. First, one reviewer evaluated the abstracts of identified articles for concordance with the formal inclusion criteria. The literature search initially identified 1,293 candidate articles (Figure 2). To increase the reliability of the search strategy, a second reviewer screened ten random abstracts in order to compare the decision to include the study in the analysis. Both reviewers were in agreement on the inclusion/exclusion of the ten random studies. Based

on the review of the abstracts, studies (n=1,253) that violated any inclusion criteria were discarded at this stage. The remaining 40 studies were selected for full-text analysis and were checked against the inclusion criteria once more. In this step, studies were excluded that did not address the study question (n=12) or did not present empirical data (n=8). Finally, the reference lists of the included studies (n=20) were screened to identify potentially relevant publications. In total, 22 publications satisfied all inclusion criteria and were included in this review.

INSERT FIGURE 2 ABOUT HERE

DATA EXTRACTION

The remaining studies that were included in the analysis were reviewed with the assistance of a coding sheet that was developed specifically for this study (Appendix 1). To ensure that the developed coding sheet contained all necessary categories, the author applied it to ten randomly selected articles from the research list. The following information was extracted from the papers: 1) research design; 2) the type of healthcare organization where coordination was studied; and 3) how care coordination was measured. The following information about predictors of care coordination was extracted from the papers: 1) types of predictors used; 2) how studies operationalized these predictors; and 3) the direction of the relationship between predictors and care coordination.

RESULTS

Reviewed studies were predominantly conducted in United States (13 of 22), were predominantly quantitative in nature (12 of 22) and cross-sectional (20 of 22) (Table 1).

Among the included studies, only two used a quasi-experimental design. Qualitative studies (n=9) used interviews (n=7) and focus group discussions (n=2) as the primary methods of data collection. All observational quantitative studies (n=12) used surveys for data collection. Reviewed studies varied in terms of their sample sizes, with qualitative studies ranging from 24 to 62 participants, whereas quantitative studies had a wider range of participants, from 96 to 124,021. Analytical techniques used varied considerably, with five studies using ordinary least squares regression (OLS), two studies employing hierarchical linear modeling, two studies using chi-square procedure only and one study adopting a structural equation modeling approach.

INSERT TABLE 1 ABOUT HERE

PROVIDER PERSPECTIVE

Approximately half of the reviewed studies (9 out of 22, or 43%) used a provider's perspective to define care coordination and identify factors that were predictive of it. Among these studies, meso-level characteristics constituted the majority of factors that were used as predictors of care coordination, being used in all nine studies (Table 2). In general, process characteristics were most prevalent (9 out of 9 studies) and were associated with better care coordination. However, there was a relatively low level of consistency in the types of variables used across the studies, with the use of HIT and EMR (3 studies out of 9) and appropriate communication between all providers (3 studies out of 9) being the only two types of variables used across multiple studies.

INSERT TABLE 2 ABOUT HERE

The review suggests that use of health information technology (HIT), electronic medical records (EMR)/electronic health records (EHR) in particular, is associated with improved care coordination (Graetz et al., 2009; O'Malley, Grossman, Cohen, Kemper, & Pham, 2010; O'Malley, Tynan, Cohen, Kemper, & Davis, 2009). For example, Graetz and colleagues reported that primary care clinicians who use EHR for more than six months were more likely than physicians without EHR to report timely access to complete patient information and be in agreement on treatment goals with other involved clinicians (Graetz et al., 2009). It is worth mentioning, however, that providers perceived that EMRs facilitated only within-office care coordination through provision of access to data during patient encounters, but had limited abilities to improve care coordination between providers and settings due to the weaknesses in existing information exchange software (O'Malley et al., 2010).

Previous studies revealed the importance of appropriate communication between all providers involved in patient care. For instance, Warrick and colleagues (1990) documented that appropriate communication between discharge planners, social workers and nurses facilitated implementation of hospital-based coordinated care. Similarly, Australian practice nurses expressed the need for on-going meetings with other team members, i.e. service coordinators, as important predictors of successful care coordination (Patterson, Muenchberger, & Kendall, 2007). It is worth noting that given some of the ambiguity surrounding definitions and operationalization of care coordination certain studies consider communication between providers as a form of care coordination (O'Malley & Reschovsky, 2011).

Structural characteristics were examined by 4 out of 9 studies and were most commonly represented by factors reflective of practice characteristics (3 out of 9) or reimbursement related factors (2 out of 9). Structural characteristics varied in terms of the direction of their relationship with care coordination. For example, Gupta et al. showed that physicians who practiced in solo or 2 physician offices were more likely than physicians from group or HMO type practices to engage in care coordination activities, such as contact with the school to coordinate care for a child or assist a family with setting up appointments with specialists (Gupta, O'Connor, & Quezada-Gomez, 2004). Similarly, Pfefferle and colleagues reported that for each additional pediatrician in the past month, care coordination was reduced by 0.005 contacts (Pfefferle, Gittell, Hodgkin, & Ritter, 2006). At the same time, providers mentioned that co-location of PCP and a specialist in one practice is very important for care coordination (O'Malley et al., 2009).

Reimbursement related factors were perceived as another set of important predictors of care coordination. Specifically, physicians and national experts noted that existing fee-for-service reimbursement is a challenge for care coordination because providers are not reimbursed for these activities (O'Malley et al., 2009).

Micro-level factors were included in four of nine studies and had mixed relationships with care coordination (Ehrlich, Kendall, & Muenchberger, 2011; O'Malley et al., 2009; Patterson et al., 2007; Warrick, Christianson, Williams, & Netting, 1990). Due to the fact that these factors were derived from qualitative studies, there was significant variation in how the variables were operationalized, ranging from unreconciled differences in opinions and role expectations among providers (2 out of 9), to lack of appropriate provider' training or expertise in care coordination (2 out of 9), to

inappropriate patient' behaviors, such as self-referral or non-compliance with provider recommendations (1 out of 9). For instance, physicians practicing in small and medium-sized medical groups stressed the lack of emphasis in medical schools and residency around coordinated care (O'Malley et al., 2009). On the other hand, practice nurses indicated the absence of actual training in the practice that would be reflective of the needs of population served (Patterson et al., 2007).

Only macro-level, munificence factors (i.e., practice location, degree of community support) had significant relationships with care coordination and were considered by three out of nine studies. These variables varied, however, in terms of their relationship with care coordination. Specifically, Gupta and colleagues showed that physicians who practiced in suburban areas engaged in more care coordination activities (Gupta et al., 2004), whereas Pfefferle and colleagues reported that physicians working in these areas engaged in fewer care coordination activities (Pfefferle et al., 2006). Additionally, in-depth interviews with providers, such as care coordinators, nursing staff, and home health agency personnel, indicated that community support for care coordination was important for improved care coordination (Warrick et al., 1990).

PATIENT PERSPECTIVE

Nine studies (9 out of 22) used the patient perspective to explore the factors that are associated with care coordination. All studies looked at meso-level characteristics, with seven studies analyzing structural factors and nine studies assessing process factors. In general, process factors were consistently associated with better care coordination. However, studies have used a wide range of predictors with relatively little consistency,

with only three studies using a consistent predictor of care coordination (Christakis, Mell, Koepsell, Zimmerman, & Connell, 2001; Liss et al., 2011; O'Malley & Cunningham, 2009). In this case, continuity of care, operationalized as seeing the same physician at every visit, was associated with better care coordination (Christakis, Wright, Zimmerman, Bassett, & Connell, 2003).

Structural characteristics were also commonly used as predictors of care coordination, with seven studies incorporating variables reflecting these characteristics. However, there was again limited consistency in the types of structural characteristics examined, with various aspects of physician reimbursement, size, and types of providers in the practice being the only factors considered in multiple studies (3 of 9 studies). These studies suggest that structural characteristics are somewhat consistent predictors of care coordination. Of note, these studies found that greater emphasis on patient experiences and clinical quality criteria in individual physician incentive formulas were associated with larger improvements in care coordination (Rodriguez, von Glahn, Rogers, & Safran, 2009). Rodriguez and colleagues reported that medical groups with a greater number of PCPs had better performance on care coordination measures, whereas Kautz and colleagues revealed no effect of a PCP being part of integrated delivery system.

Only two studies using the patient perspective considered micro-level characteristics. Beaudin and colleagues reported that patients thought that the hospital staff should be knowledgeable to answer patient' questions and have appropriate training to provide services to consumers in order to have adequate care coordination. Additionally, patients who experienced a transition from an acute care hospital back into the community noted that the health care staff having appropriate training improved care

coordination (Harrison & Verhoef, 2002). Similarly, only one study looked at the environmental munificence, operationalized as the proportion of population below the federal poverty level (Rodriguez et al., 2009), which was negatively associated with care coordination. Rodriguez and colleagues also attempted to look at environmental dynamism by assessing the relationship between managed behavioral health carve-out penetration and care, but the results were not statistically significant. Notably, Rodriguez and colleagues (2009) originally included several environmental variables in their model, such as PCP supply per 100,000 age and sex adjusted population, whether a physician was practicing in Health Professional Shortage Areas, proportion of African American, Hispanic, elderly (age 65+), and migrant residents within each primary care services areas (PCSA) for each practice. However, these covariates were substantially correlated with one another and were dropped from the final model.

Finally, four of the 22 reviewed studies considered both patient' and provider' perspectives (MacPhail, Neuwirth, & Bellows, 2009; Smeenk, de Witte, Nooyen, & Crebolder, 2000; Walsh et al., 2010; Zweifel, 2011). All of these studies looked at the structural characteristics, such as availability of a specialist nurse coordinator, multidisciplinary team meetings or reimbursement related factors. Smeenk and colleagues, for example, indicated that providers and caregivers perceived that having a specialist nurse coordinator, 24 hour consultation service and patient home care dossier, was associated with better care coordination (Smeenk et al., 2000). Interestingly, Zweifel and colleagues reported that general practitioners require a pay increase of up to 40 percent before they will be willing to participate in coordinated care programs, which are characterized by organization of providers in larger groups and reimbursing providers

using alternative to fee-for-service methods, and consumers will want a substantial reduction in premiums before they will be willing to join this type of plan (Zweifel, 2011). Focus group discussions with cancer patients and their providers identified several process characteristics, such as inadequate communication between providers and micro characteristics, i.e. recognition of health profession's roles and responsibilities as important barriers for care coordination (Walsh et al., 2010).

HEALTHCARE SETTING

Most of the reviewed studies focused on care coordination in the physician practice (11 of 22) or hospital (9 of 22). No studies were conducted in a nursing home setting. Most physician practice studies (9 of 11) examined meso-level predictors only, with only two studies including micro-level factors. Despite a high number of process characteristics examined in these studies, there was little consistency in the types of characteristics examined, with only two factors used in more than one study: use of EMR (2 studies) and continuity of care (2 studies). Similarly, structural characteristics were inconsistently examined in the reviewed studies, with provider compensation methods and practice type being the only two types of characteristics examined in multiple studies (2 of 11 studies). For instance, Rodriguez and colleagues (2009) have shown that physicians belonging to integrated medical groups had better performance on care coordination (Rodriguez et al., 2009), whereas Gupta et al (2004) reported that physicians in solo or 2 physician practices engaged in more care coordination activities than physicians in Group/HMO or Hospital/Clinic settings (Gupta et al., 2004).

Studies that took place in hospital settings allocated more attention to structural (5 of 9) rather than process characteristics (2 of 9). Relative to other studies in different healthcare settings, these studies were more interested in macro-level characteristics (4 out 9). Environmental munificence was studied rather extensively; however the results were mixed. Specifically, Gupta and colleagues (Gupta et al., 2004) showed that physicians who practiced in suburban areas engaged in more care coordination activities, whereas Pfefferle and colleagues (Pfefferle et al., 2006) reported that physicians working in these areas engaged in fewer care coordination activities. Of note, these studies surveyed participants from multiple healthcare settings (e.g., hospitals, physician practices), but did not distinguish between health care settings when analyzing and presenting study results (Gupta et al., 2004; Pfefferle et al., 2006).

DEFINITION OF CARE COORDINATION

Table 3 presents definitions and operationalizations of care coordination that were employed by the reviewed studies. Notably, many studies (9 of 22) did not include a formal definition of care coordination. Among the studies that provided a definition of care coordination, there was a significant lack of agreement and variation in ways care coordination was operationalized. For example, Christakis and colleagues defined care coordination as availability of case managers or ability to assign a primary care provider for each patient (Christakis et al., 2003). Another study by Pfefferle and colleagues defined care coordination as “all communications by pediatrician and their staff with health care, school, social service, mental health and other professionals either in or outside the practice regarding a child's treatment” (Pfefferle et al., 2006).

INSERT TABLE 3 ABOUT HERE

Similar variability is observed in how the studies operationalized their care coordination variables. Four studies used the Consumer Assessment of Healthcare Providers and Systems (CAHPS) clinician and group survey to derive care coordination items. The remaining studies used different care coordination measures that were often developed specifically for the study. For example, Haggerty and colleagues (2008) operationalized care coordination through patient' confidence that their primary care physician and the specialists communicate and collaborate in their care using a Likert-type scale (Haggerty et al., 2008). Overall, seven studies used a categorical measures of coordination, four studies used continuous measures, and one study used a dichotomous measure, with the remaining studies being qualitative in nature. Despite high variability in the operationalization of care coordination, all reviewed studies used unidimensional measures, despite definitions that described this phenomenon as multidimensional.

DISCUSSION

Care coordination is viewed as a promising approach to healthcare delivery that should improve communication and information exchange between providers and ensure a more comprehensive approach towards the patient. Evidence has shown that care coordination is associated with better patient outcomes and lower health care spending (Peikes et al., 2009). Despite such high potential, relatively little attention has been dedicated to synthesizing previous research on the factors that facilitate or impede care coordination in ways that would allow us to draw meaningful conclusions. This study

presented results of a systematic review of empirical studies that examined factors that facilitate or impede care coordination from the patient and provider perspectives.

Factors Associated with Care Coordination

Based on this review, the evidence to support the relationships between care coordination and micro, meso and macro factors that are predictive of care coordination is weak to moderate depending on the types of factors. This is due, in part, to significant inconsistency in how predictors of care coordination are operationalized across studies. Additionally, most studies have focused on meso-level predictors only, ignoring other predictors that may influence care coordination. Likewise, studies may have done a better job of recognizing the nested levels at which care coordination occurs. For instance, does the availability of specialists in the area (measure of environmental munificence), along with established communication between primary care providers and specialists within one network (measure of organizational structure), is associated with better or worse care coordination. Future studies should consider incorporating multiple levels of predictors of care coordination in their study design.

Definitions and Measures of Care Coordination

Similar to predictors of care coordination, the review revealed considerable variation in how care coordination was defined and operationalized across the studies. One potential consequence of this variability is that it might result in inconsistent relationships between predictors and care coordination across studies, something that was observed in this review. Additionally, this variation significantly limits our ability to synthesize findings and draw meaningful conclusions about the factors that promote or

hinder care coordination. Future research should consider adopting a unified definition of care coordination, such as the one suggested by National Quality Forum (2006), which was developed as a result of a systematic literature review and extensive consultations with the experts in this area (National Quality Forum, 2006).

Patient versus Provider Perspective

Nearly equal numbers of reviewed studies employed a patient or provider perspective. Studying these relationships from both the patient and provider perspectives has provided a more comprehensive understanding of the factors associated with care coordination; however different methodological approaches were used, which might lead to different conclusions regarding the factors that are associated with better or worse care coordination. Additionally, studies that used either one of the perspectives tended to look at different levels of factors predictive of care coordination that adversely affected our ability to summarize the results.

Relatively more studies, both that looked at provider's and patient's perspective, have looked at the meso, factors. Within those who looked at the organizational process factors, there have been relatively consistent and significant results. From these findings, we can conclude that previous research succeeded in identifying and consistently employing the same process predictors in their study design which allow us to have more confidence in the relationships between identified predictors and care coordination. On the other hand, studies that looked at the organizational structure characteristics had little consistency in their results. Due to the fact that most studies focused on meso-characteristics, we still have a limited understanding about micro and macro level factors

and their role in care coordination. One of the potential explanations for previous research avoiding macro level characteristics could be the multidimensionality of environment and ongoing search for the variables that would comprehensively capture different dimensions of it. The micro level predictors might have been overlooked due to the fact that it is more problematic to obtain personal information from respondents due to perceived sensitivity of this information. Future research should consider allocating more attention to the identification of appropriate micro and macro level predictors and analyzing their relationship with care coordination.

Interestingly, studies that looked at the provider and patient perspective employed different operationalizations of micro, meso and macro level factors predictive of care coordination for their analysis. Although this discrepancy could reflect the inherent differences between providers and patients, it adversely affects one's ability to effectively summarize the existing evidence and incorporate this knowledge into future research and policy initiatives. Studies that incorporate both the provider and patient perspectives may be one means of overcoming this limitation, however, few studies to date have adequately adopted such an approach. Only four studies included both providers and patients in their analysis, however failed to differentiate between perspectives in their results, thus ignoring the unique opinions and perceptions of various actors involved in care coordination. Future studies should strive to identify predictors that are facilitating or hindering care coordination from perspective of different actors involved in care coordination. This knowledge would assist scholars in gaining better understanding of what factors are important for different actors and move research closer to development of more comprehensive care coordination interventions.

Healthcare Setting

The review found that the relationship between care coordination and the factors that may facilitate or impede coordination were predominantly focused physician practice and hospital settings. Other settings or provider types such as nursing homes were not included in a single study. In the case of nursing homes, this gap is particularly troublesome because of the growing number of elderly that have multiple chronic conditions and are more likely to use nursing home services. Due to the complexity of their health care needs, this patient population has a high need for care coordination. Yet, little is known about the factors that are associated with better or worse care coordination in other settings, including nursing homes. This scarcity of research is somewhat contradictory to the entire idea of care coordination, which is intended to overcome the fragmented and episodic nature of current health care system. Therefore, future research should consider analyzing factors predictive of care coordination in many other settings, including and especially the nursing type setting.

Methodological Issues

From a methodological point of view, our review indicates that certain studies that looked at the predictors of care coordination failed to reflect the multidimensionality of this phenomenon. These studies have used basic analytical techniques, such as use of Chi-square procedures, as well as employed measurements that may not adequately represent the factors predictive of care coordination. Thus, future studies should consider developing suitable measurements that would capture the multidimensionality of care coordination as well as employing appropriate analytical techniques, such as structural

equation modeling, that are able to capture multiple dependent variables that would reflect different dimensions of care coordination. Additionally, studies to date have typically been cross-sectional in nature, thus, the relationships between factors predictive of care coordination and care coordination can be largely regarded as associational only. Future research should employ longitudinal study design to shed a light on the changes in factors predictive of care coordination or detect the variation in role of different predictors of care coordination over time.

LIMITATIONS

This study has certain limitations. First, one reviewer performed all database searches and excluded the papers that did not meet inclusion criteria. In order to minimize single reviewer bias, a second reviewer screened ten random studies from the initial list of abstracts and was in complete agreement with first reviewer on which studies should be included. Second, it is possible that the review did not capture the entire body of literature related to predictors of care coordination due to the restriction of the keywords to “care coordination”, “coordination of care”, “coordinating care” and “coordinated care” only. Care coordination, however, encompasses many activities and likely spans many different literatures. Nevertheless, the search strategy was designed to comprehensively capture this literature while maintaining an explicit focus on the factors predictive of care coordination.

CONCLUSIONS

This systematic literature review revealed that previous research allocated relatively little attention to the factors that are predictive of care coordination from both

patient and provider perspectives. Given the growing potential care coordination in addressing the cost and quality shortcomings of current healthcare system, future research should allocate more attention to the identification of factors that promote or hinder care coordination in different healthcare settings and from various perspectives.

Figure 1 Conceptual framework: predictors of care coordination

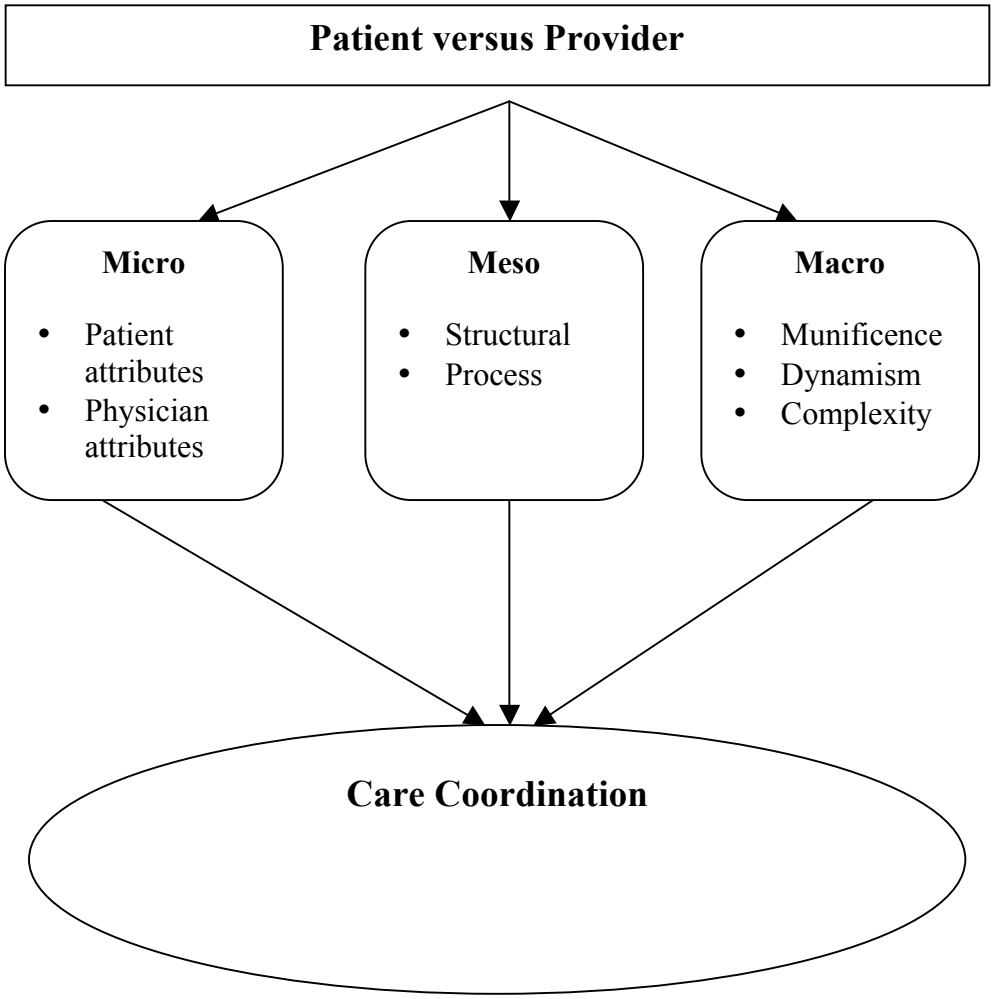
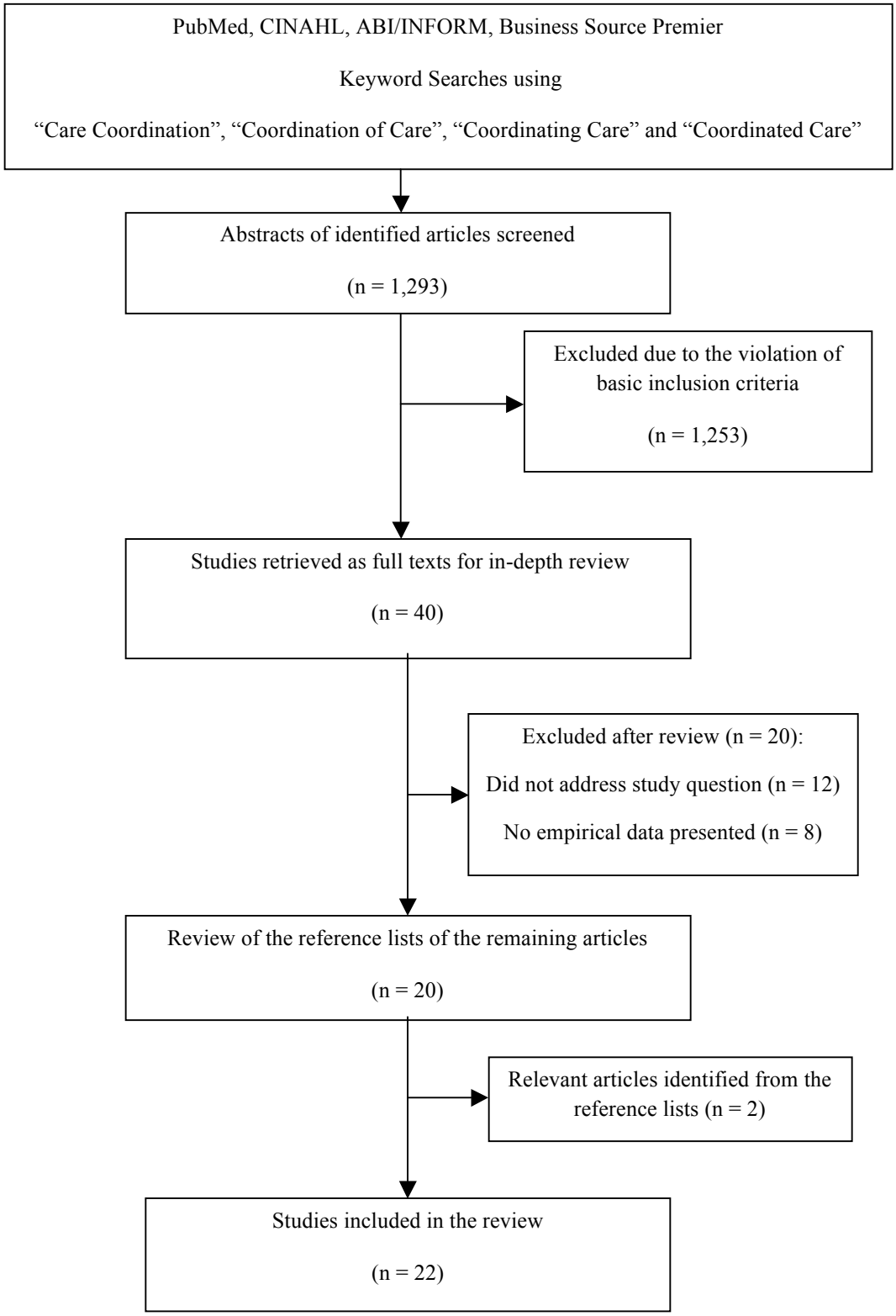


Figure 2 Flow diagram for identification and selection of studies.



Appendix 1 Coding Sheet

<table>
<tr><td colspan="4">Title</td></tr>
<tr><td>Year:</td><td colspan="3">Journal:</td></tr>
<tr><td>Volume:</td><td colspan="3">Issue:</td></tr>
<tr><td colspan="4">First author (last name):</td></tr>
<tr><td>Country
US
Non-US</td><td>Study type
Cross-sectional
Longitudinal</td><td>Analytic approach
Quantitative
Qualitative</td><td>Data collection method
Survey
Focus group
Interview
Other</td></tr>
<tr><td colspan="2">Study design
Experimental
Randomized control trial
Observational
Case study
Cohort study
Case series
Pre/post test
Retrospective review
Other
Not specified</td><td>Facility characteristics
System/chain
Stand alone
Community
Teaching
Governmental
University
Unavailable
Other</td><td colspan="2">Population Surveyed
Physician
Nurse
Healthcare manager
Patient
Other</td></tr>
<tr><td colspan="2">Specialty
Primary care
Specialty care
Other</td><td>Organization type
Hospital
Nursing home
Physician practice
Other</td><td>Sample size:
_____

or
unknown</td><td>Direction of relationship between predictor and care coordination
Improving
Not improving
Partially improving</td></tr>
<tr><td colspan="2">Type of predictor
Micro
Meso-process
Meso-structure
Macro- munificence
Macro-dynamism
Macro-complexity
Other</td><td>How many levels of predictors were used?
One
Two
Three
More than three</td><td colspan="2">Relationship between predictor and care coordination
Significant
Non-significant
Not specified</td></tr>
<tr><td colspan="2"></td><td>Care coordination (definition):
_____</td><td colspan="2">Care coordination (operationalization):
_____</td></tr>
<tr><td colspan="2">Predictor/s (operationalization):
_____
_____
_____</td><td>Care coordination (measurement):
Binary
Categorical
Continuous
Other
Unspecified</td><td colspan="2">Care coordination (domains):
Single domain
Two domains
Three domains
Four domains
Five domains
Domains are unspecified</td></tr>
</table>

Table 1 Descriptive characteristics of reviewed studies (n=22)

Study	Population Surveyed	Organization Type	Data Collection Method	Study Type	Analytic Approach
Beaudin, Lammers, and Pedroja (1999)	Patient	Hospital	Focus group	Cross-sectional	Qualitative
Christakis, Wright, Zimmerman, Bassett, and Connell (2003)	Patient	Physician practice	Survey	Cross-sectional	Quantitative
Ehrlich, Kendall, and Muenchberger (2011)	Physician Nurse	Physician practice	Interview	Cross-sectional	Qualitative
Graetz, Reed, Rundall, Bellows, Brand, and Hsu (2009)	Physician Nurse	Hospital	Survey	Cross-sectional	Quantitative
Gupta, O'Connor, and Quezada-Gomez (2004)	Physician	Physician practice Hospital	Survey	Cross-sectional	Quantitative
Haggerty, Pineault, Beaulieu, Brunelle, Gauthier, Goulet, and Rodrigue (2008)	Physician Patient	Physician practice	Survey	Cross-sectional	Quantitative
Harrison, and Verhoef (2002)	Patient	Other	Interview	Cross-sectional	Qualitative
Liss, Chubak, Anderson, Saunders, Tuzzio, and Reid (2011)	Patient	Hospital	Survey	Cross-sectional	Quantitative
Kautz, Gittell, Weinberg, Lusenhop, and Wright (2007)	Patient	Hospital	Survey	Cross-sectional	Quantitative
MacPhail, Neuwirth, and Bellows (2009)	Physician Nurse Healthcare manager Patient	Physician practice	Interview	Cross-sectional	Qualitative
O'Malley, and Cunningham(2009)	Patient	Other	Survey	Cross-sectional	Quantitative
O'Malley, Grossman, Cohen, Kemper, and Pham (2010)	Physician Nurse Healthcare manager	Physician practice	Interview	Cross-sectional	Qualitative
Patterson, Muenchberger, and Kendall (2007)	Nurse	Physician practice	Focus group	Cross-sectional	Qualitative

Table 1 (continued)

Study	Population Surveyed	Organization Type	Data Collection Method	Study Type	Analytic Approach
Pfefferle, Gittell, Hodgkin, and Ritter (2006)	Physician	Physician Practice Hospital	Survey	Cross-sectional	Quantitative
Rodriguez, von Glahn, Elliott, Rogers, and Safran (2009)	Patient Healthcare manager	Physician practice	Survey	Longitudinal	Quantitative
Rodriguez, von Glahn, Rogers, and Safran (2009)	Healthcare manager Patient	Physician practice	Survey	Cross-sectional	Quantitative
Smeenk, Witte, Nooyen, and Crebolder (2000)	Patient	Other	Survey	Cross-sectional	Quantitative
Vos, Duckers, Wagner, and van Merode (2010)	Healthcare manager	Hospital	Survey	Cross-sectional	Quantitative
Warrick, Christianson, Williams, and Netting (1990)	Healthcare manager Nurse	Hospital	Interview	Cross-sectional	Qualitative
Walsh, Harrison, Young, Butow, Solomon, and Masya (2010)	Physician Nurse	Hospital	Interview	Cross-sectional	Qualitative
Zweifel (2011)	Physician Patient	Other	Survey	Cross-sectional	Quantitative

Table 2 Predictors of care coordination

Study	Population Sampled	Operationalization of Predictor	Type of predictor
Provider perspective			
Ehrlich, Kendall, and Muenchberger (2011)	Physician Nurse	Capacity to develop trusted and tested partnership **(+)qualitative**	Micro
		Appropriate role definition for all providers, especially nurses **(+)qualitative**	Meso (process)
		Cultural change within the whole practice **(+)qualitative**	Meso (process)
		Understanding of financial models that support care coordination **(+)qualitative**	Micro
Graetz, Reed, Rundall, Bellows, Brand, and Hsu (2009)	Physician Nurse	Availability of Integrated EHR: not available (Reference)	Meso (structure)
		Availability of Integrated EHR: less than 6 months (**NS**)	Meso (structure)
		Availability of Integrated EHR: more than 6 months **(+)**	Meso (structure)
		"Systematic HIT use": using HIT for data review (view laboratory test results, current list of medications, drug allergies); order-entry (transmitting prescribed medications to the pharmacy), communication (sending messages to the clinicians or requesting referrals/consultations), documentation (entering visit notes using either free text or templates) for 80% or more of the patients **(+)**	Meso (process)
Gupta, O'Connor, Quezada-Gomez (2004)	Physician	Practice setting: Solo/2 physician (+**relative to other categories**) Group/HMO Hospital/Clinic	Meso (structure)
		Practice location: Inner city Urban Suburban (+**relative to other categories**) Rural (+**relative to other categories**)	Macro (Munificence)
		Lack of medical staff in the office **(-)qualitative**	Meso (structure)
		Limited time per patients **(-)qualitative**	Meso (process)
		Plan specialist network **(-)qualitative**	Meso (structure)
		Administrative burden for getting referrals**(-)qualitative**	Meso (process)
		Availability of care coordinator in the practice **(+)qualitative**	Meso (structure)
		Establishment of a PCP care team **(+)qualitative**	Meso (structure)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
		Deliberate restriction of practice panel size & number of visits per day **(+)qualitative**	Meso (structure)
		Phone access to physicians' patients **(+)qualitative**	Meso (structure)
		Use of EMR and e-referral **(+)qualitative**	Meso (process)
		Co-location of PCP and specialists **(+)qualitative**	Meso (structure)
		Availability of referral tracking system **(+)qualitative**	Meso (structure)
		Strategy of using the community-based support**(+)qualitative**	Meso (process)
		Development of specialized outpatient programs for high-risk patients **(+)qualitative**	Meso (process)
		Encouragement of patient, family or caregiver involvement **(+)qualitative**	Meso (process)
		Encouragement of home visits **(+)qualitative**	Meso (process)
		Standardization of particular services in the practice**(+)qualitative**	Meso (process)
		PCP-specialist service agreement **(+)qualitative**	Meso (process)
		Strategy: care transitions program **(+)qualitative**	Meso (process)
		Patients' self-referral behaviors **(-)qualitative**	Micro
		Patients' non-compliance **(-) qualitative**	Micro
		Culture of non-communication between providers **(-)qualitative**	Meso (process)
		Poor quality of consultant notes and referral notes **(-)qualitative**	Micro
		Lack of training about care coordination in medical schools/residency **(-) qualitative**	Micro
		Use of electronic medical record (EMR) for documenting and compiling patient information from within and outside PC office **(M)**	Meso (process)
		Use of electronic medical record (EMR) for using information to coordinate care within the PCP office **(M)**	Meso (process)
		Use of electronic medical record (EMR) for referrals and consultations (initiating, communicating and tracking) **(M)**	Meso (process)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
		Use of electronic medical record (EMR) for sharing care with clinicians across practices and settings **(M)**	Meso (process)
		Use of electronic medical record (EMR) for providing care or exchanging information for transitions and emergency care **(M)**	Meso (process)
Patterson Muenchberger, and Kendall (2007)	Nurse	Additional training on care coordination for practice nurses **(+) qualitative**	Micro
		Lack of recognition and clarity of nurse role in care coordination **(-) qualitative**	Meso (process)
		Regular meetings with service coordinator **(+) qualitative**	Meso (process)
		Established care planning for all patients **(+) qualitative**	Meso (process)
Pfefferle, Gittell, Hodgkin, and Ritter (2006)	Physician	Mental health practitioner is part of the practice **(+)**	Meso (structure)
		Person in practice assigned to coordinate care **(+)**	Meso (structure)
		Practice size **(-)**	Meso (structure)
		Availability of personnel to screen children for mental illness **(+)**	Meso (structure)
		Regular mechanisms of case conferencing **(+)**	Meso (process)
		Practice setting: Rural (Reference) Urban **(-)** Suburban **(-)**	Macro (Munificence)
		Psychiatrists per 100,000 **(NS)**	Macro (Munificence)
		Managed behavioral health carve-out penetration **(NS)**	Macro (Dynamism)
		Percentage patient screened **(+)**	Meso (process)
		State recommendation of a mental health screening tool **(NS)**	Macro (Complexity)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
Vos, Duckers, Wagner, and Merode (2010)	Healthcare manager	Activities to establish care programs **(+)**	Meso (process)
		Hospital employees having a process oriented view (**NS**)	Meso (process)
		Availability of protocols for specific patient groups (**NS**)	Meso (process)
		Decentralized decision-making **(NS)**	Meso (process)
		Agreements about process ownership **(NS)**	Meso (process)
		Availability of protocols for routing of patients **(-)**	Meso (process)
Warrick, Christianson, Williams, and Netting (1990)	Healthcare manager Nurse	Inadequate reimbursement **(-) qualitative**	Meso (structure)
		Inadequate number of personnel for care coordination **(-)qualitative**	Meso (structure)
		Institutional support for hospital-based coordinated care **(+)qualitative**	Micro
		Professional expertise and quality of staff**(+)qualitative**	Micro
		Prior experience of care coordinators with case management **(+)qualitative**	Micro
		Community-oriented educational programs**(+)qualitative**	Macro (Munificence)
		Cooperation between discharge planners, social workers, nurses**(+)qualitative**	Meso (process)
		Community support**(+)qualitative**	Macro (Munificence)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
		Patient perspective	
Beaudin Lammer and Pedroja (1999)	Patient	Inadequate communication between nursing shifts **(-)qualitative**	Meso (process)
		Inadequate communication between doctors **(-)qualitative**	Meso (process)
		Unclear discharge instructions**(-)qualitative**	Meso (process)
		Inadequate communication between doctors and nurses**(-)qualitative**	Meso (process)
		Poor medication management**(-)qualitative**	Meso (process)
		Appropriate number of people involved in patient's care **(+)qualitative**	Meso (structure)
		Ability of hospital staff to answer patient's questions**(+)qualitative**	Micro
		Long waiting time for tests**(-)qualitative**	Meso (process)
		Poor meal arrangements & meal assignment**(-)qualitative**	Meso (process)
		Appropriate arrangements for patient's admission**(+)qualitative**	Meso (process)
		Ability to verify patient's insurance/receive authorization**(+)qualitative**	Meso (process)
		Inadequate communication between nurses and the patient**(-)qualitative**	Meso (process)
Christakis Wright Zimmerman Bassett and Connell (2003)	Patient	Index of continuity of care **(+)**	Meso (process)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
Haggerty Pineault Beaulieu Brunelle Gauthier Goulet and Rodrigue (2008)	Physician Patient Healthcare manager	Availability of 24/7 telephone access **(+)**	Meso (process)
		Number of formal agreements with other health care establishments **(+)**	Meso (process)
		Presence of occupational and physical therapists **(+)**	Meso (structure)
		No. of medical procedures performed on site by the physician (effect of each additional procedure above the mean of 3.8) **(+)**	Meso (structure)
		Percentage of time spent in clinic is < 50 (Reference**)** Percentage of time spent in clinic is 50-70% **(+)**	Meso (structure)
Harrison and Verhoef (2002)	Patient	Regular phone calls by home care personnel to the consumer **(+)qualitative**	Meso (process)
		Availability of phone number for patient complaints **(+)qualitative**	Meso (structure)
		Health care staff having the time to provide services for patients**(+)qualitative**	Meso (process)
		Health care staff having appropriate training to provide services **(+)qualitative**	Micro
		Provision of written instructions to the patient**(+)qualitative**	Meso (process)
		Availability of consumer's chart in his/her house **(+)qualitative**	Meso (structure)
Kautz Gittell Weinberg Lusenhop and Wright (2007)	Patient	Primary care physician in integrated delivery system (IDS) network **(NS)**	Meso (structure)
		Rehabilitation provider in IDS network **(+)**	Meso (structure)
		Home health provider in IDS network **(-)**	Meso (structure)
		One third of providers in IDS network **(-)**	Meso (structure)
		One half of providers in IDS network **(NS)**	Meso (structure)
		Two thirds of providers are in IDS network **(NS)**	Meso (structure)
		All providers are in IDS network **(NS)**	Meso (structure)
Liss Chubak Anderson Saunde Tuzzio and Reid (2011)	Patient	Continuity of care **(+)**	Meso (process)
		High specialty care use **(NS)**	Meso (process)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
O'Malley and Cunningham (2009)	Patient	Visit continuity **(+)**	Meso (process)
		Referral source for the most recent specialist visit: PCP (+) Other way (Reference)	Meso (process)
Rodriguez, von Glahn, Elliott, Rogers, and Safran (2009)	Patient Healthcare manager	Financial incentives magnitude: > 10% of base compensation (Reference) <10% of base compensation **(-)** PCP not eligible for incentives **(NS)**	Meso (structure)
		Financial incentives payment formulae: Patients' experience (%) **(+)** Productivity and efficiency (%) **(NS)** Clinical quality (%) **(+)**	Meso (structure)
		Patient experience improvement activities (NS)	Meso (process)
Rodriguez, von Glahn, Rogers, and Safran (2009)	Healthcare manager Patient	Medical group type: Independent practice association(Reference) Integrated medical group **(+)** Hybrid model **(NS)**	Meso (structure)
		Primary care physicians per medical group **(+)**	Meso (structure)
		Financial incentive formula-productivity/efficiency (%) **(NS)**	Meso (structure)
		Patient experience improvement strategies **(NS)**	Meso (process)
		Area-level deprivation (% of population at or below 200% of FPL) **(-)**	Macro (Munificence)

Table 2 (continued)

Study	Population Sampled	Operationalization of Predictor	Type of predictor
Both perspectives (patient and provider)			
MacPhail, Neuwirth, and Bellows (2009)	Physician Nurse Healthcare manager Patient	Use of EHR & secure electronic messaging **(+)qualitative**	Meso (structure)
		Unreconciled differences in opinions among providers **(-)qualitative**	Micro
		Presence of discipline-specific on patient needs **(-)qualitative**	Micro
		Conflicting role expectations among providers **(-)qualitative**	Micro
		Inadequate communication between providers **(-)qualitative**	Meso (process)
		Lack of delegation of care activities to a particular provider **(-)qualitative**	Meso (process)
Smeenk Witte Nooyen and Crebolder (2000)	Patient Healthcare manager	Appointment of a Specialist Nurse Coordinator **(+)**	Meso (process)
		24 hours consultation telephone service **(+)**	Meso (structure)
		Availability of "home care dossier" for each patient **(+)**	Meso (structure)
Walsh, Harrison, Young, Butow, Solomon, and Masya (2010)	Patient Physician Nurse	Recognition of health professional roles and responsibilities **(+)qualitative**	Micro
		Implementation of comprehensive multidisciplinary meetings **(+)qualitative**	Meso (process)
		Appropriate transition of care **(+)qualitative**	Meso (process)
		Adequate communication between specialist and primary care **(+)qualitative**	Meso (process)
		Adequate access to health services for population **(+)qualitative**	Macro (Munificence)
		Providers need to manage scarce resources **(-)qualitative**	Meso (structure)
Zweifel (2011)	Physician Patient	Increase in reimbursement for providers **(+)**	Meso (structure)
		Reduction in premiums for patients **(+)**	Meso (structure)

Legend:

+: Statistically significant association with improved care coordination

- : Statistically significant association with reduced care coordination

M: Mixed results (across multiple dependent variables)

NS: No statistically significant association with care coordination.

Table 3. Definitions of care coordination

Study	Definition of care coordination	Operationalization of care coordination	Scale
Beaudin, Lammers,and Pedroja (1999)	Not provided	1. What does coordinated hospital care mean to you? 2. What one person do you believe is responsible for the coordination of hospital care?	Qualitative study
Christakis, Wright, Zimmerman, Bassett, and Connell (2003)	Availability of case managers or assignment of primary care provider	1) My child's personal provider does not always know about care my child has received at other places 2) My child's personal provider communicates with the other health care providers my child sees 3) My child's personal provider knows the results for my child's visits to other doctors 4) My child's personal provider always follows up on a problem my child has, either at the next visit or by phone 5) I want one provider to coordinate all of the health care my child receives	5-point Likert scale: 1=strongly disagree 5=strongly agree
Ehrlich, Kendall, and Muenchberger (2011)	Not provided	Not provided	Qualitative study
Graetz, Reed, Rundall, Bellows, Brand, and Hsu (2009)	Not provided	How often does each of the following occur when care is transferred across clinicians? 1)All relevant information is available and timely accessible 2) All clinicians agree on the treatment goals and plans 3) All clinicians agree on roles and responsibilities of each party	Dichotomous variables "Always" "Never"
Gupta, O'Connor, Quezada-Gomez (2004)	Process that links children with special health care needs (CSHCN) and their families to services and resources	Frequency with which following care coordination services are provided: 1) Schedule extra time for an office visit; 2) Contact the school when coordinating care 3) Integrate medical care plan with other care plans 4) Assist the family with setting up appointments with specialists 5) Schedule time to discuss the results of a visit to a specialist 6) Discuss potential needs that families might have for financial and other nonmedical services	Count

Table 3 (continued)

Study	Definition of care coordination	Operationalization of care coordination	Scale
Haggerty, Pineault, Beaulieu, Brunelle, Gauthier, Goulet, and Rodrigue (2008)	The delivery of services by different practitioners in a timely and complimentary manner so the care is connected and cohesive for the patient	Patient should express confidence that their primary care physician and the specialists communicate and collaborate in their care	4-point Likert scale: 1=definitely not 4=definitely yes
Harrison, and Verhoef (2002)	Not provided	Open-ended question: 1) What does coordination mean to you? 2) What does coordination in health care mean to you? 3) Did you think there was coordination between health care services you received in hospital and the care you are now receiving in your home? 4) What do you think is important about the coordination of services for people who leave hospital but require care in their home?	Qualitative study
Liss, Chubak, Anderson, Saunders, Tuzzio, and Reid (2011)	Not provided	1) In the last 12 months, are there other doctors or nurses in your personal doctor's office who you have seen for any of your visits? 2) How often do you feel that these other doctors or nurses had all the information they needed to provide your care? 3) How often did your personal doctor seem informed and up-to-date about the care you received from specialist doctors? 4) When this doctor sent you for a blood test, X-ray, or other test, how often did someone from the doctor's office follow-up to give you the test results?	Six-point response scale (rescaled):"Never"(0) to "Always" (100)
Kautz, Gittell, Weinberg, Lusenhop, and Wright(2007)	Regulation of diverse elements into an integrated and harmonious operation	Patient-perceived coordination of care in three areas: global care, rehabilitation, and home care settings (overall: 22 questions)	Scale: 0 = no problems reported 100= problem in every response

Table 3 (continued)

Study	Definition of care coordination	Operationalization of care coordination	Scale
MacPhail, Neuwirth, and Bellows (2009)	Deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services	Informational continuity achieved by EHR adoption	Qualitative study
O'Malley, Tynan, Cohen, Kemper, and Davis (2009)	Integration of care across all of a patient's conditions and health care needs, both within the primary care practice, as well as between the patient's PCP and other providers and settings	Open-ended questions: 1) How does your practice coordinate care for patients, both within and across practice and settings? 2) What are the barriers to and facilitators of coordination, both within and across practice and settings? 3) What are the lessons learned that might be applied in other settings that are not currently coordinating care well? 4) How has the institution of these care processes affected the practice's financial bottom line?	Qualitative study
O' Malley, and Cunningham (2009)	Degree to which information from various sources is recognized and incorporated into a patient's current care	1) In the last 12 months, how often did your usual physician seem informed and up-to-date about the care you received from specialists? 2) After going to the most recent specialist visit, did your usual doctor talk with you about what happened at the visit with specialist? 3) How well do the different doctors that see you for your [chronic condition] coordinate your care? By care coordination we mean how well do your doctors work together to manage your health care?	Response options: "Never" to "Always"
O'Malley, Grossman, Cohen, Kemper, and Pham (2010)	Integration of care in consultation with patients, their families and caregivers across all of a patient's conditions, needs, clinicians and settings	1) Do practices use electronic medical record (EMR) to support coordination of care? 2) To what degree are practices making use of specific EMR features to accomplish specific coordination tasks and how? 3) What "work-arounds" are practices using when clinicians do not believe that EMRs meet coordination needs? 4) What are perceived advantages and limitations of EMRs for coordination?	Qualitative study

Table 3 (continued)

Study	Definition of care coordination	Operationalization of care coordination	Scale
Patterson, Muenchberger, and Kendall (2007)	The overall goals of coordinated care is to facilitate integrated care for people with chronic conditions, by enhancing collaborative partnerships among general practitioners (GP) and non-medical primary and community services providers	Description of experiences coordinating care	Qualitative study
Pfefferle, Gittell, Hodgkin, and Ritter (2006)	All communications by pediatrician and their staff with health care, school, social service, mental health and other professionals either in or outside the practice regarding a child's treatment	Past month coordination behaviors: 1) Times consulted about a child with a mental illness; 2) Times participated in case conferences or team meetings about a child with mental illness; 3) Times communicated with mental specialists; 4) Times communicated with schools; 5) Community agencies regarding children with mental health	Sum of the numbers of past month coordination contacts across 5 questions
Rodriguez, von Glahn, Elliott, Rogers, and Safran (2009)	Not provided	In the last 12 months: 1) How often did this doctor seem informed and up-to-date about the care you got from specialist doctors? 2) When this doctor sent you for a blood test, X-ray, or other test, how often did someone from the doctor's office follow-up to give you the test results?	Six-point response scale (rescaled): "Never"(0) to "Always" (100)
Rodriguez, von Glahn, Rogers, and Safran (2009)	Not provided	1) How often did this doctor seem informed and up-to-date about the care you got from specialist doctors? 2) When this doctor sent you for a blood test, X-ray, or other test, how often did someone from the doctor's office follow-up to give you the test results?	Six-point response scale: "Never"(0) to "Always" (100)

Table 3 (continued)

Study	Definition of care coordination	Operationalization of care coordination	Scale
Smeenk, Witte, Nooyen, and Crebolder (2000)	Strategy which caregivers apply to enhance continuity of care	The degree of agreement on care tasks among professional caregivers: Which care tasks caregivers think belong to which caregiver for a particular patient? 1. The supervision/guidance of patients during their stay in hospital. 2. The supervision/guidance of patients' family during their stay in hospital. 3. The provision of medical information about the diseases and options for treatment. 4. The provision of health education and explanation about lifestyle. 5. Giving support in dealing with and accepting the disease. 6. Giving support to families with respect to possible problems due to the patient's illness. 7. Preparing the patient's discharge from hospital and his/her coming home. 8. The coordination of care after the patient's discharge. 9. Safeguarding the whole care process, and if necessary, taking the initiative to solve possible gaps in care provision. 10. To guide and inform patients on important settlements and institutions that are important for him/her	Scale: 1 to 10
Vos, Duckers, Wagner, and van Merode (2010)	Implementation of coordinating structures (care pathways or care programs)	Availability of coordinating structures(care programs): sequence of activities(diagnostics, consultation, treatment) and the professionals' responsibilities in the diagnosis and treatment of homogenous patient groups	Count (N)
Warrick, Christianson, Williams, and Netting (1990)	Presence of care coordinators (or case managers) based in hospitals who assess the needs of clients, develop care plans, coordinate service delivery, and monitor provider performance	Not provided	Not applicable (Qualitative study)

Table 3 (continued)

Study	Definition of care coordination	Operationalization of care coordination	Scale
Walsh, Harrison, Young, Butow, Solomon, and Masya (2010)	Numerous aspects of health service provision including appropriate care that is timely and provided by a multidisciplinary team comprising of medical, nursing and allied health professionals. Other key elements include psychosocial assessment, suitable and timely referral, information provision and individualized treatment that considers each patient's needs and preferences	Not provided	Not applicable (Qualitative study)
Zweifel (2011)	Program that organize providers into larger groups, pay providers through episode-based payment or capitation	Participants had to compare the status quo (conventional model of medical practice) with 11 hypothetical alternatives defined by varying combinations of the attributes (shared decision making; critical-incident reporting; treatment guidelines; quality circles; other attributes)	How much income the participants are willing to forgo if some of the attributes will be implemented in their practice

References

Bielaszka-DuVernay, C. (2011). Improving The Coordination Of Care For Medicaid Beneficiaries In Pennsylvania. *Health Affairs, 30*(3), 426-440.

Boaz, A., Ashby, D., & Young, K. (2002). Systematic reviews: what have they got to offer evidence based policy and practice. *ESRC UK Center for evidence based policy and practice: working paper, 2*.

Bodenheimer, T. (2008). Coordinating care-a perilous journey through the health care system. *New England Journal of Medicine, 358*(10), 1064-1071.

Christakis, D. A., Mell, L., Koepsell, T. D., Zimmerman, F. J., & Connell, F. A. (2001). Association of lower continuity of care with greater risk of emergency department use and hospitalization in children. *Pediatrics, 107*(3), 524-540.

Christakis, D. A., Wright, J. A., Zimmerman, F. J., Bassett, A. L., & Connell, F. A. (2003). Continuity of care is associated with well-coordinated care. *Ambulatory Pediatrics, 3*(2), 82-86.

Davies, G. P., Williams, A. M., Larsen, K., Perkins, D., Roland, M., & Harris, M. F. (2008). Coordinating primary health care: an analysis of the outcomes of a systematic review. *Medical Journal of Australia, 188*(8), 65-72.

Dess, G. G., & Beard, D. W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, 52-73.

Donabedian, A. (1980). Basic approaches to assessment: structure, process and outcome. *Donabedian A. Explorations in Quality Assessment and Monitoring, 1*, 75-125.

Donahue, K., Ashkin, E., & Pathman, D. (2005). Length of patient-physician relationship and patients' satisfaction and preventive service use in the rural south: a cross-sectional telephone study. *BMC Family Practice, 6*(1), 40-55.

Ehrlich, C., Kendall, E., & Muenchberger, H. (2011). Practice-based chronic condition care coordination: challenges and opportunities. *Australian Journal of Primary Health, 17*(1), 72-78.

Ehrlich, C., Kendall, E., Muenchberger, H., & Armstrong, K. (2009). Coordinated care: what does that really mean? *Health & Social Care in the Community, 17*(6), 619-627.

Forum, N. Q. (2006). National Quality Forum-endorsed definition and framework for measuring care coordination Retrieved 10/25, 2011, from http://www.qualityforum.org/projects/care_coordination.aspx

Graetz, I., Reed, M., Rundall, T., Bellows, J., Brand, R., & Hsu, J. (2009). Care coordination and electronic health records: connecting clinicians. *AMIA Annual Symposium Proceedings, 2009*, 208-212.

Gupta, V. B., O'Connor, K. G., & Quezada-Gomez, C. (2004). Care coordination services in pediatric practices. *Pediatrics, 113*(Supplement), 1517-1530.

Haggerty, J. L., Pineault, R., Beaulieu, M. D., Brunelle, Y., Gauthier, J., Goulet, F., & Rodrigue, J. (2008). Practice features associated with patient-reported accessibility, continuity, and coordination of primary health care. *The Annals of Family Medicine, 6*(2), 116-123.

Harrison, A., & Verhoef, M. (2002). Understanding Coordination of Care from the Consumer's Perspective in a Regional Health System. *Health Services Research, 37*(4), 1031-1042.

Hsieh, H. M., Clement, D. G., & Bazzoli, G. J. (2010). Impacts of market and organizational characteristics on hospital efficiency and uncompensated care. *Health Care Management Review, 35*(1), 77-90.

Justin Tan, J., & Litsschert, R. J. (1994). Environment-strategy relationship and its performance implications: An empirical study of the chinese electronics industry. *Strategic Management Journal, 15*(1), 1-20.

Liss, D. T., Chubak, J., Anderson, M. L., Saunders, K. W., Tuzzio, L., & Reid, R. J. (2011). Patient-reported care coordination: associations with primary care continuity and specialty care use. *The Annals of Family Medicine, 9*(4), 323-329.

MacPhail, L. H., Neuwirth, E. B., & Bellows, J. (2009). Coordination of diabetes care in four delivery models using an electronic health record. *Med Care, 47*(9), 993-999.

McDonald, K. M., Sundaram, V., Bravata, D. M., Lewis, R., Lin, N., Kraft, S., Owens, D. K. (2007). Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 7: Care Coordination). *Rockville, MD: Agency for Healthcare Research and Quality*.

Medicine, I. o. (2008). Retooling for an aging America: Building the health care workforce.

Miller, D. (1987). The structural and environmental correlates of business strategy. *Strategic Management Journal, 8*(1), 55-76.

Nason, C. S., Alexander, G. R., Pass, M. A., & Bolland, J. M. (2003). An evaluation of a Medicaid managed maternity program: the impact of comprehensive care coordination on utilization and pregnancy outcomes. *Journal of Health Human Services Administration, 26*(2), 239-267.

O'Malley, A. S., Grossman, J. M., Cohen, G. R., Kemper, N. M., & Pham, H. H. (2010). Are electronic medical records helpful for care coordination? Experiences of physician practices. *Journal of General Internal Medicine, 25*(3), 177-185.

O'Malley, A. S., Tynan, A., Cohen, G. R., Kemper, N., & Davis, M. M. (2009). Coordination of care by primary care practices: strategies, lessons and implications. *Research Briefs 4* (12), 1-16.

O'Malley, A. S., & Cunningham, P. J. (2009). Patient experiences with coordination of care: the benefit of continuity and primary care physician as referral source. *Journal of General Internal Medicine, 24*(2), 170-177.

O'Malley, A. S., & Reschovsky, J. D. (2011). Referral and consultation communication between primary care and specialist physicians: finding common ground. *Archives of Internal Medicine, 171*(1), 56-72.

Patterson, E., Muenchberger, H., & Kendall, E. (2007). The role of practice nurses in coordinated care of people with chronic and complex conditions. *Australian Health Review, 31*(2), 231-238.

Peikes, D., Chen, A., Schore, J., & Brown, R. (2009). Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries: 15 randomized trials. *JAMA, 301*(6), 603-618.

Pfefferle, S. G., Gittell, J. H., Hodgkin, D., & Ritter, G. (2006). Pediatrician coordination of care for children with mental illnesses. *Medical Care, 44*(12), 1085-1091.

Rodriguez, H., von Glahn, T., Rogers, W., & Safran, D. (2009). Organizational and Market Influences on Physician Performance on Patient Experience Measures. *Health Services Research, 44*(3), 880-890.

Smeenk, F. W. J. M., de Witte, L. P., Nooyen, I. W. C. J., & Crebolder, H. F. J. M. (2000). Effects of transmural care on coordination and continuity of care. *Patient education and counseling, 41*(1), 73-81.

Trinh, H. Q., & O'Connor, S. J. (2000). The strategic behavior of US Rural hospitals: a longitudinal and path model examination. *Health Care Management Review, 25*(4), 48-63.

Walsh, J., Harrison, J. D., Young, J. M., Butow, P. N., Solomon, M. J., & Masya, L. (2010). What are the current barriers to effective cancer care coordination? A qualitative study. *BMC Health Services Research, 10*(1), 132.

Warrick, L., Christianson, J., Williams, F., & Netting, F. (1990). The design and implementation of hospital-based coordinated care programs. *Hospital Health Services Administration, 35*(4), 505-518.

Zinn, J. S., Proenca, J., & Rosko, M. D. (1997). Organizational and environmental factors in hospital alliance membership and contract management: a resource-dependence perspective. *Hospital Health Services Administration, 42*(1), 67-80.

Zweifel, P. (2011). Swiss experiment shows physicians, consumers want significant compensation to embrace coordinated care. *Health Affairs (Millwood), 30*(3), 510-518.

ENVIRONMENTAL MARKET FACTORS ASSOCIATED WITH CARE COORDINATION

by

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In preparation for *Health Services Research*

Format adapted for dissertation

ABSTRACT

Objective: To examine the relationship between physician' external environment and care coordination using resource-dependence theory.

Data sources: Data from Health Tracking Physician Survey (2008), Area Resource File (2008), American Medical Association (2011), American Health Planning Association (2009) and Dartmouth Atlas (2008).

Study design: Cross-sectional study. Care coordination was operationalized through physician' level of communication and level of difficulty in obtaining needed medical and non-medical services. The explanatory variables were measures of environmental complexity, dynamism and munificence controlling for organizational and physician characteristics. Ordinary least squared regression model predicted the physician' level of communication and Poisson regression model predicted level of difficulty in obtaining needed medical and non-medical services.

Principal findings*:* Several environmental factors, including the per capita income, fluctuations in HMO penetration and poverty levels, and the presence of a malpractice crisis, were significantly associated with outcome variables. The relationship between the external environment and care coordination is nuanced and depends on the dimension of the environment being considered as well as how care coordination is measured.

Conclusions*:* Physician's external environment is associated with care coordination activities in a rather nuanced manner, requiring careful considerations by policy makers and providers.

Keywords: external environment, care coordination, physician

INTRODUCTION

Care coordination encompasses purposeful management of patient care between providers and the patient in order to facilitate the provision of needed services (McDonald et al., 2007), and includes activities such as communication among actors involved in patient care, scheduling referrals and other services, or discharge planning. Despite documented benefits of care coordination, such as improvement in patient outcomes (Donahue, Ashkin, & Pathman, 2005; Nason, Alexander, Pass, & Bolland, 2003) and quality of care (Peikes, Chen, Schore, & Brown, 2009), previous research has revealed significant variation in care coordination among physicians (Bodenheimer, 2008), which may adversely affect the quality of care provided and contribute to increasing healthcare expenditures.

Previous research suggests that communication among physicians is a particularly problematic aspect of care coordination. For instance, almost 70 percent of primary care physicians (PCP) reported sending notification of a patient's history and reason for consultation to specialists and only 35 percent of specialists said that they received such notification (O'Malley & Reschovsky, 2011). Similarly, physicians mentioned that their ability to obtain needed services, referrals in particular is a frequent challenge for coordinating patient care (O'Malley, Tynan, Cohen, Kemper, & Davis, 2009).

The external environment may account for some of these variations in care coordination, because it reflects the availability of resources and information that are needed to successfully engage in organizational activities, such as care coordination (Dess & Beard, 1984). Thus variations in the external environment may facilitate or impede care coordination activities. For example, physicians practicing in environments

with a relative scarcity of specialists in the area may experience more difficulties in communicating with other providers or obtaining needed referrals to specialists.

The purpose of this study was to examine the relationship between the external environment and physician' level of communication and level of difficulty in obtaining needed medical and non-medical services, while controlling for organizational and physician characteristics that may also be associated with these activities. Understanding the influence of the external environment on physicians' communication and inability to obtain needed services may help federal, state, and local policymakers more effectively allocate their resources to promote care coordination activities among physicians. Likewise, future incentives and/or educational campaigns could be developed to provide additional support through financial or human resources to physicians located in areas (i.e. environments) associated with lower levels of care coordination.

CONCEPTUAL FRAMEWORK

Scholars argue that organizations are not self-sufficient entities (Duncan, 1972; Kreiser & Marino, 2002) and they engage in on-going exchanges with their environment in order to survive (Aldrich & Pfeffer, 1976; Dess & Beard, 1984). The environment is usually conceptualized as a source of resources (Pfeffer & Salancik, 2003; Thompson, 1967) and information (Duncan, 1972). One of the dominant perspectives regarding how the environment influences organizational strategies and subsequent activities is resource-dependence theory. According to this theory, organizations are "capable of changing, as well as responding to, the external environment. Therefore, administrators are actively managing their external environments as well as their organizations, and the former activity may be as important, or even more important, than the latter" (Aldrich &

Pfeffer, 1976: p.134). Because organizations operate in different environments, they need to adapt to the peculiarities of their environment through the adoption of various strategies and activities. More importantly, resource-dependence theory suggests that organizations that align themselves with their unique environment are better positioned to achieve their goals (Thompson, 1967; Venkatraman & Camillus, 1984). Care coordination could be considered one of the activities chosen by an organization to adapt to its environment and fulfill the organization's goals. Thus, variations in the environment are likely to be reflected in variations in care coordination activities, such as the level of communication and level of difficulty in obtaining needed medical and non-medical services.

Previous research has identified three major dimensions of the environment: munificence, dynamism and complexity (Dess & Beard, 1984). Environmental munificence is a measure of resource abundance in the environment (Dess & Beard, 1984; Trinh & O'Connor, 2000; Zinn, Proenca, & Rosko, 1997). Environmental dynamism captures the rate of change and thus the uncertainty in the environment (Dess & Beard, 1984; Tan & Litsschert, 1994; Miller, 1987; Zinn et al., 1997). Finally, environmental complexity can be defined as the number of different elements that need to be taken into consideration when making strategic decisions (Dess & Beard, 1984; Hsieh, Clement, & Bazzoli, 2010; Zinn et al., 1997). The following discussion describes the relationship between selected environmental factors and care coordination.

Munificence

Munificence refers to the abundance and availability of critical resources in the environment (Dess & Beard, 1984; Keats & Hitt, 1988). Empirical evidence has shown

that organizations that operate in more munificent environments are more productive and have greater opportunity to pursue various activities (Balotsky, 2005; Trinh & O Connor, 2002; Yasai-Ardekani, 1989). On the other hand, organizations that operate in less munificent environments have to concentrate on securing necessary resources for their core activities (Kreiser & Marino, 2002).

Care coordination consists of several resource intensive activities, such as communication with other actors involved in a patient's care or scheduling referrals and other medical services, because it requires additional staffing (e.g., assigning a person to coordinate care), implementation of specific technology (e.g., electronic health record (EHR)), and additional physician time. More munificent environments provide resources to acquire all these things. For instance, it was shown that hospitals located in more munificent environments are more likely to implement EHR than hospitals located in less munificent areas (Kazley & Ozcan, 2007). In this case, physicians who are practicing in more munificent environments may have the necessary resources available to them to engage in care coordination activities. Thus, we hypothesize:

Hypothesis 1: Physicians practicing in more munificent environments will be more likely to report higher levels of care coordination activities.

Dynamism

Dynamism indicates the rate of change in the environment and it is reflective of the level of uncertainty perceived by decision-makers (Duncan, 1972; Lawrence & Lorsch, 1967). Thus, decision-makers have to decide on their actions and strategies despite ambiguity created by uncertainty in their environment. In highly dynamic environments, characterized by high levels of uncertainty, decision-makers tend to make

conservative choices regarding their organizations (Tan & Litsschert, 1994). For instance, in a study of companies in the medical X-ray manufacturing industry, the uncertainty that was created by changes in federal regulations was associated with the pursuit of less risky and resource-consuming activities (Birnbaum, 1984). Similarly, research in the healthcare setting has shown that hospitals located in more dynamic environments, measured by the change in unemployment rates (Menachemi, Shin, Ford, & Yu, 2011) or rate of the managed care penetration (Kazley & Ozcan, 2007), were less likely to adopt complex strategies that would require allocation of significant resources from their core activities.

Care coordination is an ongoing and time-consuming process because it requires deliberate organization of a patient's care among multiple providers involved in the care process through ongoing communication and information exchange. In environments that are more dynamic, physicians may find it difficult to communicate with other providers and patients or obtain needed medical services, including referrals, due to the high levels of perceived uncertainty and ambiguity about other providers in the market or characteristics of the patients and their ability to pay for provided services. These physicians will be more likely to engage in essential non-care coordination activities that already exist in the scope of their working responsibilities. In the current study, we hypothesize that physicians situated in environments characterized by greater uncertainty will be less likely to engage in care coordination. Thus, we hypothesize the following:

Hypothesis 2: Physicians practicing in environments that are more dynamic will be less likely to report higher levels of care coordination activities.

Complexity

Environmental complexity represents the range and quantity of elements that should be taken into consideration by an organization (Layman & Bamberg, 2005). Decision makers operating in relatively complex environments have to account for a greater number of environmental factors, which may result in more time spent analyzing all relevant information needed to make a decision. Because complex environments have several issues that need to be taken care of, decision makers may not have sufficient time and energy left to devote to a new activity or strategy. Therefore, organizations operating in more complex environments will pursue defensive-oriented, short-term activities rather than proactive, future-oriented and more risky initiatives (Tan & Litsschert, 1994). Previous research supported this theoretical premise by indicating that medical practices located in more complex environments, characterized by the presence of a malpractice crisis in the state where the medical practice is located, were less likely to pursue a strategic initiative, such as adoption of electronic medical record (EMR) (Menachemi, Mazurenko, Kazley, Diana, & Ford, 2012).

Care coordination requires ongoing interaction between all actors involved in a patient's care, which might be a difficult task for physicians operating in environments that are more complex and have a greater number of actors (e.g. different providers and insurance companies). This is the case because physicians would have to analyze more information or they are more likely to be missing certain information to successfully communicate and exchange information or obtain needed medical services. Thus, we hypothesize:

Hypothesis 3: Physicians practicing in environments that are more complex will be less likely to report higher levels of care coordination activities.

METHODS

This study uses a cross-sectional design to analyze relationships between environmental characteristics and the level of communication and level of difficulty in obtaining needed medical and non-medical services. The data is obtained from Health Tracking Physician Survey (2008) conducted by Center for Studying Health System Change (CSHSC), Area Resource File (2008), American Medical Association (AMA), American Health Planning Association (AHPA) and Dartmouth Atlas (2008). The CSHSC used the American Medical Association (AMA) Masterfile to identify the target population and used the following eligibility criteria for inclusion in the study, such as "provision of at least 20 hours per week in direct patient care"; completed medical training (residents, interns were excluded) and practice within 50 states and the District of Columbia. Therefore, the survey included only those physicians who were non-federal employees, specialists with a primary focus on direct patient care, IMGs licensed to practice in the U.S., physicians who had completed all of their training. The response rate among eligible participants was 61.9%, yielding a sample of 4,720 physicians.

The Institutional Review Board of our university approved this research.

Variables

Dependent variables. The first dependent variable was the physician's level of communication. This variable was constructed from four survey items: 1.amount of time allocated for e-mail communications with patients and their families; 2. amount of time allocated for telephone conversations with patients and their families; 3. amount of time

allocated for e-mail communication with physicians and other clinicians; 4. amount of time allocated for telephone conversations with physicians and other clinicians (see Table 1). The response categories for the questions were: none; less than a half hour; ½ to 1 hour; 1-2 hours; more than 2 hours; not ascertained, which were scored as 0, 1, 2, 3, 4, respectively. "Not ascertained" responses were coded as missing. Scores for these four items were averaged to create a composite communication score where higher values indicated a higher level of communication. This measure had acceptable reliability (Chronbach's alpha = 0.83) and convergent validity (4 items had loadings greater than 0.5 on 1 factor).

The second dependent variable was a physician's level of difficulty in obtaining needed medical and non-medical services (see Table 1). This variable was constructed from four survey items: 1. a physician's inability to obtain needed referrals to high quality specialists; 2. a physician's inability to obtain needed referrals to non-emergency hospital admissions; 3. a physician's inability to obtain needed referrals to high quality outpatient mental health services; and 4. a physician's inability to obtain needed interpreter services for non-English speaking patients when they received care in their practice. The response options were: no (0); yes (1); not ascertained. "Not ascertained" responses (2.1% of respondents) were coded as missing and omitted from subsequent analyses. Responses were summed across the four items (range 0-4) to create a composite variable where a higher value reflects a greater level of difficulty in obtaining needed medical and non-medical services. This measure had acceptable reliability (Chronbach's alpha= 0.68) and convergent validity with all 4 items having high loadings (>0.5) on 1 factor.

Independent Variables. Environmental munificence is represented by the following variables: community income level, geographical location of the physician's practice (metro area or not metro area), the percentage of Medicare enrollees and supply of physicians (Hsieh et al., 2010; Kazley & Ozcan, 2007). Specifically, community income level is measured as per capita income. The supply of physicians is captured through the number of physician specialists per 1,000 capita (Menachemi et al., 2011). The percentage of Medicare enrollees is measured as the total number of Medicare enrollees in the county divided by the county's total population.

Environmental dynamism is operationalized by the following variables: the levels of managed care penetration and degree of instability in health services demands (Kazley & Ozcan, 2007; Weech-Maldonado, Qaseem, & Mkanta, 2009; Zinn et al., 1997). In this study, managed care penetration is measured as the percentage of a given county's population that is covered by a health maintenance organization and it was obtained from Dartmouth Atlas (2008). The degree of instability in health services demands is measured by the changes in unemployment rate, changes in poverty levels and changes in the population size from 2002 to 2007, representing the five years prior to the study.

Environmental complexity is represented by two variables: presence of a malpractice crisis in the state of a physicians' practice (Mazurenko et al., 2012; Menachemi et al., 2011) and intensity of certificate of need in the state. States are classified by the AMA as having a malpractice crisis if a significant proportion of physicians are limiting the scope of services they provide, for example, by no longer performing trauma surgery or delivering newborns (AMA, 2011). The intensity of certificate of need is obtained from American Health Planning Association (2009) and

reflects number of services and equipment that require obtaining certificate of need in each state.

To control for organizational characteristics that may influence physician's engagement in care coordination, the following control variables were included in the analysis: practice size; practice type; use of five mechanisms of physician's compensation and heterogeneity of payer types. Practice size was operationalized as the number of physicians working in the practice. Practice type was measured through the following categories: solo/2physicians; group with 3 physicians or more; HMO; Medical School; Hospital-based or other. Compensation mechanisms are reflected in five questions about factors important for determining a physician's compensation: 1. a physician's productivity; 2. results of satisfaction surveys from patients; 3. quality-of-care measures, such as rates of preventive care services for your patients; 4. results of practice profiling, i.e. comparing your pattern of using medical resources with that of other physicians; 5. overall financial performance of the practice. The response categories were: factor does not affect compensation ("no"); factor affects compensation ("yes"), not ascertained. The not ascertained response category was used by approximately 3.4 percent of respondents and was excluded from the final analysis. Five individual dummy variables were created to represent each of the above mentioned compensation mechanisms. The survey included questions on sources of practice revenue from the following sources: Medicare, Medicaid and other. The physicians were asked to report what percentage of practice revenue from patient care comes from these payers. The proxy for heterogeneity of payer types was constructed by using sum of squared shares of payers. Thus, if a practice receives revenue from one source, such as Medicare, the value

of heterogeneity of payer types is 1. On other hand, if a practice receives equal revenue from different sources, the value of heterogeneity of payer types is approaching zero.

Additionally, several physician level characteristics were entered as control variables in the analysis: a physician's demographic characteristics (gender, race and years in practice), professional characteristics (specialty, board certification, and country of medical degree) and number of hours in direct patient care. Gender is operationalized as a binary variable, where male is coded as one and female is coded as zero. Race is specified as a binary variable representing non-Hispanic white coded as one or others coded as zero. Years practicing medicine was coded as a continuous variable. Specialty is coded as categorical variable with the following categories: internal medicine, family/general practice; pediatrics, medical specialties, surgical specialties, psychiatry, obstetrics and gynecology. Board certification was specified as a binary variable, where board certified physicians were coded as one and the rest were coded as zero. Country of medical degree is operationalized as a binary variable, indicating that a physician received his/her training in the United States or Canada versus other countries. Number of hours in direct patient care is specified as a continuous variable.

DATA ANALYSIS

The unit of analysis adopted in this study was the physician. The physician was selected as the unit of analysis because physicians play a central role in the process of care coordination. Their unique professional knowledge and skills are necessary for provision of adequate care to patients. Therefore, it is important to analyze care coordination from the physicians' perspective.

Descriptive statistics were calculated to examine variable distributions and identify potential data anomalies, such as outliers or abnormal variable distributions. Given the stratified random sampling method used by the HTPS, data analysis accounted for the complex survey design and used appropriate weighting variables. The composite communication score had normal distribution, thus an ordinary least squared regression (OLS) was used to estimate the effects of external environment on physician' level of communication. The composite measure of physician' level of difficulty in obtaining needed medical and non-medical services was a count variable, thus a Poisson regression was employed to test the relationship between external environment and care coordination. Data analysis was conducted in STATA version 11.2. Results were flagged for significance at the $p<0.1$, $p<0.05$, and $p<0.01$ levels.

RESULTS

Characteristics of the 4,229 physicians are displayed in Table 2. The majority of respondents were males (70%), specialty physicians (55%), board certified (91%), received their medical training in United States or Canada (78.6%) and were practicing in urban areas (93.7%). On average, responding physicians had been in practice 16.4 years (range1-68 years). Almost half of the physicians (45%) practiced in a group practice with 3 or more physicians. About one-quarter of the responding physicians indicated that they spend less than a half hour on e-mail communication with patients and their families (30%) and other providers (40%). Similarly, about one-quarter of responding physicians reported spending less than a half hour on telephone communication with patients and their families (29.6 %). Almost half of respondents indicated spending less than a half

hour on telephone communication with other providers (43.5%). The average level of communication was 1.33 on a scale from 0 to 4. Forty percent of physicians reported being unable to get needed referrals to high quality specialists (40%). Approximately one third of respondents indicated problems obtaining non-emergency hospital admissions (28%) or interpreter services for non-English speaking patients (30.3%). Finally, more than half of the responding physicians reported they were not able to get high quality outpatient mental health services for their patients (58.2%). On average, physicians reported 1.6 problems obtaining needed medical and non-medical services.

Communication with Other Clinicians and Patients

In the ordinary least squared regression, several variables that represent environmental dimensions were significantly associated with physician level of communication (see Table 3). Hypothesis 1, which stated that physicians practicing in more munificent environments will be more likely to report higher levels of care coordination activities, received weak support with only 1 out of 4 variables having a statistically significant relationship with the dependent variable. Specifically, a one unit increase in per capita income was associated with a 0.07 higher level of communication, holding everything else constant ($p < 0.001$).

Hypothesis 2 suggested that an increase in dynamism will be associated with lower levels of care coordination activities. This hypothesis received mixed support, with one of the four dynamism measures negatively associated with the level of communication while another one was positively associated with the level of communication (see Table 3). Specifically, a one unit higher level of poverty was associated with a 0.02 lower level of communication by physicians, holding everything

else constant ($p < 0.001$). However, a one unit higher level of HMO penetration was associated with 0.24 higher level of communication, holding everything else constant ($p < 0.001$).

Finally, Hypothesis 3 which suggested that an increase in environmental complexity would be associated with lower levels of care coordination activities was not supported, with one measure of environmental complexity significantly associated with outcome variable, but in the opposite direction than predicted. Specifically, physicians who practiced in the states with a malpractice crisis reported .07 higher level of communication than physicians who practice in states without a malpractice crisis.

Our analysis also found several control variables significantly associated with the level of communication. For instance, physicians who practiced in an HMO ($\beta = .18$; $p < 0.05$), medical school ($\beta = .15$; $p < 0.001$) or hospital-based ($\beta = .05$; $p < 0.001$) practices were more likely to report higher levels of communication. On other hand, physicians who's reimbursement was determined by his/her own productivity ($\beta = -.06$; p-<0.05) were more likely to report lower level of communication.

Level of Difficulty in Obtaining Needed Medical and Non-Medical Services

Based on the results of the Poisson regression Hypothesis 1, which stated that physicians practicing in more munificent environments would be more likely to report higher levels of care coordination activities was not supported. Because one of three measures was associated with the outcome variable, but in the opposite direction (see Table 4). A one thousand dollar increase in the per capita income was associated with 0.04% increase in the level of difficulty in obtaining needed medical and non-medical services.

Hypothesis 2 suggested that an increase in dynamism would be associated with lower levels of care coordination activities. This hypothesis received weak support in our analysis, with a one unit increase in the change in the population rates associated with 0.01% increase in the level of difficulty in obtaining needed medical and non-medical services.

Finally, Hypothesis 3 suggested that an increase in the complexity of environment will be associated with lower levels of care coordination activity, which received some support in the analysis, with one of the two measures significantly associated with the outcome variable. Physicians who practiced in malpractice crisis states reported 0.06% higher level of difficulty in obtaining needed medical and non-medical services than physicians who practiced in states with no malpractice crisis.

Our analysis also found several control variables were associated with level of difficulty in obtaining needed medical and non-medical services. For instance, physicians who practiced in an HMO (Incidence Rate Ratio=.45; $p < 0.05$), and medical school (Incidence Rate Ratio=.89; $p < 0.01$) reported a lower level of difficulty in obtaining needed medical and non-medical services.

DISCUSSION

Care coordination is believed to be a promising approach to healthcare delivery that aims to reduce health care spending and improve the quality of care (Orszag & Emanuel, 2010) through better mangement of chronic conditions (O'Malley, Mandelblatt, Gold, Cagney, & Kerner, 1997) and more appropriate utilization of health resources (Bodenheimer, 2008; Christakis, Mell, Koepsell, Zimmerman, & Connell, 2001; Kripalani et al., 2007; O'Malley & Reschovsky, 2011). Despite these benefits, there is

significant variation in care coordination activities among providers. A review of the literature revealed a paucity of research on the factors that influence care coordination, with a particularly small number of studies examining the role of different types of environmental factors in care coordination in a non-systematic manner (Pfefferle, Gittell, Hodgkin, & Ritter, 2006; Warrick, Christianson, Williams, & Netting, 1990). To our knowledge, no study has attempted to systematically examine the association between the external environment and care coordination. This study employed the resource-dependence theory to examine how various environmental factors are related to care coordination.

The findings of our study indicate that several environmental factors, including per capita income, fluctuations in HMO penetration and poverty levels, and the presence of a malpractice crisis, are significantly associated with selected care coordination activities. In general, our study indicates that the relationship between the external environment and care coordination is nuanced and depends on the dimension of the environment being considered as well as how care coordination is measured. In some cases we found significant relationships in the direction that was predicted. For instance, an increase in per capita income (environmental munificence) was positively associated with level of communication reported by physicians. Similarly, a higher level of population change (environmental dynamism) was associated with more reported problems in getting medical and non-medical services. These relationships are consistent and provide support for resource-dependence theory. In other instances, however, the relationship between the external environment and care coordination was in the opposite direction of what might be predicted based on resource-dependence theory. For example,

higher levels of change in HMO penetration (environmental dynamism) were associated with higher levels of care coordination and opposite to what was hypothesized.

It is also worth noting that some environmental measures had contrasting relationships with care coordination that depended on how care coordination was measured. For instance, per capita income (environmental munificence) was associated with higher levels of communication (as predicted) and higher levels of difficulty in obtaining needed medical and non-medical services (contrary to what was predicted). Similarly, physicians who practiced in states with malpractice crisis, a measure of environmental complexity, reported higher levels of communication (contrary to what was predicted) and more problems obtaining needed medical and non-medical services (as was predicted).

There are several potential explanations for these mixed results. First, it is plausible that resource-dependence theory may provide a reasonable way to conceptualize the relationships between a physician's external environment and care coordination but not necessarily as it has been applied to other kinds of strategic responses, such as adoption of new innovations (e.g. EMR adoption). This may be due to care coordination being a multidimensional construct with some aspects of care coordination influenced by the external environment in one way while other aspects are influenced in a different, even opposite way. Additionally, the resource-dependence theory is somewhat limited in acknowledging the fact that there are diverse types of environmental resources (e.g. patient resources versus payer resources) that may have different influences on care coordination. For instance, more munificent environments that are characterized by higher levels of Medicaid patients may not be considered as

munificent from physician' perspective because of the lower Medicaid reimbursement rates in comparison with other payers. Thus, despite the environment being "munificent" physicians may report lower levels of care coordination. Second, the results of our study may be influenced by the chosen variables to reflect environmental munificence, dynamism and complexity. Although we derived our environmental variables from prior research (Menachemi et al., 2011; Weech-Maldonado et al., 2009), these measures were not previously applied to care coordination specifically and may have resulted in inconsistent results. Third, the measures of care coordination, such as amount of time allocated for communication and inability to get needed referrals, are based on the physician' self-report. Thus, our results may suffer from "desirability" bias, e.g. physicians might report higher levels of communication and greater difficulty getting needed medical services than they actually have. Future research should attempt to collect objective information on the level of care coordination activities that physicians engage in.

Several of our control variables were associated with care coordination. Physicians who practiced in an HMO and medical school practices were more likely to report higher levels of communication and lower levels of difficulty in obtaining needed medical and non-medical services. These practice types are more likely to have more resources, such as HIT, that may provide support for physicians to engage in more care coordination activities than physicians practicing in relatively smaller group practices (Menachemi & Brooks, 2006). Additionally, compensation methods that were based on physician productivity were associated with lower levels of communication. This may be due to the fact that physicians that are reimbursed based on their productivity are

expected to see greater number of patients in order to get full reimbursement and may be less likely to engage in non-essential activities, such as care coordination (O'Malley et al., 2009).

Our study has several limitations that should be noted. First, because care coordination is a multidimensional construct that is difficult to operationalize, we recognize the possibility of not including all dimensions of care coordination in our model. Due to the limitations of the HTPS (2008) data set, the current study was not able to identify measures that would adequately represent each domain. Therefore, future research should consider focusing on using standardized, multidimensional measures of care coordination, such as the one proposed by National Quality Forum (National Quality Forum, 2006). Second, due to the cross-sectional nature of this study, the identified relationships should be interpreted as associational only. Furthermore, due to data availability, the environment measures were operationalized at the county level. It is possible that the county might not be the most appropriate unit to represent physician practice environments. Therefore, future studies might consider adopting environmental measures using smaller units of analysis such as zip codes.

Our research revealed that certain aspects of a physician's external environment are associated with care coordination activities in a rather nuanced manner. Policy makers may use this information by acknowledging that different types of care coordination activities may be associated with specific environmental resources. The findings may also help explain the mixed success of various care coordination pilot projects (Peikes, Chen, Schore, & Brown, 2009), as they may not have adequately accounted for the complex role of an organization's environment. Such considerations are

likely to be important for practitioners (e.g., providers and payers) responsible for implementing care coordination programs, as they introduce the possibility that an organization's external environment may moderate the effectiveness of care coordination activities. These considerations also highlight the potential for using facilitative environmental factors as key leverage points for fostering greater coordination.

Table 1. Variables used in the study and their sources

Construct	Measurement	Data Source
Level of communication	During a typical day, how much time do you spend on each of the following activities? (Response categories: None; Less than a half hour, 0.5-1 hour; 1-2 hours; more than 2 hours; Not ascertained) A. E-mail communications with patients and their families. B. Telephone conversations with patients and their families. C. E-mail communications with physicians and other clinicians. D. Telephone conversations with patients and their families.	HTPS
Level of difficulty in obtaining needed medical and non-medical services	During the last 12 months, were you unable to obtain the following services for your patients when you thought they were medically necessary? (Response categories: No; Yes; Not ascertained) A. Referrals to high quality specialists B. Non-emergency hospital admissions C. High quality outpatient mental health services D. Interpreter services for non-English speaking patients when they received care in your practice	HTPS
Environmental Munificence	• Per capita income • Urban geographic location • Physician specialists per 1,000 capita • Percentage of Medicare enrollees in the county	ARF HTPS ARF ARF
Environmental Dynamism	• HMO penetration • Changes in unemployment rate (2002 – 2007) • Changes in poverty levels (2002 – 2007) • Changes in the population size (2002 – 2007)	Dartmouth Atlas ARF ARF ARF
Environmental Complexity	• State with current malpractice crisis • Intensity of certificate of need in the state	AMA AHPA

Note:
HTPS is Health Tracking Physician Survey (2008)
ARF is Area Resource File (2008)
AMA is American Medical Association
AHPA is American Health Planning Association (2009)

Table 2. Physician and environmental characteristics of the sample (N=4,229)

Physician Characteristics		**Frequency (%)**
Gender	Male	2,964 (70%)
	Female	1,265 (30%)
Mean years in practice (SD)		16.4 (9.8)
Specialty	Internal Medicine	685 (16.2%)
	Family/General Practice	774 (18.3%)
	Pediatrics	449 (10.6%)
	Medical Specialties	1,150 (27.2%)
	Surgical Specialties	492 (11.6%)
	Psychiatry	227 (5.4%)
	Obstetrics & Gynecology	452 (10.75)
Board Certified		3,849 (91%)
Country of Medical Degree	U.S./Canada	3,326 (78.6%)
	Other	903 (21.4%)
Practice Type	Solo/2 physicians	1,079 (25.5%)
	Group>=3 physicians	1,823 (43.1%)
	HMO	228 (5.4%)
	Medical School	443 (10.5%)
	Hospital-based	448 (11.5%)
	Other	168 (4%)
Mean of practice size		27 (37.6)
Factors determining physician's compensation ("Yes")		
	A physician's productivity	3,093 (73.1%)
	Results of patient' satisfaction surveys	1,267 (30%)
	Quality-of-care measures	1,135 (27%)
	Results of practice profiling	900 (21.3%)
	Financial performance of the practice	3,022 (71.5%)
Mean of heterogeneity of payer types (SD)		0.56 (.17)
Average for level of communication (SD)		1,31 (0.60)
Average for level of difficulty in obtaining needed medical and non-medical services (SD)		1.6 (1.33)
Market Characteristics		**Mean (S.D.)**
Per Capita Income in 2006		41,838 (14,333)
Physician specialists per 1000 capita		1.21 (0.79)
Percentage of Medicare enrollees in the county (SD)		11.7 (2.84)
HMO Penetration		0.13 (0.11)
Changes in unemployment rate (2002-2007)		1.14 (1.4)
Changes in poverty levels (2002-2007)		-0.8 (1.9)
Changes in the population size (2002-2007)		-38,041 (92,128)
Malpractice crisis state	Yes	2,089 (49.4%)
	No	2,140 (50.6%)
Geographic location	Urban	3,961 (93.7%)
	Rural	265 (6.3%)
Mean intensity of certificate of need in the state (range)		9.44 (0-28)

Table 3. Results of the ordinary least squares regression: relationship between environmental factors and level of communication (N=4,299)

	Beta coefficient	**Confidence Interval**
Munificence		
Per capita income	.07***	.05, .08
Urban geographic location	-.04	-.10, .03
Physician specialists per 1,000 capita	.03	-.30, .03
Percentage of Medicare enrollees	.04	-.02, .03
Dynamism		
HMO penetration	.24***	.05, .42
Changes in unemployment rate (2002 – 2007)	.09	-.00, .02
Changes in poverty levels (2002 – 2007)	-.02***	-.02, -.00
Changes in the population size (2002 – 2007)	.02	.07, .04
Complexity		
Malpractice crisis state	.07***	.03, .12
Intensity of certificate of need in the state	.01	-.05, .04
Practice type		
Solo/2 physicians	Reference	Reference
Group>=3 physicians	.20***	.13, .27
HMO	.18***	.13, .23
Medical School	.15***	.08, .21
Hospital-based	.05*	.00, .16
Other	.15***	.09, .22
Practice size	.01***	.01, .10
Compensation mechanisms		
Physician's productivity	-.06***	-.09, -.02
Results of satisfaction surveys from patients	-.02	-.05, .04
Quality-of-care measures	.16***	.10, .21
Results of practice profiling	.09	.03, .14
Overall financial performance of the practice	Reference	
Heterogeneity of payer types	-.16	-.05, .14
Male gender	-.07***	-.11, -.03
White	-.07***	-.12, -.04
Years in practice	.01	-.01, .02
Specialty		
Internal Medicine	Reference	Reference
Family/General Practice	-.08	-.05, .03
Pediatrics	.44	.35, .54
Medical Specialties	.33	.26, .41
Surgical Specialties	.12	.06, .18
Psychiatry	-.07	-.16, .01
Obstetrics & Gynecology		
Board Certified	.07**	.01, .12
IMG	.02	-.03, .08
Weekly hours in direct patient care	.08***	.00, .01

*p<0.1, **p<0.05. ***p<0.01

Table 4. Results of the Poisson regression: relationship between environmental factors and level of difficulty in obtaining needed medical and non-medical services (N=4,299)

	Beta coefficient	Confidence Interval	Incidence Rate Ratio
Munificence			
Per capita income	.04***	.01, .06	1.04***
Urban geographic location	-.07	-.18, .02	.92
Physician specialists per 1,000 capita	-.01	-.06, .04	.98
Percentage of Medicare enrollees	.05	-.03, .07	1.01
Dynamism			
HMO penetration	-.14	-.43, .14	.86
Changes in unemployment rate (2002 – 2007)	.05	-.01, .02	1.00
Changes in poverty levels (2002 – 2007)	.06	-.01, .02	1.06
Changes in the population size (2002 – 2007)	-0.02*	-.05, -.30	.99*
Complexity			
Malpractice crisis state	.04**	-.05, 1.27	1.06**
Intensity of certificate of need in the state	.04	-.03, .03	1.00
Practice type			
Solo/2 physicians	Reference		Reference
Group>=3 physicians	-.09**	-.16, -.01	.91**
HMO	-.77***	-1.0, -.55	.45***
Medical School	-.10*	-.22, .01	.89*
Hospital-based	-.05	-.16, .04	.94
Other	.24***	.11, .37	1.28***
Practice size	-.03***	-.04- -.02	.99***
Compensation mechanisms			
Physician's productivity	.03	-.02, .10	1.03
Results of satisfaction surveys from patients	.26***	.17, .34	1.29***
Quality-of-care measures	-.27***	-.36, -.18	.75***
Results of practice profiling	.41***	.32, .49	1.51***
Overall financial performance of the practice	Reference		Reference
Heterogeneity of payer types	-.84***	-1.03, -.65	.42***
Male gender	-.02	-.06, .05	.99
White	.11***	.04, .17	1.11***
Years in practice	-.06	-.03, .02	.99
Specialty			
Internal Medicine	Reference		Reference
Family/General Practice	.17***	.08, .26	1.19***
Pediatrics	.25***	.14, .36	1.28***
Medical Specialties	-.11**	-.20, -.02	.89**
Surgical Specialties	-.46***	-.58, -.34	.62***
Psychiatry	.31***	.18, .43	1.36***
Obstetrics & Gynecology	.14***	.03, .26	1.15***
Board Certified	.06	-.02, .14	1.06
IMG	.08**	.01, .14	1.08**
Weekly hours in direct patient care	.04***	.00, .06	1.04***

*p<0.1, **p<0.05. ***p<0.01

References

Aldrich, H. E., & Pfeffer, J. (1976). Environments of organizations. *Annual Review of Sociology, 2*, 79-105.

Balotsky, E. R. (2005). Is it resources, habit or both: Interpreting twenty years of hospital strategic response to prospective payment. *Health Care Management Review, 30*(4), 337-350.

Birnbaum, P. H. (1984). The choice of strategic alternatives under increasing regulation in high technology companies. *Academy of Management Journal*, *27*,489-510.

Bodenheimer, T. (2008). Coordinating care—a perilous journey through the health care system. *New England Journal of Medicine, 358*(10), 1064-1071.

Dess, G. G., & Beard, D. W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, *29,* 52-73.

Donahue, K., Ashkin, E., & Pathman, D. (2005). Length of patient-physician relationship and patients' satisfaction and preventive service use in the rural south: a cross-sectional telephone study. *BMC Family Practice, 6*(1), 40-52.

Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, *17*, 313-327.

Hsieh, H. M., Clement, D. G., & Bazzoli, G. J. (2010). Impacts of market and organizational characteristics on hospital efficiency and uncompensated care. *Health Care Management Review, 35*(1), 77-90.

Kazley, A. S., & Ozcan, Y. A. (2007). Organizational and environmental determinants of hospital EMR adoption: A national study. *Journal of Medical Systems, 31*(5), 375-384.

Keats, B. W., & Hitt, M. A. (1988). A causal model of linkages among environmental dimensions, macro organizational characteristics, and performance. *Academy of Management Journal*, *31*, 570-598.

Kreiser, P., & Marino, L. (2002). Analyzing the historical development of the environmental uncertainty construct. *Management Decision, 40*(9), 895-905.

Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and Environment*. Boston: Harvard University.

Layman, E. J., & Bamberg, R. (2005). Environmental Scanning and the Health Care Manager. *The Health Care Manager, 24*(3), 200-209.

McDonald, K. M., Sundaram, V., Bravata, D. M., Lewis, R., Lin, N., Kraft, S., Owens, D. K. (2007). Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 7: Care Coordination). *Rockville, MD: Agency for Healthcare Research and Quality*.

Menachemi, N., & Brooks, R. G. (2006). EHR and other IT adoption among physicians: results of a large-scale statewide analysis. *Journal of Healthcare Information Management, 20*(3), 79-94.

Menachemi, N., Mazurenko, O., Kazley, A. S., Diana, M. L., & Ford, E. W. (2012). Market factors and electronic medical record adoption in medical practices. *Health Care Management Review, 37*(1), 14-22.

Menachemi, N., Shin, D. Y., Ford, E. W., & Yu, F. (2011). Environmental factors and health information technology management strategy. *Health Care Management Review, 36*(3), 275-290.

Miller, D. (1987). The structural and environmental correlates of business strategy. *Strategic Management Journal, 8*(1), 55-76.

Nason, C. S., Alexander, G. R., Pass, M. A., & Bolland, J. M. (2003). An evaluation of a Medicaid managed maternity program: the impact of comprehensive care coordination on utilization and pregnancy outcomes. *Journal of Health and Human Services Administration, 26*(2), 239-250.

National Quality Forum (2006). National Quality Forum-endorsed definition and framework for measuring care coordination Retrieved 10/25, 2011, from http://www.qualityforum.org/projects/care_coordination.aspx

O'Malley, A. S., & Reschovsky, J. D. (2011). Referral and consultation communication between primary care and specialist physicians: finding common ground. *Archives of Internal Medicine, 171*(1), 56-72.

O'Malley, A. S., Tynan, A., Cohen, G. R., Kemper, N., & Davis, M. M. (2009). Coordination of care by primary care practices: strategies, lessons and implications. *Research Briefs, 12*, 1-16.

Peikes, D., Chen, A., Schore, J., & Brown, R. (2009). Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries. *JAMA: the Journal of the American Medical Association, 301*(6), 603-618.

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. Stanford Business Books.

Pfefferle, S. G., Gittell, J. H., Hodgkin, D., & Ritter, G. (2006). Pediatrician coordination of care for children with mental illnesses. *Medical Care, 44*(12), 1085-1091.

Thompson, J. (1967). *Organizations in action*. New York: McGraw-Hill.

Trinh, H. Q., & O'Connor, S. J. (2000). The strategic behavior of US Rural hospitals: a longitudinal and path model examination. *Health Care Management Review, 25*(4), 48-62.

Trinh, H. Q., & O Connor, S. J. (2002). Helpful or harmful? The impact of strategic change on the performance of US urban hospitals. *Health Services Research, 37*(1), 145-172.

Venkatraman, N., & Camillus, J. C. (1984). Exploring the concept of" fit" in strategic management. *Academy of Management Review*, *9 (3),* 513-525.

Warrick, L., Christianson, J., Williams, F., & Netting, F. (1990). The design and implementation of hospital-based coordinated care programs. *Hospital Health Services Administration, 35*(4), 505-520.

Weech-Maldonado, R., Qaseem, A., & Mkanta, W. (2009). Operating environment and USA nursing homes' participation in the subacute care market: a longitudinal analysis. *Health Services Management Research, 22*(1), 1-7.

Yasai-Ardekani, M. (1989). Effects of environmental scarcity and munificence on the relationship of context to organizational structure. *Academy of Management Journal*, *6*,131-156.

Zinn, J. S., Proenca, J., & Rosko, M. D. (1997). Organizational and environmental factors in hospital alliance membership and contract management: a resource-dependence perspective. *Hospital Health Services Administration, 42*(1), 67-80.

THE RELATIONSHIP BETWEEN THE EXTERNAL ENVIRONMENT AND CARE COORDINATION: THE MEDIATING ROLE OF REIMBURSEMENT AND HEALTH INFORMATION TECHNOLOGY (HIT) AVAILABILITY

by

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In preparation for *Journal of Ambulatory Care Management*

Format adapted for dissertation

ABSTRACT

The objective of this study was to explore the possibility that the relationship between the external environment and care coordination is mediated by reimbursement for communication and availability of health information technology (HIT). The data was obtained from the Health Tracking Physician Survey (2008), the Area Resource File (2008), the American Health Planning Association (AHPA) and the Dartmouth Atlas (2008). Results of structural equation modeling (SEM) showed that per capita income, number of specialists per capita and level of HMO penetration were significantly associated with physician' reported level of communication. Furthermore, HIT availability and reimbursement for communication significantly mediated the relationship between the measures of the external environment and physician' reported level of communication. Policy makers and healthcare managers may increase care coordination among physicians by taking into consideration characteristics of the external environment. They may also do so through the establishment of HIT in medical practices and reimbursement for communication.

Keywords: care coordination, health information technology, reimbursement, mediation analysis, external environment

INTRODUCTION

Care coordination is designed to facilitate appropriate delivery of health services through the "deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care" (McDonald et al., 2007). Communication between physicians is one of the cornerstones of care coordination (Starfield, 1998) as it is shown to be highly important to patients and physicians (Laine et al., 1996; Stille, McLaughlin, Primack, Mazor, & Wasserman, 2006) and lead to improvement in patient outcomes and physician satisfaction (Forrest et al., 2000; Schoen et al., 2006). Unfortunately, the fragmented nature of healthcare makes the communication among physicians a particularly troublesome aspect of care coordination with considerable variation in the degree to which it occurs (O'Malley & J. D. Reschovsky, 2011; Pham, O'Malley, Bach, Saiontz-Martinez, & Schrag, 2009; Starfield, 1998).

Evidence indicates that this variation could be partially attributed to characteristics of medical practices' external environment, such as practice location (Gupta, O'Connor, & Quezada-Gomez, 2004), or socio-demographic characteristics of the surrounding community (Rodriguez, von Glahn, Rogers, & Safran, 2009) that may facilitate or hinder care coordination. More importantly, previous research suggests that the relationship between care coordination and the external environment is complex with certain environmental characteristics having inconsistent relationships with care coordination (Gupta et al., 2004; Pfefferle, Gittell, Hodgkin, & Ritter, 2006). The external environment may be considered as a relatively distant factor in its likely effects on care coordination. For instance, it may be difficult to imagine how per capita income,

measure of environmental munificence, may directly influence physician's engagement in care coordination. Therefore, it is reasonable to believe that the external environment may influence physician's care coordination through changes in how physician practice operates rather than through direct influence on care coordination. Thus, it is plausible that this complex relationship could be explained, at least partially, by the presence of certain factors that intervene between the environment and care coordination. These mediating factors may be part of organization's structural (availability of HIT to coordinate care, provider's reimbursement for care coordination) or process characteristics (ongoing staff training on the care coordination activities) that may facilitate or hinder care coordination. To date, this possibility has not been explored in the literature.

The purpose of this study is to examine whether the relationship between the external environment and care coordination is mediated by two factors, reimbursement for communication and HIT availability. A better understanding of these mediating relationships has several practical implications. First, this knowledge may be used by healthcare managers to increase care coordination among physicians by incorporating factors that are associated with higher levels of care coordination in their own organizations, taking into consideration the characteristics of the external environment in which they exist. Second, future policies focused on improving care coordination may target the mediating factors that are associated with higher levels of care coordination through focused policy efforts (e.g. resource allocation, program development). Finally, future research may use this knowledge to refine the care coordination research agenda

by acknowledging the presence of mediating factors, such as HIT and reimbursement, and incorporating them in their design.

CONCEPTUAL FRAMEWORK

The environment represents the availability of resources and information that are needed to successfully engage in organizational activities (Dess & Beard, 1984). One of the dominant theoretical perspectives regarding how the environment influences organizational activities is resource-dependence theory. This theory suggests that organizational survival is dependent on how successfully and efficiently an organization can acquire and maintain critical resources from its external environment (Aldrich & Pfeffer, 1976; Dess & Beard, 1984). While the environment has control over critical resources essential for organization's survival, administrators tend to manage their external environments to their own advantage (Aldrich & Pfeffer, 1976; Fennell, Ross, & Warnecke, 1987). Because organizations operate in different environments, they need to continuously adopt different strategies and activities to align themselves with peculiarities of their environment in order to achieve the goals of their organization in a more efficient and effective manner (Thompson, 1967; Venkatraman & Camillus, 1984). These adaptations are reflected in an organization's strategies and activities. Care coordination could be considered one of the activities chosen by an organization to adapt to its environment. Thus, variations in the organization's environment are likely to be reflected in variation in care coordination activities.

Previous research has identified three primary dimensions of the external environment: complexity, munificence, and dynamism (Dess & Beard, 1984). Environmental complexity reflects the number of different actors/elements that need to

be taken into consideration when making strategic decisions (Dess & Beard, 1984; Hsieh, Clement, & Bazzoli, 2010; Zinn, Proenca, & Rosko, 1997). The resource abundance in the environment is representative of environmental munificence (Dess & Beard, 1984; Trinh & O'Connor, 2000; Zinn et al., 1997). Environmental dynamism reflects the rate of change and thus uncertainty in the environment (Dess & Beard, 1984; Tan & Litsschert, 1994; Miller, 1987; Zinn et al., 1997).

External Environment and Care Coordination

Previous studies have shown that the external environment contributes to variation in physician's engagement in care coordination (Gupta et al., 2004; Rodriguez et al., 2009; Warrick, Christianson, Williams, & Netting, 1990). For instance, physicians operating in more munificent environments, operationalized through community support for care coordination, reported higher levels of care coordination (Warrick et al., 1990). On the other hand, physicians located in less munificent environments, reflected by a higher proportion of the population below the federal poverty level, indicated lower levels of care coordination (Rodriguez et al., 2009). Less is known about the association between other environmental dimensions and care coordination. Research on other organizational activities, however, such as adoption of electronic medical records (EMR), suggests that medical practices located in more dynamic and more complex environments are less likely to engage in novel activities, and would focus on activities essential to their survival (Menachemi, Mazurenko, Kazley, Diana, & Ford, 2012).

External Environment and Care Coordination: Mediating Role of Reimbursement

Previous research indicates that the relationship between external environment and care coordination is nuanced and complex and it is plausible that there are several

factors that intervene in between, one of them could be the physician' reimbursement. In the 1960's and 1970's, the U.S. healthcare environment was characterized by an abundance of resources through the influx of government funds and physicians enjoyed considerable freedom in establishing an appropriate amount of reimbursement for the types of services they provided (Scott, 1982). Rising healthcare expenditures and the introduction of several cost-containment strategies (sustainable growth rate index, managed care, etc.) in the 1990s has transformed healthcare environment from benevolent to malevolent (Manchikanti et al., 2012), which was reflected in less generous reimbursement schemes for physicians. The transformed healthcare environment also became more complex due to an increasing number of regulations (McKinlay & Marceau, 2002), which resulted in a reduction in physician reimbursement especially for activities not directly related to the provision of patient care, such as care coordination (O'Malley, Tynan, Cohen, Kemper, & Davis, 2009). Similarly, the uncertainty of resource flows introduced by changes in healthcare policies (e.g. passage of diagnostic related groups in the early 1980s), made current healthcare environment more dynamic which may have negatively affected the physician' reimbursement for non-treatment related activities (e.g. communication with patients and other providers) by third-party payers.

As described earlier, the characteristics of external environment (munificence, complexity and dynamism) may be attributable for the differences in physician' reimbursement, which in turn may be associated with how physicians engage in certain care-related activities. This is due to the fact that healthcare providers tend to prioritize certain activities over others based on the amount of reimbursement that they receive

from payers. For instance, an increase in physician's fee for evening visits lead to a 33% increase in the number of visits by GPs (Baker, Klein, & Carter, 1994). Another study showed that fee-for-service physicians scheduled more visits per patient than did salaried physicians and saw their patients more often (Hickson, Altemeier, & Perrin, 1987). To conclude, the above mentioned evidence suggests that characteristics of external environment may influence physician engagement in care coordination through presence of reimbursement for these activities. Based on the above arguments, we hypothesize that:

Hypothesis 1: *Reimbursement for care coordination activities, such as communication with patients and other providers, will mediate the relationship between the external environment and care coordination.*

External Environment and Care Coordination: Mediating Role of HIT Availability

HIT availability may be considered another factor that mediates the relationship between the external environment and care coordination. Research suggests that HIT availability, an electronic medical record (EMR) in particular, is related to several characteristics of the external environment (Kazley & Ozcan, 2007; Menachemi et al., 2012). For instance, Kazley and colleagues (2007) reported that hospital EMR adoption was negatively associated with environmental uncertainty (change in the unemployment rates) and environmental munificence, measured by urbaneness. Similarly, Menachemi and colleagues have found that measures of market dynamism, including increases in unemployment or poverty rates, were negatively associated with EMR adoption by practice-based physicians (Menachemi et al., 2012).

Furthermore, other research has established the relationship between HIT and care coordination (Graetz et al., 2009; O'Malley, Grossman, Cohen, Kemper, & Pham, 2010; O'Malley et al., 2009). For example, Graetz and colleagues reported that primary care clinicians who have EHR for more than six months were more likely than physicians without EHR to report timely access to complete patient information, and be in agreement on treatment goals with other involved clinicians. Therefore, it is reasonable to believe that characteristics of the external environments may promote or hinder care coordination by promoting or hindering HIT availability. For instance, more munificent environments may promote care coordination through promotion of HIT in the medical practice. Similarly, more complex environments may hinder care coordination by obstructing HIT availability in medical practice. Finally, more dynamic environments may be less conducive to care coordination because they would hold back the availability of HIT in medical practice. Therefore, we hypothesize:

Hypothesis 2: *Availability of HIT for care coordination activities, such as electronic communication with patients and other providers, will mediate the relationship between external environment and care coordination.*

METHODS

This study uses a cross-sectional design to analyze the mediating role of reimbursement and HIT availability on the relationship between care coordination and several environmental factors. The data was obtained from the Health Tracking Physician Survey (2008) conducted by the Center for Studying Health System Change (CSHSC), the Area Resource File (2008), the American Health Planning Association (AHPA) and the Dartmouth Atlas (2008).

The study sample consisted of nationally representative sample of U.S. physicians. A stratified random sample was derived from a list of physicians provided by the American Medical Association. The mail-based survey excluded federal employees, specialists in fields in which the primary focus was not direct patient care, graduates of foreign medical schools who were only temporarily licensed to practice in the United States, physicians who had not completed their medical training (resident, interns, and fellows), and physicians who requested that the American Medical Association (AMA) not release their names. Additionally, the following specialties were excluded from the survey: radiologists, anesthesiologists and pathologists. The response rate among eligible participants was 61.9%, leading to the final sample of 4,720 physicians. The Institutional Review Board of our university approved this analysis.

Predictor Variables

Environmental munificence is represented by the following variables: community income level and supply of physicians (Hsieh et al., 2010; Kazley & Ozcan, 2007). Community income level is measured as the average per capita income. The supply of physicians was measured as the number of physician specialists per 1,000 capita. Environmental dynamism is operationalized as the level of managed care penetration (Kazley & Ozcan, 2007; Weech-Maldonado, Qaseem, & Mkanta, 2009; Zinn et al., 1997) and measured as the percentage of a given county's population that is covered by a health maintenance organization. Environmental complexity is represented by intensity of certificate of need in a state and was obtained from American Health Planning Association (2009). It reflects the number of services and equipment that require obtaining certificate of need in each state.

In line with previous literature (Menachemi et al., 2012; O'Malley & J.D. Reschovsky, 2011), the following control variables are included in the analysis: physician demographic characteristics (gender, race), professional characteristics (specialty, years in practice) and practice characteristics (practice type). Gender is operationalized as a binary variable, where male is coded as one and female is coded as zero. Race is specified as a binary variable representing non-Hispanic white coded as one and others coded as zero. Specialty is coded as a binary variable, where primary care provider (PCP) is coded as one and the rest are coded as zero. Practice type was measured through a series of dummy variables: solo/2physicians; group with 3 physicians or more; HMO; medical school; hospital-based or other.

Mediator Variables

Reimbursement for communication with patients and other providers. Reimbursement for communication was measured with 4 items that were modeled individually in the analysis. These items asked whether a physician's practice is reimbursed by any health insurance plans for the following activities: 1. E-mail communications with patients and their families; 2. Telephone conservations with patients and their families; 3. E-mail communications with physicians and other clinicians; 4. Telephone conversations with physicians and clinicians. Responses are provided on 3-point scale with 1 indicating "*Reimbursed*", 2 indicating "*Not Reimbursed*", 3 indicating "*Unsure if reimbursed*". "*Unsure if reimbursed*" responses (4.5 % of responses) were treated as missing and excluded from the final analysis.

Health information technology (HIT) availability. Health information technology (HIT) availability was measured with 4 items that were modeled individually in the

analysis. These items asked whether a physician's practice has the following HIT capabilities: 1. Communication about clinical issues with patients by e-mail; 2. Electronic exchanging of clinical data and images with other physicians; 3. Electronic exchanging of clinical data and images with other hospitals and laboratories; 4. Availability of electronic medical record (EMR). The responses were recorded as "yes" or "no".

Outcome Variable

Level of communication with patients and other providers. The level of communication with patients and other providers was measured with 4 items that were modeled individually in the analysis. The items were: 1. Amount of time allocated for e-mail communications with patients and their families; 2. Amount of time allocated for telephone conversations with patients and their families; 3. Amount of time allocated for e-mail communication with physicians and other clinicians; 4. Amount of time allocated for telephone conversations with physicians and other clinicians. The responses were provided on a 4-point scale ranging from 0 (*none*) to 4 (*more than 2 hours*) plus the "*not ascertained*" category. "Not ascertained" responses were coded as missing and excluded from final analysis.

DATA ANALYSIS

The unit of analysis adopted in this study is the physician. Descriptive statistics were calculated to examine the variable distributions and identify potential data anomalies (skewness, kurtosis). Given the stratified random sampling method used by the HTPS, data analysis accounted for the complex survey design and used appropriate weighting variables. A confirmatory factor analysis (CFA) was used to test whether the measurement model provided a good fit for the data. Structural equation modeling (SEM)

was used to analyze the mediating role of reimbursement for communication and HIT availability in the relationship between the external environment and care coordination (see Figure 1). The SEM analysis was performed using Mplus software (version 6). Results were flagged for significance at the $p < 0.05$; $p < 0.01$ and $p < 0.001$ levels. All results are presented as standardized regression coefficients to facilitate comparisons across variables.

In this analysis, direct relationships were considered as the path regression coefficients between two variables. Indirect relationships were calculated as the product of the regression coefficients for the relationships or linkages in that path (between predictor and mediator variable or between mediator and outcome variable) (Klem, 1995). Goodness of fit levels (CFI=> .90; TLI= > .90; WRMR=> .90; RMSEA=< .08) were based on established criteria in the SEM literature (Browne & Cudeck, 1993; Kelloway, 1995; Marsh, Balla, & McDonald, 1988).

First, the model with indirect effects (M1) was tested by including the indirect paths between communication and environmental variables through reimbursement for communication and HIT adoption. Next, the direct effects of environmental variables on level of communication were added to the model (M2). M1 served as a baseline model against which the other, more complex, model (M2) was examined to see if it provided more gains to explanatory power. A model was considered to fit the data better than a rival model if the chi-square value was significantly lower ($p < 0.05$) than that of the model to which it was compared.

RESULTS

After pair wise deletion of observations with missing values on the mediating (reimbursement for communication or HIT Adoption) or outcome (level of communication) variables, the final sample was 3,555 physician observations. Respondents with missing values for these variables were not significantly different from respondents with complete data with respect to specialty, years in practice and gender characteristics.

Physician, practice and environmental characteristics are presented in Table 1. Briefly, physicians were predominately male (71.1%), White (74.8%), and board certified in their practice specialty (91.4%). Approximately half of the responding physicians were working in a practice with more than three physicians (44.7%) and were primary care physicians (PCPs) (44.8%). Lastly, a mean per capita income across markets was $44,278 and the mean number of specialists per 1,000 capita was 0.93.

INSERT TABLE 1 ABOUT HERE

First, we tested the model 1 (M1) which included paths from environmental variables (per capita income; specialists per 1,000 capita; HMO penetration; intensity of certificate of need) to reimbursement and HIT availability and from reimbursement and HIT availability to level of communication with patients and other providers. This model had acceptable fit for the data: CFI= 0.88, RMSEA= 0.02, WRMR= 1.70. Next, we included paths between each environmental variable and level of communication. This model had a significantly better fit (change in Chi-square= 79. 250; $p < 0.05$) with CFI= 0.90; RMSEA= 0.02; WRMR = 0.92. Therefore, we concluded that model 2 represented a better fit to the data.

Direct relationships

Our analysis revealed a moderate association between environmental characteristics and care coordination, with three out of four environmental variables having a direct significant association with care coordination. Specifically, the standardized regressions showed that per capita income and number of specialists per capita (environmental munificence), and HMO penetration (environmental dynamism), had a direct association with physician' level of communication. Physicians located in more munificent environments, e.g. with one standard deviation higher level of per capita income and one standard deviation higher level of specialists per 1,000 capita, reported 0.011 and 10.014 standard deviation higher levels of communication respectively. Additionally, physicians located in more dynamic environments, with one standard deviation higher level of HMO penetration, indicated 0.02 standard deviation higher levels of communication. Of note, the intensity of certificate of need (environmental complexity) had no significant direct and indirect paths through mediating variables with level of communication (See Table 2).

INSERT TABLE 2 ABOUT HERE

Indirect relationships

We found that the relationship between selected environmental characteristics and care coordination, operationalized through the level of communication was mediated by reimbursement and HIT availability.

Per capita income. Per capita income was significantly associated with the level of communication through two indirect paths. The results indicated a significant path from per capita income to reimbursement and from reimbursement to the level of

communication. Specifically, a one standard deviation higher level of income is associated with 0.007 standard deviation higher level of communication ($p<0.001$). Per capita income to HIT availability and from HIT availability to level of communication was also significant ($p<0.001$), indicating an approximately a 0.004 standard deviation higher level of communication through this path for respondents reporting a one standard deviation higher level of per capita income.

Supply of physicians. The supply of specialist physicians was significantly associated with the level of communication through one indirect path. Our results indicated a path of significant relationships from the supply of specialist physicians to reimbursement and from reimbursement to the level of communication ($p<0.05$). This path shows that a one standard deviation higher level of specialist physician supply was associated with 0.01 standard deviation lower level of physician' communication.

HMO penetration. HMO penetration was also significantly associated with the level of communication through two indirect paths. There was a path of significant relationships from HMO penetration to reimbursement and from reimbursement to the level of communication ($p<0.01$), indicating a 0.018 standard deviation higher level of communication through this path for respondents practicing in areas with a one standard deviation-unit higher level HMO penetration. There was also a path of significant relationships from HMO penetration to HIT availability and from HIT availability to level of communication ($p<0.01$), or approximately a 0.015 standard deviation higher level of communication through this path for respondents practicing in areas with a one standard deviation-unit higher level HMO penetration.

Our analysis revealed that several control variables were associated with the level of communication. Specifically, the level of communication was significantly lower among primary care providers (β= -0.174, $p<0.001$). On other hand, physicians practicing in HMO type practices (β= 0.332, $p<0.001$) and medical school type practices (β= 0.275, $p<0.01$) were associated with a higher level of communication.

DISCUSSION

The purpose of this study was to enhance our understanding of the factors that may mediate the relationship between the external environment and care coordination. The findings of our study provided moderate support for the hypothesized mediating role of reimbursement and HIT availability. The results of our study also indicated that the indirect relationships were significantly associated with communication, over and above the direct relationships between the external environment and care coordination. Thus, our findings suggest that, in addition to directly facilitating or impeding physician communication, external environment may also promote changes in medical practices, such as HIT adoption, that in turn may promote or impede physician communication.

Additionally, our study suggests that certain environmental characteristics may play a particularly important role in physician' reported level of communication. Specifically, HMO penetration had the strongest relationship with physician' level of communication in comparison to other environmental characteristics. Despite theoretical reasons to believe that dynamic environments increase uncertainty and reduce the likelihood of an organization engaging in novel activities (Duncan, 1972; Lawrence & Lorsch, 1986), such as care coordination, our results suggest that may not necessarily be the case. Notably, this relationship was significantly and positively mediated by

availability of HIT. It is possible that dynamic environments stimulate organizations to respond in ways that buffer them from their external environment. Because the decision to adopt an HIT is more directly controllable by medical practices, it may be a strategic response taken by these physician practices to protect themselves from dynamic and uncertain environments. Similarly, reimbursement for communication also significantly and positively mediated the relationship between the HMO penetration and level of communication. These types of reimbursements may be more prevalent in more dynamic environments, characterized by higher levels of HMO penetration. HMOs place growing attention on initiatives aimed at increasing overall quality and efficiency of care (e.g. case management, disease management) (Rosenthal, Landon, & Huskamp, 2001). Therefore, more dynamic environments may facilitate care coordination through the reimbursement of activities that they consider as beneficial to their quality improvement initiatives.

Our findings indicate that higher levels of environmental munificence were associated with higher levels of communication. Interestingly, the total positive effect of the number of specialists per 1,000 capita on level of communication was reduced by the negative, indirect relationships of the HIT and reimbursement. One could argue that specialists predominantly engage in activities that are more related to diagnosis and treatment of certain health conditions rather than care coordination. Therefore, third-party payers may be less likely to establish reimbursement for care coordination activities in areas with high numbers of specialists, which in turn adversely affect a physician's level of communication. Similarly, HIT availability negatively mediated the relationship between specialists per capita and care coordination. Previous research suggests that an increase in the number of specialists in a given market is associated with higher use of

technology (Schuster, McGlynn, & Brook, 1998), although it is predominantly used for diagnosis and treatment purposes only. Therefore, even though there is a higher use of technology in areas with more specialists, it is not used for care coordination purposes. Additional research is needed to explore why physician specialists are investing in more treatment-related technology but do not appear to be using it for care coordination purposes.

Finally, intensity of certificate of need, a measure of environmental complexity, was not significantly associated with physician' reported level of communication, either directly or indirectly. It is possible that certificate of need does not adequatly represent environmental complexity, despite being used in previous literature (Banaszak-Holl, Zinn, & Mor, 1996; Zinn et al., 1997).

Some limitations should be considered when interpreting our findings. First, the study draws from the resource-dependency theory to identify three dimensions of the external environment and used selected measures of market environment that were derived from previous literature (Kazley & Ozcan, 2007; Menachemi, Shin, Ford, & Yu, 2011; Weech-Maldonado et al., 2009). Although resource-dependency theory is widely used in the strategic management literature, it may not be exhaustive in terms of capturing a medical practice' environment. Therefore, future research should consider incorporating certain potentially omitted measures of external environment in their analysis. Second, the data presented is cross-sectional, and subsequently we are not able to comment on the causality of the relationships. Subsequent research could build on our findings by employing longitudinal designs to examine the relationships between the external environment and care coordination. Third, our study used "self-reported"

measures of care coordination, operationalized through physician' self-reported level of communication with patients and other providers, which have notable limitations such as desirability bias. However, due to the fact that information about physician' levels of communication with patients and other providers may not be as socially sensitive as some other constructs (e.g. intention to leave, job satisfaction), we believe that the magnitude of the desirability bias should not substantially influence our results. Nevertheless, future studies should consider using more objective measures of care coordination.

Our findings have a number of implications for healthcare managers, policy makers and researchers. Our results indicate that certain characteristics of the external environment are associated with higher levels of care coordination when mediated by reimbursement and HIT availability. By understanding how these factors (HIT and reimbursement for communication) mediate the relationship between the external environment and care coordination, managers may be able to customize their organization's response to the external environment in ways that foster better care coordination. For instance, managers may be more willing to adopt HIT knowing that it can help position the organization to respond to the environment in ways that are associated with better communication. Likewise, managers might be able to use this information to promote greater use of HIT by physicians and other medical staff. Policy makers may consider implementing policies aimed at increasing physician' reimbursement for communication and implementation of HIT in medical practices as they appear to foster higher levels of communication among physicians. Finally, researchers may want to consider other aspects of these mediating relationships (different types of care coordination activities) or other mechanisms that may mediate the

relationship between the external environment and care coordination. For instance, recent research suggests that patient-centered care is associated with fewer problems with care coordination (Jaén et al., 2010) and it is plausible that higher levels of patient-centered care may mediate the relationship between the external environment and care coordination.

CONCLUSION

Care coordination is viewed as promising approach that may address inefficiencies in existing healthcare system, although physicians vary in the degree to which they engage in care coordination activities. Among other factors that may influence care coordination, the external environment has received relatively little attention. More importantly, little is known about the mediating factors that may intervene between the external environment and care coordination. The findings of this study shed light on this relationship by revealing that physician' reimbursement and HIT availability mediate the relationship between the external environment and care coordination.

Table 1. Physician and environmental characteristics of the sample (N=3,555)

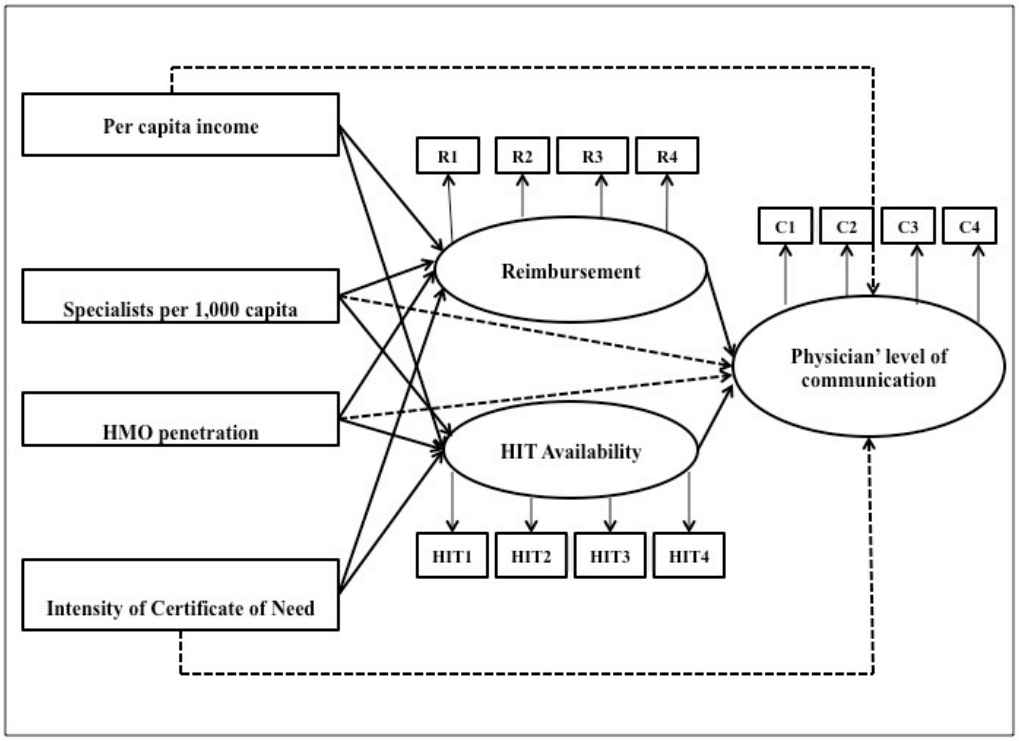
Physician Characteristics		**Frequency (%)**
Gender	Male	2,528 (71.1%)
	Female	1,027 (28.9%)
Mean years in practice (SD)		16.5 (9.6)
Specialty	Primary Care Provider	1,592 (44.8%)
	Other	1,963 (55.2%)
Board Certified		3,248 (91.4%)
Practice Type	Solo/2 physicians	887 (24.9%)
	Group>=3 physicians	1,591 (44.7%)
	HMO	160 (4.5%)
	Medical School	393 (11.1%)
	Hospital-based	372 (10.5%)
	Other	152 (4.3%)
Race	White	2,662 (74.8%)
	Other	893 (25.2%)
Environmental Characteristics		**Mean (S.D.)**
Per Capita Income in 2006		42,278 (14,56)
Physician specialists per 1,000 capita		0.93 (0.24)
HMO Penetration		0.14 (0.11)
Mean intensity of certificate of need in the state		9.46 (8.43)

Table 2: Standardized Effect Sizes for Mediated Relationships (N=3,555)

	Standardized Path Coefficient (Std Error)
Environmental Munificence	
Per capita income → Communication	0.0115 (0.0001)***
Per capita income →reimbursement → Communication	0.007 (0.0001)**
Per capita income → HIT→ Communication	0.0049 (0.0001)***
Total indirect effects	0.0119 (0.0001)***
Total effects	0.0234 (0.0001)***
Specialists per capita → Communication	0.014 (0.060)*
Specialists per capita →reimbursement → Communication	-0.010 (0.040)*
Specialists per capita →HIT→ Communication	-0.003 (0.012)
Total indirect effects	-0.013 (0.052)*
Total effects	0.001 (0.008)*
Environmental Dynamism	
HMO penetration → Communication	0.020 (0.202)*
HMO penetration →reimbursement → Communication	0.018 (0.183)**
HMO penetration →HIT→ Communication	0.015 (0.144)**
Total indirect effects	0.033(0.327)***
Total effects	0.053 (0.125)**
Environmental Complexity	
Intensity of certificate of need → Communication	-0.010 (0.001)
Intensity of certificate of need →reimbursement → Communication	0.008 (0.001)
Intensity of certificate of need → HIT→ Communication	0.0001 (0.001)
Total indirect effects	0.008 (0.001)
Total effects	-0.002 (0.001)

*p<0.05; **p<0.01; ***p<0.001

Figure 1. Relationship between external environment and care coordination: mediating role of reimbursement and HIT

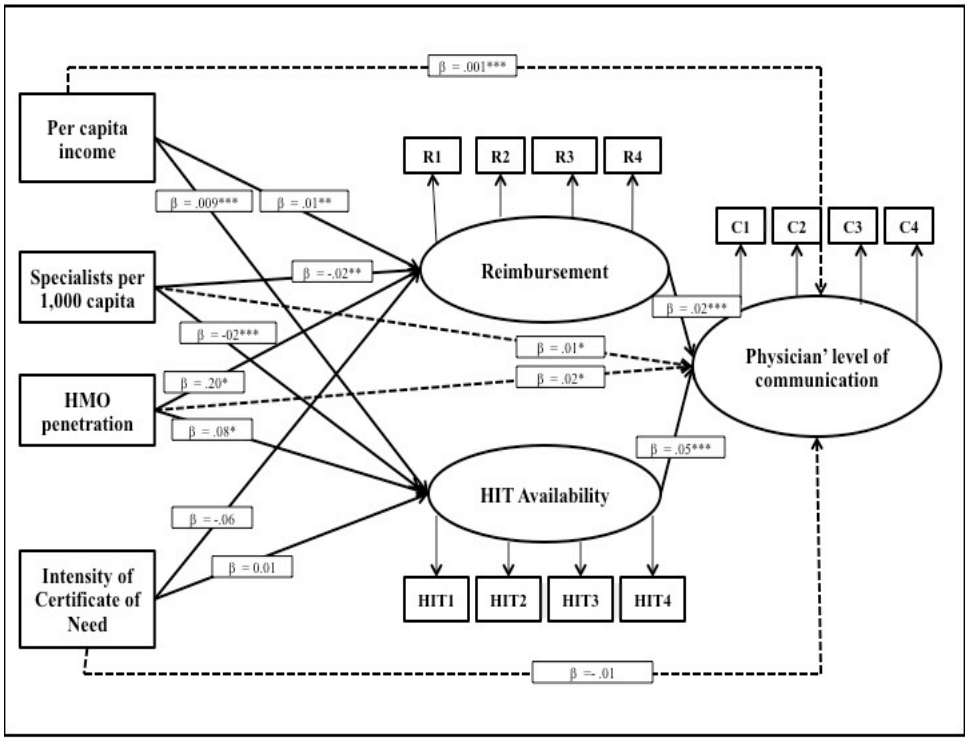


R1- Reimbursement for E-mail communications with patients and their families;
R2 - Reimbursement for telephone conservations with patients and their families;
R3- Reimbursement for E-mail communications with physicians and other clinicians;
R4 - Reimbursement for telephone conversations with physicians and clinicians;
HIT1- HIT for communication about clinical issues with patients by e-mail;
HIT2 – HIT for exchanging clinical data and images with other physicians;
HIT3- HIT for exchanging clinical data and images with other hospitals and laboratories;
HIT4 – Availability of electronic medical record (EMR);
HIT –Health Information Technology

C1- Amount of time allocated for e-mail communications with patients and their families;
C2 -Amount of time allocated for telephone conversations with patients and their families;
C3 - Amount of time allocated for e-mail communication with physicians and other clinicians;
C4 -Amount of time allocated for telephone conversations with physicians and other clinicians.

Direct relationship
Indirect relationship

Figure 2. Relationship between external environment and care coordination: beta coefficients for study relationships



R1- Reimbursement for E-mail communications with patients and their families;
R2 - Reimbursement for telephone conservations with patients and their families;
R3- Reimbursement for E-mail communications with physicians and other clinicians;
R4 - Reimbursement for telephone conversations with physicians and clinicians;
HIT1- HIT for communication about clinical issues with patients by e-mail;
HIT2 – HIT for exchanging clinical data and images with other physicians;
HIT3- HIT for exchanging clinical data and images with other hospitals and laboratories;
HIT4 – Availability of electronic medical record (EMR);
HIT –Health Information Technology

C1- Amount of time allocated for e-mail communications with patients and their families;
C2 -Amount of time allocated for telephone conversations with patients and their families;
C3 - Amount of time allocated for e-mail communication with physicians and other clinicians;
C4 -Amount of time allocated for telephone conversations with physicians and other clinicians.
*p<0.05; **p<0.01; ***p<0.001

Direct relationship
Indirect relationship

References

Aldrich, H. E., & Pfeffer, J. (1976). Environments of organizations. *Annual Review of Sociology, 2*, 79-105.

Baker, D., Klein, R., & Carter, R. (1994). Impact of the 1990 contract for general practitioners on night visiting. *The British Journal of General Practice, 44*(379), 68-80.

Banaszak-Holl, J., Zinn, J. S., & Mor, V. (1996). The impact of market and organizational characteristics on nursing care facility service innovation: a resource dependency perspective. *Health Services Research, 31*(1), 97-117.

Browne, M. W., & Cudeck, R. (1993). *Alternative ways of assessing model fit*. Sage focus edition.

D'Aunno, T. A., & Zuckerman, H. S. (1987). The emergence of hospital federations: An integration of perspectives from organizational theory. *Medical Care Research and Review, 44*(2), 323-343.

Dess, G. G., & Beard, D. W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*,*29 (1),* 52-73.

Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*,*17,* 313-327.

Fennell, M. L., Ross, C. O., & Warnecke, R. B. (1987). Organizational environment and network structure. *Research in the Sociology of Organizations, 5*, 311-340.

Forrest, C. B., Glade, G. B., Baker, A. E., Bocian, A., von Schrader, S., & Starfield, B. (2000). Coordination of specialty referrals and physician satisfaction with referral care. *Archives of Pediatrics and Adolescent Medicine, 154*(5), 499-512.

Graetz, I., Reed, M., Rundall, T., Bellows, J., Brand, R., & Hsu, J. (2009). Care coordination and electronic health records: connecting clinicians. *AMIA Annual Symposium Proceedings, 2009*, 208-212.

Gupta, V. B., O'Connor, K. G., & Quezada-Gomez, C. (2004). Care coordination services in pediatric practices. *Pediatrics, 113*, 1517-1529.

Hickson, G. B., Altemeier, W. A., & Perrin, J. M. (1987). Physician reimbursement by salary or fee-for-service: effect on physician practice behavior in a randomized prospective study. *Pediatrics, 80*(3), 344-350.

Hsieh, H. M., Clement, D. G., & Bazzoli, G. J. (2010). Impacts of market and organizational characteristics on hospital efficiency and uncompensated care. *Health Care Management Review, 35*(1), 77-87.

Jaén, C. R., Ferrer, R. L., Miller, W. L., Palmer, R. F., Wood, R., Davila, M., Stange, K. C. (2010). Patient outcomes at 26 months in the patient-centered medical home: National Demonstration Project. *The Annals of Family Medicine, 8* (Suppl 1), S57-S67.

Kazley, A. S., & Ozcan, Y. A. (2007). Organizational and environmental determinants of hospital EMR adoption: A national study. *Journal of Medical Systems, 31*(5), 375-384.

Kelloway, E. K. (1995). Structural equation modelling in perspective. *Journal of Organizational Behavior, 16*(3), 215-224.

Klem, L. (1995). *Reading and Understanding Multivariate Statistics*. Washington, DC: American Psychology Association.

Laine, C., Davidoff, F., Lewis, C. E., Nelson, E. C., Nelson, E., Kessler, R. C., & Delbanco, T. L. (1996). Important elements of outpatient care: a comparison of patients' and physicians' opinions. *Annals of Internal Medicine, 125*(8), 640-645.

Lawrence, P. R., & Lorsch, J. W. (1986). *Organization and Environment*. Boston: Harvard University.

Manchikanti, L., Singh, V., Caraway, D. L., Benyamin, R. M., Falco, F. J., & Hirsch, J. A. (2012). Physician payment outlook for 2012: deja vu. *Journal of Neurointerventional Surgery, 15*(1), 27-52.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin, 103*(3), 391-405.

McDonald, K. M., Sundaram, V., Bravata, D. M., Lewis, R., Lin, N., Kraft, S., Owens, D. K. (2007). Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 7: Care Coordination). *Rockville, MD: Agency for Healthcare Research and Quality*.

McKinlay, J. B., & Marceau, L. D. (2002). The end of the golden age of doctoring. *International Journal of Health Services, 32*(2), 379-416.

Menachemi, N., Mazurenko, O., Kazley, A. S., Diana, M. L., & Ford, E. W. (2012). Market factors and electronic medical record adoption in medical practices. *Health Care Management Review, 37 (1),* 14-22.

Menachemi, N., Shin, D. Y., Ford, E. W., & Yu, F. (2011). Environmental factors and health information technology management strategy. *Health Care Management Review, 36*(2), 1-12.

Miller, D. (1987). The structural and environmental correlates of business strategy. *Strategic Management Journal, 8*(1), 55-76.

O'Malley, A. S., Grossman, J. M., Cohen, G. R., Kemper, N. M., & Pham, H. H. (2010). Are electronic medical records helpful for care coordination? Experiences of physician practices. *Journal of General Internal Medicine, 25*(3), 177-185.

O'Malley, A.S., & Reschovsky,J. D. (2011). Referral and consultation communication between primary care and specialist physicians: finding common ground. *Archives of Internal Medicine, 171*(1), 56-70.

O'Malley, A. S., Tynan, A., Cohen, G. R., Kemper, N., & Davis, M. M. (2009). Coordination of care by primary care practices: strategies, lessons and implications. *Research Briefs, 12*, 1-16.

Pfefferle, S. G., Gittell, J. H., Hodgkin, D., & Ritter, G. (2006). Pediatrician coordination of care for children with mental illnesses. *Medical Care, 44*(12), 1085-1091.

Pham, H. H., O'Malley, A. S., Bach, P. B., Saiontz-Martinez, C., & Schrag, D. (2009). Primary care physicians' links to other physicians through Medicare patients: the scope of care coordination. *Annals of Internal Medicine, 150*(4), 236-242.

Rodriguez, H., von Glahn, T., Rogers, W., & Safran, D. (2009). Organizational and Market Influences on Physician Performance on Patient Experience Measures. *Health Services Research, 44*(3), 880-892.

Rosenthal, M. B., Landon, B. E., & Huskamp, H. A. (2001). Managed care and market power: physician organizations in four markets. *Health Affairs, 20*(5), 187-193.

Schoen, C., Osborn, R., Huynh, P. T., Doty, M., Peugh, J., & Zapert, K. (2006). On the front lines of care: primary care doctors' office systems, experiences, and views in seven countries. *Health Affairs, 25*(6), 555-571.

Schuster, M. A., McGlynn, E. A., & Brook, R. H. (1998). How good is the quality of health care in the United States? *Milbank Quarterly, 76*(4), 517-563.

Scott, W. R. (1982). Managing professional work: three models of control for health organizations. *Health Services Research, 17*(3), 213-240.

Starfield, B. (1998). *Primary care: balancing health needs, services, and technology*: Oxford University Press, USA.

Stille, C. J., McLaughlin, T. J., Primack, W. A., Mazor, K. M., & Wasserman, R. C. (2006). Determinants and impact of generalist–specialist communication about pediatric outpatient referrals. *Pediatrics, 118*(4), 1341-1349.

Tan, J., & Litsschert, R. J. (1994). Environment-strategy relationship and its performance implications: An empirical study of the chinese electronics industry. *Strategic Management Journal, 15*(1), 1-20.

Thompson, J. (1967). *Organizations in action*. New York: McGraw-Hill.

Trinh, H. Q., & O'Connor, S. J. (2000). The strategic behavior of US Rural hospitals: a longitudinal and path model examination. *Health Care Management Review, 25*(4), 48-62.

Venkatraman, N., & Camillus, J. C. (1984). Exploring the concept of" fit" in strategic management. *Academy of Management Review*, *9(3),* 513-525.

Warrick, L., Christianson, J., Williams, F., & Netting, F. (1990). The design and implementation of hospital-based coordinated care programs. *Hospital Health Services Administration, 35*(4), 505-520.

Weech-Maldonado, R., Qaseem, A., & Mkanta, W. (2009). Operating environment and USA nursing homes' participation in the subacute care market: a longitudinal analysis. *Health Services Management Research, 22*(1), 1-7.

Zinn, J. S., Proenca, J., & Rosko, M. D. (1997). Organizational and environmental factors in hospital alliance membership and contract management: a resource-dependence perspective. *Hospital Health Services Administration, 42*(1), 67-86.

CONCLUSION

This dissertation investigated factors that are predictive of care coordination, with particular attention to the role of the external environment. The findings make a number of contributions to the care coordination research literature. First, this study identifies numerous gaps in the existing empirical literature that have studied the predictors of care coordination, with a paucity of care coordination studies related to the external environment. Second, results of study presented in Chapter 2 reveal no empirical studies focused on several healthcare settings, such as nursing homes. Third, results of the study presented in Chapter 3 identify a nuanced and complex relationship between the external environment and care coordination. Finally, the results presented in Chapter 4 show that the relationships between several environmental characteristics and care coordination are mediated by physician reimbursement and the availability of health information technology (HIT). These findings should draw more attention to research on care coordination, particularly to factors that may facilitate or hinder care coordination.

Chapter 2 provides an overview of how factors predictive of care coordination were previously studied and operationalized. Future research can use this information in their study design to adopt previously used measures of predictors of care coordination, thus generating greater reliability of results and making a stronger case regarding the association between the factors predictive of care coordination and care coordination activities. Importantly, the focus on consistency in how the predictors of care coordination are operationalized should not come at the expense of search for other factors that may be associated with care coordination. Despite the established multi-level nature of factors predictive of care coordination (Davies et al., 2008), previous research

has primarily focused on meso-level characteristics, reflective of the organizational level, and largely ignores the individual-level and external environment-level factors. Additionally, the majority of previous studies have examined the predictors reflective of one level only, without appropriately acknowledging the simultaneous influence of factors representing other levels. Therefore, future research should strive to incorporate factors that will be reflective of each level in their study design. It is worth noting that this study found that no research has analyzed the role of the factors predictive of care coordination in several types of healthcare settings, such as nursing homes. Increasing numbers of American people have chronic conditions and are in greater need of coordination of their care. A significant proportion of people with chronic conditions are the elderly, who are more likely to use nursing homes. Yet, little is known about the factors that are associated with better or worse care coordination in these types of settings. This scarcity of research is somewhat contradictory to the premise of care coordination, which is aimed at improving the episodic nature of the current health care system. Therefore, future research should consider analyzing factors predictive of care coordination in many other settings, including and especially the nursing home type setting.

In order to improve our knowledge of care coordination, it is important to use a standardized definition of care coordination, which has rarely been observed in previous studies. Based on a systematic review of the literature, The National Quality Forum (2006) developed a unified definition of care coordination with five distinct dimensions reflective of each aspect of this concept (Forum, 2006). Therefore, a stronger case should be made to use the National Quality Forum definition in future empirical research. The

use of a standardized definition will facilitate a more rigorous analysis and will provide more meaningful information for researchers as well as policymakers and practitioners.

Conceptually, future research can benefit from the adoption of various theoretical paradigms to better understand the relationship between the external environment and care coordination. For instance, the study presented in Chapter 3 showed that resource-dependence theory, which is widely used in strategic management literature, fail somewhat short in fully explaining the relationship between the external environment and care coordination. This may be due to the nuanced and complex nature of the relationship between these two constructs and the challenge to appropriately operationalize each of them. Therefore, future research should identify alternative theoretical paradigms that may provide a better explanation of the complex relationship between the external environment and care coordination.

Results of the study presented in Chapter 4 further support the nuanced and complex relationship between the external environment and care coordination, as it appears to be mediated by physician reimbursement and HIT availability. Future studies should strive to identify other factors that may mediate this relationship, as it may bring us closer to understanding the complexity of relationships between the external environment and care coordination.

This dissertation provides a number of future topics worth consideration. First, due to data limitations, the current study is not able to provide appropriate operationalization of each domain of care coordination as identified by The National Quality Forum (2006). Therefore, future research should consider using appropriate measures for each domain and use them simultaneously in their study design. Second, the

current study derives measures reflective of the external environment from prior research. These environmental measures were not previously applied to care coordination, thus future research may consider selecting other measures to operationalize the environment. Finally, the current study has a cross-sectional design, thus the relationship between the external environment and care coordination can be analyzed as an association only. Therefore, future research should adopt a time-series design to evaluate the longitudinal effects of the external environment on care coordination.

Overall, the results from this study are useful to both researchers and practitioners. Researchers can use these results to extend knowledge of the importance of factors predictive of care coordination in general and the external environment in particular. Future studies of factors predictive of care coordination should strive to incorporate a unified definition of care coordination, simultaneously analyze multiple levels of predictors and apply it in different healthcare settings. Practitioners (e.g., providers and payers) can use these findings to consider the possibility that an organization's external environment may influence the effectiveness of its care coordination activities. These considerations also highlight the potential for using facilitative environmental factors as key leverage points for fostering greater coordination. Overall, this research not only extends knowledge on factors predictive of care coordination, but opens the door for future research benefiting scholarship and practice.

References

Anderson, G., & Knickman, J. R. (2001). Changing the chronic care system to meet people's needs. *Health Affairs, 20*(6), 146-160.

Bielaszka-DuVernay, C. (2011). Improving The Coordination Of Care For Medicaid Beneficiaries In Pennsylvania. *Health Affairs, 30*(3), 426-440.

Bodenheimer, T. (2008). Coordinating care—a perilous journey through the health care system. *New England Journal of Medicine, 358*(10), 1064-1071.

Bodenheimer, T., Chen, E., & Bennett, H. D. (2009). Confronting the growing burden of chronic disease: can the US health care workforce do the job? *Health Affairs, 28*(1), 64-74.

Christakis, D. A., Mell, L., Koepsell, T. D., Zimmerman, F. J., & Connell, F. A. (2001). Association of lower continuity of care with greater risk of emergency department use and hospitalization in children. *Pediatrics, 107*(3), 524-540.

Davies, G. P., Williams, A. M., Larsen, K., Perkins, D., Roland, M., & Harris, M. F. (2008). Coordinating primary health care: an analysis of the outcomes of a systematic review. *Medical Journal of Australia, 188*(8), 65-80.

Dess, G. G., & Beard, D. W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, 52-73.

DeVol, R., Bedroussian, A., & Charuworn, A. (2007). An unhealthy America: The economic burden of chronic disease. *Charting a New Course to Save Lives and Increase Productivity and Economic Growth. CA: Milken Institute*.

Donahue, K., Ashkin, E., & Pathman, D. (2005). Length of patient-physician relationship and patients' satisfaction and preventive service use in the rural south: a cross-sectional telephone study. *BMC Family Practice, 6*(1), 40-60.

Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, *17*, 313-327.

Ehrlich, C., Kendall, E., Muenchberger, H., & Armstrong, K. (2009). Coordinated care: what does that really mean? *Health & Social Care in the Community, 17*(6), 619-627.

Forster, A. J., Murff, H. J., Peterson, J. F., Gandhi, T. K., & Bates, D. W. (2003). The incidence and severity of adverse events affecting patients after discharge from the hospital. *Annals of Internal Medicine, 138*(3), 161-167.

Gilbody, S., Whitty, P., Grimshaw, J., & Thomas, R. (2003). Educational and organizational interventions to improve the management of depression in primary care. *JAMA: the Journal of the American Medical Association, 289*(23), 3145-3151.

Graetz, I., Reed, M., Rundall, T., Bellows, J., Brand, R., & Hsu, J. (2009). Care coordination and electronic health records: connecting clinicians. *AMIA Annual Symposium Proceedings, 2009*, 208-212.

Gupta, V. B., O'Connor, K. G., & Quezada-Gomez, C. (2004). Care coordination services in pediatric practices. *Pediatrics, 113*(Supplement), 1517-1530.

Institute of Medicine (2008). Retooling for an aging America: Building the health care workforce.

Knight, K., Badamgarav, E., Henning, J. M., Hasselblad, V., Gano Jr, A. D., Ofman, J. J., & Weingarten, S. R. (2005). A systematic review of diabetes disease management programs. *American Journal Management Care, 11*(4), 242-250.

Kripalani, S., LeFevre, F., Phillips, C. O., Williams, M. V., Basaviah, P., & Baker, D. W. (2007). Deficits in communication and information transfer between hospital-based and primary care physicians. *JAMA: the Journal of the American Medical Association, 297*(8), 831-850.

McAlister, F. A., Stewart, S., Ferrua, S., & McMurray, J. V. (2004). Multidisciplinary strategies for the management of heart failure patients at high risk for admission: a systematic review of randomized trials. *Journal of the American College of Cardiology, 44*(4), 810-819.

McDonald, K. M., Sundaram, V., Bravata, D. M., Lewis, R., Lin, N., Kraft, S., Owens, D. K. (2007). Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 7: Care Coordination). *Rockville, MD: Agency for Healthcare Research and Quality*.

Nason, C. S., Alexander, G. R., Pass, M. A., & Bolland, J. M. (2003). An evaluation of a Medicaid managed maternity program: the impact of comprehensive care coordination on utilization and pregnancy outcomes. *Journal of Health and Human Services Administration, 26*(2), 239-250.

National Quality Forum (2006). National Quality Forum-endorsed definition and framework for measuring care coordination Retrieved 10/25, 2011, from http://www.qualityforum.org/projects/care_coordination.aspx

Norris, S. L., Nichols, P. J., Caspersen, C. J., Glasgow, R. E., Engelgau, M. M., Jack, L., Garfield, S. (2002). The effectiveness of disease and case management for people with diabetes. *Americal Journal of Preventive Medicine, 22*(4 Suppl), 15-38.

O'Malley, A. S., Grossman, J. M., Cohen, G. R., Kemper, N. M., & Pham, H. H. (2010). Are electronic medical records helpful for care coordination? Experiences of physician practices. *Journal of General Internal Medicine, 25*(3), 177-185.

O'Malley, A. S., Mandelblatt, J., Gold, K., Cagney, K. A., & Kerner, J. (1997). Continuity of care and the use of breast and cervical cancer screening services in a multiethnic community. *Archives of Internal Medicine, 157*(13), 1462-1472.

O'Malley, A. S., & Reschovsky, J. D. (2011). Referral and consultation communication between primary care and specialist physicians: finding common ground. *Archives of Internal Medicine, 171*(1), 56-68.

Patterson, E., Muenchberger, H., & Kendall, E. (2007). The role of practice nurses in coordinated care of people with chronic and complex conditions. *Austalian Health Review, 31*(2), 231-238.

Peikes, D., Chen, A., Schore, J., & Brown, R. (2009). Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries. *JAMA: the Journal of the American Medical Association, 301*(6), 603-615.

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. Stanford Business Books.

Rodriguez, H., von Glahn, T., Rogers, W., & Safran, D. (2009). Organizational and Market Influences on Physician Performance on Patient Experience Measures. *Health Services Research, 44*(3), 880-892.

Shojania, K. G., Ranji, S. R., McDonald, K. M., Grimshaw, J. M., Sundaram, V., Rushakoff, R. J., & Owens, D. K. (2006). Effects of quality improvement strategies for type 2 diabetes on glycemic control. *JAMA: the Journal of the American Medical Association, 296*(4), 427-440.

Stille, C. J., & Antonelli, R. C. (2004). Coordination of care for children with special health care needs. *Current Opinion in Pediatrics, 16*(6), 700-715.

Stille, C. J., McLaughlin, T. J., Primack, W. A., Mazor, K. M., & Wasserman, R. C. (2006). Determinants and impact of generalist–specialist communication about pediatric outpatient referrals. *Pediatrics, 118*(4), 1341-1352.

Thompson, J. (1967). *Organizations in action*. New York: McGraw-Hill.

Venkatraman, N., & Camillus, J. C. (1984). Exploring the concept of" fit" in strategic management. *Academy of Management Review*, *9 (3),* 513-525.

Von Korff, M., Gruman, J., Schaefer, J., Curry, S. J., & Wagner, E. H. (1997). Collaborative management of chronic illness. *Annals of Internal Medicine, 127*(12), 1097-1102.

Windham, B. G., Bennett, R. G., & Gottlieb, S. (2003). Care management interventions for older patients with congestive heart failure. *American Journal Management Care, 9*(6), 447-460.

Wolff, J. L., & Boult, C. (2005). Moving beyond round pegs and square holes: restructuring Medicare to improve chronic care. *Annals of Internal Medicine, 143*(6), 439-445.

Wu, S., & Green, A. (2000). Projection of chronic illness prevalence and cost inflation. *RAND Corporation, October*.

APPENDIX A

Coding Sheet

<table>
<tr><td colspan="4">Title</td></tr>
<tr><td>Year:</td><td colspan="3">Journal:</td></tr>
<tr><td>Volume:</td><td colspan="3">Issue:</td></tr>
<tr><td colspan="4">First author (last name):</td></tr>
<tr><td>Country
US
Non-US</td><td>Study type
Cross-sectional
Longitudinal</td><td>Analytic approach
Quantitative
Qualitative</td><td>Data collection method
Survey
Focus group
Interview
Other</td></tr>
<tr><td rowspan="2">Study design
Experimental
Randomized control trial
Observational
Case study
Cohort study
Case series
Pre/post test
Retrospective review
Other
Not specified</td><td>Facility characteristics
System/chain
Stand alone
Community
Teaching
Governmental
University
Unavailable
Other</td><td colspan="2">Population Surveyed
Physician
Nurse
Healthcare manager
Patient
Other</td></tr>
<tr><td>Organization type
Hospital
Nursing home
Physician practice
Other</td><td>Sample size:
_____

or
unknown</td><td>Direction of relationship between predictor and care coordination
Improving
Not improving
Partially improving</td></tr>
<tr><td>Specialty
Primary care
Specialty care
Other</td><td colspan="3"></td></tr>
<tr><td>Type of predictor
Micro
Meso-process
Meso-structure
Macro- munificence
Macro-dynamism
Macro-complexity
Other</td><td>How many levels of predictors were used?
One
Two
Three
More than three</td><td colspan="2">Relationship between predictor and care coordination
Significant
Non-significant
Not specified</td></tr>
<tr><td colspan="2">Care coordination (definition):
_____</td><td colspan="2">Care coordination (operationalization):
_____</td></tr>
<tr><td>Predictor/s (operationalization):
_____
_____
_____</td><td>Care coordination (measurement):
Binary
Categorical
Continuous
Other
Unspecified</td><td colspan="2">Care coordination (domains):
Single domain
Two domains
Three domains
Four domains
Five domains
Domains are unspecified</td></tr>
</table>

APPENDIX B

IRB Approval Form

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on August 29, 2016. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator: MAZURENKO, OLENA
Co-Investigator(s):
Protocol Number: **E111215002**
Protocol Title: *Contextual Influences on Care Coordination*

The above project was reviewed on 1-24-12. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This project qualifies as an exemption as defined in 45CF46.101, paragraph_____.

This project received EXEMPT review.

IRB Approval Date: 1-24-12

Date IRB Approval Issued: 1-24-12

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301
irb@uab.edu

The University of
Alabama at Birmingham
Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104

APPENDIX C

Project Revision/Amendment Form

Project Revision/Amendment Form

Form version: June 26, 2012

In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.

- **Federal regulations require IRB approval before implementing proposed changes. See Section 14 of the IRB Guidebook for Investigators for additional information.**
- **Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.**

1. Today's Date	06/29/2012

2. Principal Investigator (PI)

Name (with degree)	**MAZURENKO, OLENA**	**Blazer ID**	olenaukr@uab.edu
Department	Health Services Administration	**Division (if applicable)**	
Office Address	1675 University Boulevard, #604, Birmingham, AL, 35205	**Office Phone**	205-586-5256
E-mail	olenaukr@uab.edu	**Fax Number**	205-934-9112

Contact person who should receive copies of IRB correspondence (Optional)

Name	Martha Hilley	**E-Mail**	mhilley@uab.edu
Phone	205-934-3113	**Fax Number**	205-934-9112
Office Address (if different from PI)			

3. UAB IRB Protocol Identification

3.a. Protocol Number	E111215002
3.b. Protocol Title	Contextual Influences on Care Coordination

3.c. Current Status of Protocol—Check ONE box at left; provide numbers and dates where applicable

- ☐ **Study has not yet begun** — **No participants, data, or specimens have been entered.**
- ☐ **In progress, open to accrual** — **Number of participants, data, or specimens entered:**
- ☐ **Enrollment temporarily suspended by sponsor**
- ☐ **Closed to accrual, but procedures continue as defined in the protocol (therapy, intervention, follow-up visits, etc.)**

  Date closed: — **Number of participants receiving interventions:** / **Number of participants in long-term follow-up only:**
- ☒ **Closed to accrual, and only data analysis continues**

  Date closed: 05/01/2012 — **Total number of participants entered:** N/A

4. Types of Change

Check all types of change that apply, and describe the changes in Item 5.c. or 5.d. as applicable. To help avoid delay in IRB review, please ensure that you provide the required materials and/or information for each type of change checked.

- ☐ **Protocol revision (change in the IRB-approved protocol)**
  In Item 5.c., if applicable, provide sponsor's protocol version number, amendment number, update number, etc.
- ☐ **Protocol amendment (addition to the IRB-approved protocol)**
  In Item 5.c., if applicable, provide funding application document from sponsor, as well as sponsor's protocol version number, amendment number, update number, etc.
- ☐ **Add or remove personnel**
  In Item 5.c., include name, title/degree, department/division, institutional affiliation, and role(s) in research, and address whether new personnel have any conflict of interest. See "Change in Principal Investigator" in the IRB Guidebook if the principal investigator is being changed.
  - ☐ **Add graduate student(s) or postdoctoral fellow(s) working toward thesis, dissertation, or publication**
    In Item 5.c., (a) identify these individuals by name; (b) provide the working title of the thesis, dissertation, or publication; and (c) indicate whether or not the student's analysis differs in any way from the purpose of the research described in the IRB-approved HSP (e.g., a secondary analysis of data obtained under this HSP).
- ☐ **Change in source of funding; change or add funding**
  In Item 5.c., describe the change or addition in detail, include the applicable OSP proposal number(s), and provide a copy of the application as funded (or as submitted to the sponsor if pending). Note that some changes in funding may require a new IRB application.

☐ **Add or remove performance sites**
In Item 5.c., identify the site and location, and describe the research-related procedures performed there. If adding site(s), attach notification of permission or IRB approval to perform research there. Also include copy of subcontract, if applicable. If this protocol includes acting as the Coordinating Center for a study, attach IRB approval from any non-UAB site added.

☐ **Add or change a genetic component or storage of samples and/or data component—this could include data submissions for Genome-Wide Association Studies (GWAS)**
To assist you in revising or preparing your submission, please see the IRB Guidebook for Investigators or call the IRB office at 934-3789.

☐ **Suspend, re-open, or permanently close protocol to accrual of individuals, data, or samples (IRB approval to remain active)**
In Item 5.c., indicate the action, provide applicable dates and reasons for action; attach supporting documentation.

☐ **Report being forwarded to IRB (e.g., DSMB, sponsor or other monitor)**
In Item 5.c., include date and source of report, summarize findings, and indicate any recommendations.

☐ **Revise or amend consent, assent form(s)**
Complete Item 5.d.

☐ **Addendum (new) consent form**
Complete Item 5.d.

☐ **Add or revise recruitment materials**
Complete Item 5.d.

☒ **Other (e.g., investigator brochure)**
Indicate the type of change in the space below, and provide details in Item 5.c. or 5.d. as applicable.
Include a copy of all affected documents, with revisions highlighted as applicable.

Change in the title of the study due to the revisions advised by dissertation committee. The new title is: "**An examination of the relationship between the external environment and care coordination".**

Change in the title of the third dissertation paper due to the revisions advised by dissertation committee. The title of the third paper is: "The relationship between external environment and care coordination: mediating role of reimbursement and health information technology (HIT)".

The above mentioned changes did not affect the use of previously described datasets. Specifically, this study used two nationally representative data sources, Area Resource File (ARF) and Health Tracking Physician Survey (2008) Restricted Data File in an effort to better understand the association between external environment and care coordination. The Health Tracking Physician Survey (2008) is a nationally representative data set that contains physician' level information. All participants' information is de-identified and the only information available is the county where physicians are living. The Area Resource File (ARF) contains county-level and physician-practice data and is publicly available.

5. Description and Rationale

In Item 5.a. and 5.b, check Yes **or** No **and see instructions for** Yes **responses.**
In Item 5.c. and 5.d, describe—and explain the reason for—the change(s) noted in Item 4.

☐Yes ☐No **5.a. Are any of the participants enrolled as normal, healthy controls?**
If yes, describe in detail in Item 5.c. how this change will affect those participants.

☐Yes ☐No **5.b. Does the change affect subject participation, such as procedures, risks, costs, location of services, etc.?**
If yes, FAP-designated units complete a FAP submission and send to fap@uab.edu. Identify the FAP-designated unit in Item 5.c.
For more details on the UAB FAP, see www.uab.edu/cto.

5.c. Protocol Changes: In the space below, briefly describe—and explain the reason for—all change(s) to the protocol.

▶

5.d. Consent and Recruitment Changes: In the space below,
(a) describe all changes to IRB-approved forms or recruitment materials and the reasons for them;
(b) describe the reasons for the addition of any materials (e.g., addendum consent, recruitment); and
(c) indicate either how and when you will reconsent enrolled participants or why reconsenting is not necessary (not applicable for recruitment materials).

Also, indicate the number of forms changed or added. For new forms, provide 1 copy. For revised documents, provide 3 copies:
- **a copy of the currently approved document (showing the IRB approval stamp, if applicable)**
- **a revised copy highlighting all proposed changes with "tracked" changes**
- **a revised copy for the IRB approval stamp.**

▶

Signature of Principal Investigator _____ Date 06/29/2012

FOR IRB USE ONLY

☐ Received & Noted ☐ Approved Expedited* ☐ To Convened IRB

_____ 7/3/12
Signature (Chair, Vice-Chair, Designee) Date

DOLA 1/24/12

Change to Expedited Category Y / N / (NA)

*No change to IRB's previous determination of approval criteria at 45 CFR 46.111 or 21 CFR 56.111

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