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A mixed methods investigation of leadership and performance in practice-based research networks

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A MIXED METHODS INVESTIGATION OF LEADERSHIP AND PERFORMANCE IN PRACTICE-BASED RESEARCH NETWORKS

by

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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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ABSTRACT

The objectives of this study were to: 1) create a measure of PBRN clinician member individual performance; 2) produce a rich description of PBRN directors' leadership behaviors and styles; and, 3) identify significant relationships between PBRN director leadership-PBRN clinician member performance. A sequential, exploratory mixed methods design was used to interview and survey PBRN directors and non-director participants. In Phase I, a semi-structured interview guide was used to identify PBRN director leadership behaviors, PBRN non-director performance behaviors and expectations, and decision making activities. A clinician member performance measure was created using a validated behavioral item extraction method. A thematic analysis was conducted on all other data. In Phase II, two quantitative surveys were administered to PBRN directors assessing demographics, membership activity, PBRN productivity, and clinician member performance. One survey was administered to PBRN clinician members assessing their demographics, activity level, and their perceptions of PBRN leadership behaviors. Clinician member performance within PBRNs is a multidimensional construct distinct from participation that is comprised of ownership and engagement aspects, although there is some evidence of a further division into leadership, awareness, follow-through, and communication factors. Collaborative leadership was reported as being distributed to all roles in the PBRN, but is primarily inculcated by a collaborative PBRN director. Time and funding were reported as important resources necessary for the completion of PBRN activities, and are increasingly becoming more limited in their availability. PBRNs engage in a variety of projects and other activities carried out and monitored through ongoing collaborative communication and consensus-based decision making efforts. Top-

down decision making patterns by PBRNs have negative relationships with measures of productivity. Directive and participative leadership behaviors do not appear to have direct relationship with clinician member performance, but years of involvement in current PBRN does have a positive association. However, further investigation is necessary to replicate these findings in larger samples. Aiding busy clinicians with engagement through use of central staff may be beneficial. PBRN directors should focus on strengthening collaborative culture of their PBRN and minimizing barriers to effective communication and decision making.

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CHAPTER I

INTRODUCTION

If we want more evidence-based practice, we need more practice-based evidence.

L.W. Green (2001)

Specific Aims

Practice-based research networks (PBRNs) have fueled healthcare research in clinical settings by providing infrastructure necessary to identify and investigate clinically-relevant research questions. However, PBRNs are highly complex organizations with tremendous variability that makes meaningful evaluation of performance and productivity difficult. This limitation is of great importance considering the millions of dollars the Agency for Healthcare Research and Quality (AHRQ) and other research-minded entities have invested and continue to invest in research conducted by PBRNs.

The AHRQ has provided criteria PBRNs can use to become officially recognized, and one requirement is designation of a PBRN director. PBRN directors are expected to provide leadership by defining missions, recruiting practice sites and researchers, generating research ideas, securing funding, and overseeing completion of research projects. Two major gaps prevent us from understanding leadership-performance relationships within PBRNs: a lack of conceptualization of PBRN participant individual performance and limited information describing PBRN director leadership. Not understanding PBRN leadership-performance relationships is an important problem because PBRN directors can take many actions in their role without knowing which behaviors are most effective. Thus, a critical initial step is to conceptualize PBRN

participant performance, identify PBRN director leadership actions and experiences, and examine leadership-performance relationships.

My long-term goal is to optimize PBRN effectiveness. The objectives of this dissertation were to create a measure of PBRN participant performance and explore PBRN leadership-performance relationships. We expected that PBRN participant performance can be measured reliably, PBRN director leadership experiences and behaviors can be described, and that leadership behaviors were significantly associated with participant performance. As literature from management suggests, worker performance can be measured in a reliable and consistent manner and both leadership behaviors are positively associated with worker performance.

My two-phase study used a mixed methods research design to create a performance measure for PBRN participants, describe leadership provided by PBRN directors, and evaluate leadership-performance relationships within a PBRN context. This study addressed the following aims.

Aim 1) Create a measure of PBRN clinician member individual performance. PBRN directors and participants, including support staff, research investigators, clinicians, will be interviewed to develop a PBRN clinician member performance measure that can be used by all PBRNs.

Aim 2) Produce a rich description of PBRN directors' leadership behaviors and styles. PBRN directors and participants will be interviewed to provide a dense description of their leadership behaviors.

Aim 3) Identify significant relationships between PBRN director leadership-PBRN clinician member performance. PBRN director styles and participative and directive leadership behaviors are hypothesized to be positively associated with PBRN participant performance, but this

relationship may be moderated by PBRN participant characteristics, such as tenure and activity level.

This proposed research was innovative because it created an evaluative framework PBRNs can use to identify relative strengths and weaknesses in their ability to support clinician members in attaining performance expectations. Additionally, this study has advanced leadership research that has only recently unified participative and directive leadership behaviors. Finally, this study utilized a mixed methods design to add credibility and depth in meeting the research objectives. As AHRQ continues work to provide "organizational technical assistance to primary care PBRNs across the country" to help PBRNs become more efficient in conducting research, further research is needed to understand how to make PBRN organizations operate more efficiently.

Significance

Translation of bench science research into health care gains at practices delivering care remains a significant and elusive problem facing the health care research enterprise today (Glasgow, Lichtenstein, & Marcus, 2003; Institute of Medicine, 2001; Sung et al., 2003). Limited input from practicing health care providers in developing research questions and a lack of understanding how healthcare interventions can be implemented in practice fuels this division between research and practice (Atkins & DiGuiseppi, 1998; Sloane, Dolor, & Halladay, 2009). A newly defined nexus dubbed "translational research", serves as intermediary focal points in the research continuum that spans between traditional "bench" research and human-focused "bedside" research and to clinically-focused "practice" research (Genel & Dobs, 2003; Glasgow & Emmons, 2007; Nutting & Green, 1994; Westfall, Mold, & Fagnan, 2007; Woolf, 2008). While some translational research is aimed earlier in the continuum, where basic scientists use innovative and interdisciplinary methods to drive applications of

bench science into early-phase clinical studies, other translational research occurs downstream where application and implementation scientists use creative yet rigorous methods to bring clinical sciences into practices and improve the health of populations.

Practice-based research networks (PBRNs) have served as a new age "laboratory" that explores clinically-driven research questions and tests implementations of efficacious healthcare interventions to determine their real world effectiveness (Fraser, Lanier, Hellinger, & Eisenberg, 2002; Lindbloom, Ewigman, & Hickner, 2004). Practice-based research networks (PBRNs) have been established in the US since the '70s with the hopes of providing organizational infrastructure, resources, and systematized policies and procedures to facilitate practice-based research (Green & Dovey, 2001; Lanier, 2005; Zwar, 2006). Early examples of PBRNs in the US include the regional Dartmouth CO-OP Project and the national Ambulatory Sentinel Practice Network (Green et al., 1984; Nelson et al., 1981).

Complex Organizations with Important Variability

PBRNs are complex organizations comprised of host institutions (primarily academic or large health centers) and clinical practices in which clinicians, researchers, and support staff work together to identify clinically relevant research questions and to conduct studies that address those questions using their own patient populations (AHRQ, 2011; Green et al., 1993; Green, 2000; Green & Glasgow, 2006; Strange, 1993). Research foci vary highly from PBRNs and include such diverse topics as cancer, cardiovascular disease, diabetes, obesity, mental health, disabilities, respiratory illness, substance abuse, and pediatrics just to name a few (Green, Hames, & Nutting, 1994; Nutting, Beasley, & Werner, 1999; PBRN Resource Center, 2012). Most PBRNs conduct 4 studies in a year, but this number ranges from 2-6 (PBRN Resource Center, 2011;

Peterson, Lipman, Lange, Cohen, & Durako, 2012). Additionally, half of all PBRNs have conducted 16 or fewer studies over their existence, while 16% of PBRNs have conducted up to 40 studies and 17% have conducted over 40 studies (PBRN Resource Center, 2011; Peterson et al., 2012). These data suggest variability in the research productivity of PBRNs, one important outcome measure. Additionally, it suggests that there is variation in performance of individuals within the PBRN, including the leaders and participants within each network.

The Agency for Healthcare Research and Quality (AHRQ) has developed a PBRN Resource Center that maintains coordination of PBRN registration through an annual survey and an online database, facilitates communication amongst PBRNs and their participants through web-based applications, and supports PBRN research efforts through educational materials, consultative services, and financial resources obtained through competitive application (PBRN Resource Center, 2011). The AHRQ PBRN Resource Center maintains a registry of active, registered PBRNs that meet or are in-the process of fulfilling criteria and they conduct an annual survey of PBRNs to identify key issues facing PBRN research cataloging efforts across registered PBRNs. As of 2012, there are 165 PBRNs (161 developed and 4 developing) in the US (PBRN Resource Center, 2012). Not all PBRNs operate at a national level. According to 2011 data, PBRNs cover geographic areas either encompass practices nationally (24), regionally (36), state-wide (38), or city-wide (33) (PBRN Resource Center, 2012). These data suggest that PBRNs might have diverse stakeholders and needs as these vary within their geographic areas served.

Further adding to the complexity and variability of PBRNs is the spread of PBRNs to clinical disciplines outside of medicine. Largely developed with a primary care focus, it is only recently that other healthcare professions beyond

family medicine including nursing, pharmacy, dentistry, and dietetics have established PBRNs (Anderko, Bartz, & Lundeen, 2005; Deshefy-Longhi, Swartz, & Grey, 2002; Gilbert et al., 2008; Lipowski, 2008; Marinac & Kuo, 2010; Trostler & Myers, 2003). Interdisciplinary PBRNs have also been established with hopes of generating evidence that captures interdisciplinary delivery of healthcare services couched in team-based care models (Dickerson et al., 2007). According to 2011 data, PBRNs had the following clinician profiles: mixed clinician (49), family medicine (39), other clinician (17), pediatrician (16), internal medicine (6), and nursing (5) (PBRN Resource Center, 2011).While the diversity of PBRNs contributes to the range of research they conduct, these younger developing networks with clinical compositions and research foci may implement different procedural protocols and may have different outcome expectations. Complexity and variability of the PBRN research apparatus makes it difficult to evaluate performance across PBRNs and this is a problem for those wishing to participate, lead, and fund such organizations.

Variability Creates Difficulty for Evaluation

Creating meaningful evaluation tools for PBRNs is an emerging and important area of research. Evaluation of PBRNs is of paramount importance to three fundamental participants in the healthcare research enterprise: funding agencies wishing to allocate financial resources to the most efficient investigators, academic investigators and practice sites participating in or contemplating participation in PBRNs, and PBRN leaders wishing to monitor and improve their PBRN's performance. Support for PBRNs is often provided through public funding agencies and profession associations (Tierney et al., 2007). AHRQ alone has dedicated millions of dollars in financing grants and resource centers aimed to empower PBRN development and research (AHRQ, 2005; Green & Hickner, 2006). Participation in PBRN research has been shown to

be influenced by factors beyond financial incentives alone, such as collaborative relationships fostered with researchers and support staff of host organizations (Bakken et al., 2009; Berg, 2010; Carr, Divine, Hanna, Freeman, & Blumenschein, 2011; Croughan, 2001; Fagnan, Handley, Rollins, & Mold, 2010; Fulda et al., 2011; Gibson et al., 2010; Green, Niebauer, Miller, & Lutz, 1991; Solberg, 2006; Yawn et al., 2010). These audiences need evaluation tools that can help them participate, lead, and fund highly active and efficient PBRNs.

Current conceptualizations of PBRN performance are cumbersome to use as evaluative tools. To date, three conceptualizations have been proposed to evaluate PBRNs as a whole (Clement et al., 2000; Fenton, Harvey, & Sturt, 2007; Hayes, Parchman, & Howard, 2011) and two approaches have been proposed to evaluate the practice sites participating within PBRNs (Carter, Shaw, & Macfarlane, 2002; Doorn, Kocken, Crebolder, Dinant, & Knottnerus, 1999). The initial framework was described as seven objective-based criteria derived from a survey of 22 PBRN leaders in the United Kingdom (Clement et al., 2000). These objectives included development of network infrastructure, development of practice site research capacity, increasing quantity and quality of practice site-led research projects, increasing quantity and quality of research projects with practice site collaboration, increasing quantity and quality of research projects, increasing practice site utilization of research findings, and increasing acceptability of the network to practice sites. This checklist set of criteria was strengthened with management theory describing how each of the criteria factored into a three-construct cycle consisting of strategic emphasis leading to utilization of inputs or physical and social capital, such as structure, process, boundaries, and self-evaluation, to produce potential outputs or intellectual capital, such as research awareness and capacity of practice sites and published articles (Fenton, Harvey, Griffiths, Wild, & Sturt, 2001; Fenton et al., 2007;

Griffiths, Wild, Harvey, & Fenton, 2000). More recently, a logic model framework for evaluating PBRN projects has been proposed in which PBRNs can model inputs, activities, outputs, and outcomes along with indicators for both practice sites and academic investigators (Hayes et al., 2011).

In the comprehensive Primary Care Research Team Assessment (PCRTA), a rigorous accreditation process for practice sites to become eligible for a multi-tiered certification status has been approved for use in the United Kingdom (Carter et al., 2002). Sites must meet pre-established criteria in the following domains: practice organization, strategic planning, practices as a learning organization, research resources and infrastructure, project finding and management, involvement of patients, and dissemination of findings. Dutch researchers have proposed an outcome-driven framework for evaluating PBRN participating-practice sites affiliated with academic institutions with emphasis on research activities and data collection, healthcare quality indicators, and teaching by faculty and others in practice (Doorn et al., 1999).

While these evaluative conceptualizations have stimulated much discussion and debate in PBRN evaluation, their utility for use by all PBRNs is imperfect for assessing the performance of PBRN participants, performance vital for the success of PBRNs. The case study approach proposed by Fenton and colleagues is costly and time-consuming; only the role of clinicians is analyzed in the approach proposed by Doom and colleagues; and, the accreditation approach by the PCRTA is conducted prior to actual PBRN work. Additionally, after using a ten-item checklist exploring the domains of content validity, reliability, feasibility, and practice investment to assess the quality of currently available PBRN evaluation tools and provide systematic critique, researchers concluded that there remains no validated method that could be consistently used for PBRN evaluation (Bleeker, Stalman, & van der Horst, 2010). Systematic research is

needed to create a reliable, usable measure of PBRN participant performance and its antecedents to facilitate proper evaluation and dissemination of information useful to PBRN stakeholders in increasing the efficiencies of their organizations.

PBRN Directors Accountable for PBRN Performance

Focusing on the leadership domain contained in many of the PBRN evaluation frameworks and creating tools around leadership and performance is a novel way to provide PBRN directors needed evaluative information. Leadership structure is central to what an organization is able to produce in fulfilling its mission. AHRQ stipulates having a director as one requirement for certification as an official Primary Care PBRN (PBRN Resource Center, 2012). PBRN directors are usually experienced researchers or clinicians that are responsible for PBRN attain its mission, articulate its vision, acquire resources, actively participate or possess knowledge of all PBRN activities, provide mentoring and other project assistance, perform outreach and recruitment activities, hold meetings, and provide oversight in the administration of their PBRN (Green, White, Barry, Nease Jr., & Hudson, 2005).

Other PBRN participants such as clinicians, research investigators, and support staff form collaborative relationships with PBRN directors in completing tasks associated with PBRN work and help decide strategic direction in some PBRNs (Goode, Mott, & Chater, 2008; Mold & Peterson, 2005). People working in these roles in conjunction with one another form the performance capacity of the PBRN, the amount of output the PBRN is able to produce. The PBRN director has even more tasks and decisions to make when providing leadership for developing PBRNs. These PBRNs often have a limited amount of support staff and fewer participants (Graham et al., 2007). Additional processes associated with PBRN initiation emphasize the immediate necessity of building collaborative relationships and creating an administrative core of advisory

groups (Kuo, Steinbauer, & Spann, 2008; Schommer, 2010). PBRN directors can provide many different forms of leadership without knowing which approaches increases individual performance.

Leadership and Performance Theory

Leadership conceptualizations have evolved from early frameworks focused on personality to more behavioral-based theories. Since the days of Homer, philosophers, theorists, and researchers have proposed ideas of what leadership is and why it is important to organizational effectiveness (Bass & Bass, 2008; Northouse, 2007; Sarachek, 1968; Yukl, 2010). Early notions of leadership centered on ideas of great people and intrinsic personality characteristics that were used to drive organizations toward attaining goals (Bass & Bass, 2008; Northouse, 2007; Yukl, 2010). These "great man" theories of leadership were supplanted by theories that explored leadership behaviors, such as participative (e.g., encouraging subordinates to be active in decision making) and directive (e.g., providing subordinates with clear decisions), that would guide both relationship development and task execution by stimulating motivation of subordinates (Bass & Bass, 2008; Northouse, 2007; Yukl, 2010). Behavioral theories of leadership have evolved to describe charismatic or transformational leaders that inspire followers to achieve greatness or prevail under harsh conditions (Bass & Bass, 2008; Northouse, 2007; Yukl, 2010). While these theories have been useful in accounting for some of significant, positive effects leaders have on organizations, they largely ignored the contextual and situational factors leaders face (Hogan & Kaiser, 2005; Kaiser, Hogan, & Craig, 2008; Yukl, 2008).

Situational leadership theories advanced our understanding of how leaders interact with subordinates and their environment. House (1971) offered a path-goal theory of leadership that stipulated leaders are most effective when

leadership style they possess match the situations they face. In this sense, a leader is most effective when they fit their environmental constraints. Vroom and colleagues later developed a contingency or situational theory of leadership which posits leaders can be adaptive to their situations if they can determine which behavioral style to employ, but largely remain static to change once their leadership style is selected (Vroom & Jago, 2007). One major problem with these theories is the incompatibility of seemingly opposite participative and directive leader behaviors, in spite of evidence that suggests leaders could be both directive and participative in dynamic ways. As suggested in commentary, PBRNs often have varied leadership structures with leaders who utilize many leadership strategies simultaneously (Thomas, Griffiths, Kai, & O'Dwyer, 2001).

In compensating for these deficiencies of previous theory, Sagie proposed a theory of loose-tight leadership that posits leaders may exhibit both participative (loose) and directive (tight) behaviors together to increase subordinate performance (Sagie, 1997a). He hypothesized that a leader is likely to provide a framework (directive) in which they direct dialogue with followers and help align decisions with the organizational mission and values while they may also allow for substance (participation) about what decisions are made and how tasks are executed to be made by subordinates (Sagie, 1997a). This is just one example of the contingency, the decision making aspect, in which loose-tight leadership may be applied, others could work in a similar vein (Sagie, 1997b). As leaders and followers interact in interpersonal contact, the leader exhibits a dynamic set of behaviors that both guide and empower the follower. Additionally, characteristics of the leader and subordinates can moderate the effect of leadership on subordinate performance (Sagie, 1997b).

Understanding performance is rooted in the jobs people perform. Performance measurement has long been thought of by industrial and

organizational psychologists as a means to reward effective and modify ineffective behaviors of workers (Harvey, Anderson, Baranowski, & Morath, 2007; Pulakos, 2007). Performance measurement of workers can be informed through development of critical incidents. Behavioral and trait-based scales rely on raters comparing observed with expected traits workers possess and behaviors workers perform to provide a quantitative or qualitative rating. These scales are representative of performance conducted by workers for a given period of time and can be used for analytical purposes as criteria (Pulakos, 2007).

Proposed Theoretical Framework

The initial conceptual framework for this study rooted in theories of loose-tight leadership and performance evaluation is found in Figure 1. It examines how leadership behaviors and styles are related to PBRN participant performance. PBRN director leadership behaviors are thought to provide direct effects on PBRN participant performance.

Innovation

This dissertation will generate information that PBRN directors, participants, and policy makers can use to inform their decisions about participating in and funding PBRN research. This project provides three unique practical, theoretical, and methodological innovations. It will be the first study to test significant relationships between leadership and performance in PBRNs. Second, it will advance the field of leadership research by expanding our understanding of situational leadership theories. Finally, it will use a mixed methods approach to collect and analyze field data collected from active PBRNs.

PBRN Leadership Performance Relationships

Leadership has been described as an essential component of PBRNs (Green et al., 2005; Nutting, 1996). However, leadership structures are highly variable across PBRNs with both top-down and bottom-up approaches, in which

directors and participants interact to make decisions, have been identified (Thomas et al., 2001). No single study has explored specific leadership behaviors of PBRN directors and their effects on PBRN participant performance. Leadership behaviors have been shown to influence subordinate job performance in achieving organization missions and goals in other industries and settings (Katzell, Miller, Rotter, & Venet, 1970; Nutt, 1986; Sagie & Koslowsky, 1994; Tetrick, 1989; Thiagarajan & Deep, 1970; Thomas et al., 2001). Additionally, calls for more research using theories of organizations and leadership have been made (Hogan, 2012). Leadership behaviors can be richly described and these rich descriptions can serve as a basis for quantitatively testing for significant leadership-performance relationships in PBRNs. This study will be the first undertaken to build evidence for such a relationship in a PBRN context.

Advance Understanding of Situational Leadership

While leadership studies have remained prevalent in the literature over the past 60 years and many theories have been proposed to describe the leadership phenomena, little agreement exists amongst scholars about which theories best describe how leadership works (Bass & Bass, 2008; Northouse, 2007; Yukl, 2010). Situational leadership theories were developed in part as a response to shortcomings of previous theories that focused on leader personality and inflexible leader behaviors that inadequately described leadership effects on subordinates (Vroom & Jago, 2007). The loose-tight leadership theory was proposed by Sagie to acknowledge the ability of leaders to be both directive and participative in their leadership style in a dynamic manner as situations or subordinates needed (Sagie, 1997a; Sagie, 1997b). While empirical studies have investigated theoretical propositions made in the loose-tight leadership theory, testing contextual boundaries of the theory may prove beneficial. This project

will add to the extant leadership literature by testing leadership-performance relationships in a networked organization.

Utilize a Mixed Methods Approach

Studying leadership in the context in which it is found is important, especially as organizations gain complexity, in terms of limited resources, interdependent structures, and organization-spanning relationships (Bryman, 2004). A mixed methods research design is particularly useful for exploring leadership and performance within PBRNs because limited data are available in the PBRN literature to support wide use of generally accepted and validated instruments of either performance or leadership, as would be done in a typical survey design. Qualitative research can be used as a means to conceptualize how PBRN participants perform their jobs and how PBRN directors can influence that performance through provided leadership.

This study will create evidence in a manner that independently conducted qualitative and quantitative studies alone cannot (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Creswell & Plano Clark, 2007; Hurley, 1999; Office of Behavioral and Social Sciences Research, 2001). Instruments measuring leadership behaviors perceived by PBRN participants and PBRN participant performance can be created through qualitative inquiries; and, quantitative methods can be used to test for significant relationships (Bryman, 2004). Findings from this innovative study will speak directly to PBRN directors, participants, and funding agencies looking to increase performance of PBRNs and improve their impact on the healthcare research enterprise.

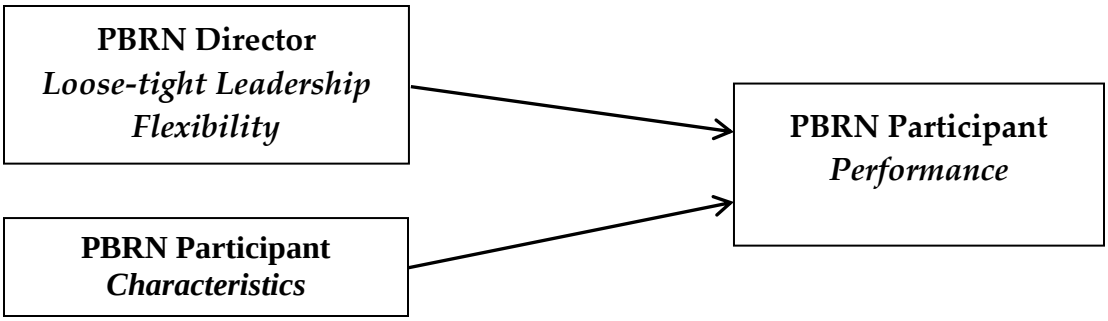

Figure 1. Initial Conceptual Framework

CHAPTER II

LITERATURE REVIEW

This chapter presents an in-depth exploration of literature relevant to Practice Based Research Networks (PBRNs), leadership, and individual performance. These areas help explicate the conceptual framework underpinning the hypotheses and explorations of this study into how leadership provided by PBRN directors influences PBRN participants and their performance. Each section presents extant literature that was used in framing research necessary to complete the specific aims of this project.

A general history of PBRNs as practice-based research laboratories and description is first introduced. PBRNs are then defined as organizations with complexity and diversity. Current PBRN evaluation literature is presented next with an emphasis on identifying gaps in our knowledge. A discussion of PBRN positions concludes the section.

Leadership theories and the empirical evidence supporting and challenging propositions are presented in the next section. A brief history of leadership theories and empirical research is presented first. Then a discussion of situational leadership theories is presented to narrow the focus of the discussion on the role of leadership flexibility. A loose-tight theory of leadership is presented to highlight the role of leadership flexibility in decision making. The leadership section concludes with a rationale for applying the loose-tight leadership theory to the PBRN context.

Measurement of individual performance in organizational settings is discussed in the next section. The scope of performance measurement is presented first. Then literature examining the best ways to measure performance includes rating formats, scaling, and antecedents to performance ratings are

critically discussed. Psychometric properties including halo, leniency, central tendency, and reliability are presented to close the section.

Finally, research questions are presented that will guide qualitative inquiry into conceptualizing leadership and performance in PBRN settings. Additionally, hypotheses are presented when applicable that will guide quantitative inquiry in the nature of leadership-performance relationships.

To conduct this literature review, search terms such as practice-based research networks, primary care research networks, practice-based research, translational research, evaluation, leadership, job performance, and work performance were used to search PubMed, PsycINFO, and Google Scholar databases. No date restrictions were applied to the literature search. Additionally, reviews of reference lists of articles identified during the literature search were made.

PBRNs

The Agency for Healthcare Research and Quality (AHRQ, 2011) has defined a primary care PBRN as:

> a group of ambulatory practices devoted principally to the primary care of patients. Typically, PBRNs draw on the experience and insight of practicing clinicians to identify and frame research questions whose answers can improve the practice of primary care. By linking these questions with rigorous research methods, the PBRN can produce research findings that are immediately relevant to the clinician and, in theory, more easily assimilated into everyday practice.

While this definition emphasizes the focus of primary care practice sites in PBRNs, they often are more complex than just practice sites alone. Practice sites collaborate with research investigators from academic or consultative entities acting as host sites to house PBRN infrastructure (Fagnan et al., 2007; Goode, Mott, & Chater, 2008). Additionally, professional associations, such as the American Academy of Family Practitioners and the American College of Clinical

Pharmacy, have served as host organizations of nationally dispersed PBRNs (Fraser et al., 2002; Marinac & Kuo, 2010).

PBRNs Bridge the Gap in Healthcare Research

PBRNs were developed as a means to bridge the gap in the healthcare research continuum between clinical research conducted in academic health centers and community practice sites where a majority of patients are treated. The Institute of Medicine (2001) has reported that poor translation of efficacy research has resulted in millions of dollars in waste and poorer health outcomes. Difficulties in enrolling study participants, a lack of information technology, an inadequate supply of trained investigators, and insufficient funding plague current clinical research efforts (Sung et al., 2003). PBRNs can overcome some of these challenges.

Efficacy research primarily conducted in academic health centers using randomized-control trial (RCT) design often fail to include patient preferences, risk assessments, economic decision analysis, and other contextual factors known to affect the implementation and uptake of healthcare interventions in real world settings (Atkins & DiGuiseppi, 1998; Glasgow & Emmons, 2007). Therefore, these studies often lack external validity and fail to explore propositions for why implementation does not easily occur in practice (Green & Glasgow, 2006). PBRNs could overcome these challenges; however, funding opportunities for practice-based research are limited relative to the abundance of federal funding given to basic biomedical research (Green & Dovey, 2001).

Research conducted in PBRNs rests at the interface of healthcare providers and patients, an area often ignored by researchers and undervalued by funders of healthcare research (Green, 2001; Nutting & Green, 1994; Westfall et al., 2007). PBRNs provide an alternative laboratory to traditional research by conducting studies in community practices with treatments by healthcare professionals

focused on improving community health through primary care or family practice medicine (Lindbloom et al., 2004). Advantages to PBRN research include the identification of practice-relevant research questions, an ability to produce a larger and more generalizable sample of patients and practitioners for research studies, and the creation of an infrastructure geared toward community research (Green et al., 1993; Strange, 1993; Strange, 1993). This makes PBRNs well suited to address the needs of translational research in healthcare from bedside to community practice.

A Brief History of PBRNs

Many intellectually curious and independently acting physicians pioneered work in practice-based research of primary care. Physician-researchers, including James Mackenzie, Will Pickles, John Fry, and Curtis Hames, sought to collect information about people they were treating and the contexts from which their patients' diseases developed (Green, 1999). While these physicians paved the way for practice-based research, a tipping point came in the form of enhanced recognition of family practice medicine in community settings and the establishment of the first national PBRN.

Another major impetus pushing forward primary care and its associated research is the development of the medical specialty of family practice (Green, 1999). As medicine turned to specialization, it was through the formalization of creating a specialty that family medicine and care delivered by medical professionals in the community began to gain legitimacy and recognition.

Early Networks

The Ambulatory Sentinel Practice Network (ASPN) was the first example of a National PBRN formed in the late 70's from an earlier regional network of practitioners in the Colorado area. Its primary goals were to serve as a laboratory for practice-based research and to provide surveillance of primary care

influences on population health (Green et al., 1984). At its core was primary care practice sites dispersed throughout the country. Connecting these sites through electronic means became the hallmark of that PBRN, which was sometimes referred to as a virtual network (Nutting, 1999).

Another early effort was the Dartmouth Cooperative Primary Care Research Network (COOP) (Nelson et al., 1981). The COOP was a regional PBRN based in the Northeast that was established to investigate primary care delivery including informatics, decision making, and education (Wasson, 1999). Unique to the COOP was a patient-centered focus that was created by asking "What matters to patients?" The success of the COOP in integrating research into practice led to 50 publications from 11 studies in its first two decades of operation (Wasson, 1999).

Additionally, PBRN research was beginning to take hold internationally in the 70s. The United Kingdom provided substantial public funding for the development of practice-level infrastructure for conducting research (Carter et al., 2002). Practitioners in Canada and Yugoslavia utilized community reporting mechanisms to collect information on health status and disease management (Green & Hickner, 2006). Recently, Australia was looking to establish sentinel reporting networks in community settings (Zwar, 2006).

Funding

Federal funding has primarily been championed through grants awarded by AHRQ and the National Institute of Health (NIH). AHRQ has provided over 8 million dollars in support of establishing PBRNs and has funded the PBRN Resource Center which provides support and guidance to PBRNs across the country through training and networking (Bourman & Neale, 2011; Lanier, 2005). The NIH's Clinical and Translational Science Awards (CTSA) program was launched in 2006 with the goal of "accelerating discoveries toward better health"

through research conducted at the bedside and in practice-based settings (National Institutes of Health, 2012). PBRNs have taken advantage of CTSA funding through their academic host institutions to provide funding for full-time personnel and research activities (Bakken et al., 2009).

Other Professions Adopt PBRN Framework

Having seen its utility in advancing research in primary care, other disciplines have adopted the PBRN model by integrating themselves into primary care PBRNs or creating their own networks. Pharmacy, dietetics, dentistry, and nursing have all adopted the PBRN model for creating evidence to support evidence-based practice within their professions. Nursing and pharmacy are particularly interested in studying effects of advanced training and trying to provide justification for reformed payment structures (Anderko et al., 2005; Lipowski, 2008).

Defining PBRNs as Organizations

Adhering to boundary conditions is important in conducting theory-based research studies. The theories used in this study come from organizational literature and are bound in the context of organizations. Thus, defining PBRNs as organizations is necessary.

Characteristics of an Organization

In their review of organizational literature, Allison and Zelikow (1999) identified five aspects for defining organizations:

1) "organizations are groups of individual human members assembled in regular ways, and established structures and procedures dividing and specializing labor, to perform a mission or achieve an objective";

2) organizations possess the ability to accomplish tasks an individual alone could not complete;

3) organizations accomplish future tasks closely related to tasks they currently perform;

4) organizations create normative behaviors that manifest through informal and formal mechanisms; and,

5) organizations possess technological capabilities through resource acquisition and refinement of those resources in fulfilling their mission.

Thus, organizations represent a mission-driven collective of individuals capable of accomplishing significant tasks through the acquisition and use of resources as enacted through normative and cohesive behaviors.

PBRNs are Organizations

Using this conceptual lens, PBRNs can be defined as organizations. First, a PBRN has a distinct guiding mission statement, a set of members with specialized positions, and an infrastructure that facilitates communication and resource use. PBRN mission statements usually focus on improving care of patients, improving practice environments, and furthering understanding of medical care through systematic inquiry.

Another example of organizational behavior of PBRNs is through the use of symbols. Many PBRNs have acronyms, such as IRENE (Iowa Research Network), to denote their name or other characteristics, such as geographic location or research foci. Additionally, some PBRNs create logos to include on all communication forms. Symbols are a powerful way to create unity within an organization and to communicate organizational values and missions to external stakeholders in a quick memorable way (Deshefy-Longhi et al., 2002). These symbols allow individuals to create an emotional connection to the organization through a process of sense making of highly complex cultural information (Bolman & Deal, 2008).

Second, a PBRN can create new knowledge and advance clinical practice in ways that individual practitioners or health service investigators alone could not. As mentioned previously, many early pioneers engaged in research to better understand clinical practice; however, the extent of their research was limited. PBRNs provide infrastructure and collective power to compete for research funding and engage in research on scales not achieved through individual physicians conducting research. For example, in enrolling patients for studies, 80% of PBRNs have enrolled over 100 patients, 53% have enrolled more than 1,000 patients, and 2% have enrolled more than 10,000 patients (Tierney et al., 2007).

Third, a PBRN has a research focal area, uses a consistent set of procedures, and examines specific populations in conducting their current research which lays the foundation for all future research endeavors they complete. Many PBRNs focus on specific research areas, either as conditions common to their practice partners' settings contained in the PBRN or the external funding agency predominately utilized to support PBRN activities. Specific populations are often explored by PBRNs in both geographic and demographic ways. That is, a PBRN can sample from a state, a region, or national population of patients they serve or according to patient demographics, such as pediatric or other specialties. Also, many PBRNs collect data using survey and electronic record reviews while relatively few ~25% conduct RCTs (Sloane et al., 2009).

Fourth, a PBRN has formal and informal policies and procedures for accomplishing research tasks. Communication channels form by using consistent modes of communication, including newsletters and electronic web-based messages (Fulda et al., 2011). Also, processes provide consistent opportunities for community participants and practice sites to provide feedback to PBRN central staff (Dickerson et al., 2007). Research protocols are developed to guide data collection at practice sites and can be either project specific or consistent across

projects (Kuo et al., 2008). These processes and procedures create the nervous system of the organization guiding how actions are preformed and who will be involved.

Finally, a PBRN acquires and consumes technological resources enabling its members to perform research. All PBRNs utilize some form of communication technologies and some of the most successful PBRNs possess capability to collect electronic medical information from practice sites. Additionally, many PBRNs are interested in electronic surveillance of health issues and seek to establish interconnected systems of shared electronic medical records (Green et al., 1984). These advanced information technologies require vast amounts of up-front capital; however, the benefits of creating the electronic infrastructure are also great (Nutting, 1996; Schommer, 2010).

In addition to labeling PBRNs as distinct organizations, they may also be described as complex. Current demographic characteristics of PBRNs have been identified by the PBRN Resource Center (PBRN Resource Center, 2012). These demographics, presented in the introduction, help characterize PBRNs as complex organizations that undergo dynamic change over time on a number of aspects, including geographic dispersion, clinical practice composition, research focus, and leadership. As demonstrated through the literature above and registry data, PBRNs are organizations with complexity and diversity.

Evaluating PBRNs

One important aspect for ensuring PBRNs can work effectively is creating meaningful evaluation tools for PBRNs. This research is in the initial stages of development. This emerging area is important to funding agencies, PBRN directors, and academic investigators. To date, three frameworks have been proposed to evaluate PBRNs as a whole (Clement et al., 2000; Fenton et al., 2007;

Hayes et al., 2011) and two approaches have been proposed to evaluate practice sites participating in PBRNs (Carter et al., 2002; Doorn et al., 1999).

PBRN Effectiveness

The PBRN evaluation framework concept proposed by Clemet et al. (2000) was an objective-based criterion set derived from a survey of 22 PBRN leaders in the United Kingdom. Process and outcome indicators were created for seven objectives:

1) Development of network infrastructure;

2) Development of practice site research capacity;

3) Increasing quantity and quality of practice site-led research projects;

4) Increasing quantity and quality of research projects with practice site collaboration;

5) Increasing quantity and quality of research projects with practice site participation as subjects;

6) Increasing practice site utilization of research findings; and,

7) Increasing acceptability of the network to practice sites.

While many objectives are centered on practice site improvement and outcomes, the ability of this framework to provide a testable set of criteria to measure across PBRNs was not established. Specifically, mechanisms underlying the presence of the objectives were not well described.

Fenton, Harvey, and Sturts' (2007) PBRN evaluation framework was based heavily on organizational science literature and elaborated the objectives principles of the earlier PBRN evaluation model. Their model consisted of three perpetually cycling constructs: 1) objectives or strategic emphasis leading to utilization of inputs or physical and social capital, such as structure, process, boundaries, and self-evaluation; 2) to produce potential outputs or intellectual capital, such as research awareness; and, 3) capacity of practice sites and number

of PBRN published articles. From these constructs, eight dimensions were identified: strategic emphasis, policy, network structure, research infrastructure, network processes, process facilitation, network boundaries, and self-evaluation were able to be evaluated by independent investigators using a case-study approach. While this evaluation model expands on the objectives-based approach of earlier models, it relies solely on a method of evaluation that is cumbersome for PBRNs to facilitate and inhibits meaningful comparisons across PBRNs.

A logic model framework for evaluating PBRNs has been proposed by Hayes, Parchman, and Howard (2011). In their model, inputs, activities, outputs, and outcomes along with their metrics for both practice sites and academic investigators are identified; additionally, assumptions about relationships between items being tracked are stated up front. This framework can then be used to measure the identified constructs for evaluative purposes and to modify performance expectations based on changes in any of the expected values. While this approach is unique in acknowledging assumptions in relationships across measurable outcomes, it does not provide a testable criterion for evaluation across PBRNs.

Practice Site Effectiveness

While not directly evaluating the effectiveness of PBRNs as an organizational whole, practice site evaluation criteria can provide insight into how influential processes of practice partners should impact their collaborative partners. In the United Kingdom, funding of PBRNs is based on assessment and certification. The Primary Care Research Team Assessment (PCRTA) stipulates that sites must meet pre-established criteria in practice organization, strategic planning, commitment to principles of learning organizations, research resources and infrastructure, project finding and management, involvement of patients,

and dissemination of findings (Carter et al., 2002). The PCRTA outlines a two-level system of accreditation in which practice sites can demonstrate minimal acceptable standards for developing a collaborative model of practice-based research (i.e. Level I) or provide evidence of a level of excellence and experience in conducting such work (i.e. Level II) (Carter et al., 2002). Using the established criteria, an assessment team conducts a half-day site visit to gather data to inform the accreditation (Carter et al., 2002).

An outcomes-focused framework for evaluating practice sites was described by Dutch researchers (Doorn et al., 1999). They proposed examining research productivity in terms of data collection, quality of healthcare services provided, and teaching conducted. These criteria have been used in academic health center settings where all three activities of research, teaching, and service are required but are generally not what is expected for practice sites in community settings.

While these evaluative models can be useful in identifying downstream outcomes expected for practice sites participating in an effectively functioning PBRN, they do little to describe performance standards for individuals fulfilling roles within a specific PBRN.

Need for New Evaluative Frameworks

Bleeker, Stalman, and van der Horst (2010) used a ten-item checklist exploring the domains of content validity, reliability, feasibility, and practice investment to assess the quality of currently available evaluation tools for use by primary care research networks. After their exhaustive review and systematic critique, they concluded that while a couple of evaluative frameworks have been proposed at organization and practice site levels, there is no validated method that could be consistently used for PBRN evaluation. They determined PBRN evaluation tools were poorly validated, inadequately described, cost prohibitive,

or having limited evidence for their use. Effective use of resources by PBRNs remains unknown (Peterson et al., 2012).

Specialized Positions of PBRN Members

Health care practitioners, PBRN directors and/or advisory boards, central support staff, and principal investigators are considered the four specialized positions necessary for conducting practice-based research within a PBRN organizational framework. Each position makes a unique contribution to a PBRN through the efforts and abilities of individuals filling those positions. The individual performance of these participants together creates the effectiveness of PRBNs. It is through participant efforts, led by a director, that a PBRN can fulfill organizational mission and provide value to the healthcare research enterprise. Creating a measure of individual performance will help improve our understanding of PBRN effectiveness in a manner that is assessable across PBRNs.

Health Care Practitioners/Practice-site Champions

Each practice site that comes together to form a PBRN often has a champion of practice-based research in the form of a clinician, nurse, or office manager (Nagykaldi, Mold, Robinson, Niebauer, & Ford, 2006). These champions carry out the work of the PBRN at the practice site. Often, these participants do not have training in statistical methods or research design and their case loads are high (Deshefy-Longhi et al., 2002). Clinicians and other champions do not receive consistent financial incentives beyond individual studies and are often asked to volunteer for any efforts pre and post specific research projects (Hahn, 1999).

Research on PBRN or practice-based research participation has primarily focused on clinicians. Several antecedents to clinician participation have been identified through surveys and qualitative studies. Having the potential to create

or already possess strong relationships with researchers and other members of the PBRN, the reputation of the host organization, the protection of clinician time in completing research tasks, the provision of financial incentives and information about relative quality information, the development of communication channels, and mutual respect are all important factors for successfully recruiting clinicians for research participation (Solberg, 2006).

Some practitioners desire training in research and the ability to help advance their profession through new knowledge creation without having to leave practice (Fagnan et al., 2010; Gibson et al., 2010; Yawn et al., 2010). Other studies have identified mentorship and training as important considerations for participation (Bakken et al., 2009). Another study examined clinician discontinuation from a PBRN and found that internal changes to the practice site and "fatigue" or burnout from "participating in all the studies" were major threats to clinician involvement over the long term (Green et al., 1991). Additional research supports the use of clinical staff and relief personnel provided by the PBRN to assist during research activities in overcoming some of the barriers to participation (Carr et al., 2011). Research on PBRN participation by clinicians highlights the importance of human motivation. This research identifies esteem needs of practicing healthcare professionals participating in PBRNs as a strong motivator beyond financial incentive (Maslow, 1943).

Principal/Co-Investigators

Academicians, most of who serve as principal investigators for individual studies, are highly trained in statistical methods and research design. Therefore, a majority of the principal investigators (PI) role is preparing grant applications, designing studies, and directing data collection and analyses (Mold & Peterson, 2005). Quality control in PBRN studies is the most difficult aspect for the PI to maintain, making essential trust they have in clinical partners (Fleming, 1999). As

one person typically is responsible for preparing manuscripts, the principal investigators often take on the manuscript writing task (Green, 2000). However, academics must also be able to suppress the tendency to do research extensively in areas of their own interests, as many ideas generated in the PBRN model may not fit cleanly into their research stream (Mold & Peterson, 2005).

Additionally, it is often the relationship with researchers that helps initiate clinician participation in research (Croughan, 2001; Green et al., 1991). Thus, researchers can provide important social ties that help form and maintain a cohesive PBRN. While participation incentives for academicians have received little attention in the literature, some descriptions do exist. Academicians like being able to address big questions in areas of research that matter. Patient oriented evidence that matters is easily built by conducting studies in PBRNs (Fleming, 1999).

Central Support Staff

Central support staff can include the assistant directors, coordinators, administrative assistants, and research assistants. A central staff aids the PBRN in conducting regular meetings within the administrative core and with the PBRN membership, soliciting research ideas, conducting pilots of projects suggested by PBRN members, assisting in study design, data collection, and analysis, and maintaining a list of active members in the PBRN (Croughan-Minihane, 1999).

A coordinator or assistant director is the chief person responsible for handling day-to-day operations of the PBRN (Green et al., 2005). Their three main jobs are to provide research management, infrastructure administration, and assistance to the director (Green et al., 2005). In fulfilling these roles, the coordinator or coordinators can develop protocols for research, hire and train research support staff, organize research workflows, create and distribute PBRN

communications, oversee website or technological capabilities, recruit new PBRN members, help communicate PBRN goals to the community, and maintain PBRN directory and demographic information (Green et al., 2005).

PBRN Directors and Advisory Groups

PBRN directors are generally researchers or clinicians with training in study design and experience in conducting research (Green et al., 2005). They ensure appropriate use of resources in completing the mission of the PBRN as well as the acquisition of additional resources (Green et al., 2005). Outreach to external stakeholders are important tasks considering the amount of resources a PBRN needs to sustain an infrastructure sufficient for conducting practice-based research.

Additionally, PBRN directors have been called "zealots with a purpose" in describing their need to have strong internal motivation and an interest in promoting the vision of PBRN research to others (Anderko et al., 2005). They are expected to help PBRN members conduct the studies through support and mentorship. With all of these responsibilities, it is important that the director be allocated at least 50% time for PBRN work if not more (Green et al., 2005).

Boards are required to receive recognition as a primary care PBRN by the AHRQ (Green et al., 2005). These boards provide administrative oversight and strategic coordination of PBRNs. Patient representation may be on this board or a separate advisory board. Patient representation ensures practice-based research is relevant to community needs.

Research is needed to address conceptual gaps in the PBRN literature. Effectiveness and performance within PBRNs is not well understood. Leadership provided by PBRN directors remains elusive and the effects of such provided leadership by PBRN directors on productivity and performance are not established.

Leadership

PBRN directors are expected to provide leadership to their PBRNs. Descriptions of leadership provided by PBRN directors and advisory groups are thin in the literature. Without adequate description and testing of leadership behaviors, clinical practice sites and host organizations looking to develop PBRNs and currently functioning PBRNs will not have enough information to function at optimal efficiencies. One area where disagreement exists among PBRNs is the leadership approach, while supporters of either a bottom-up or top-down approach have reasons for their beliefs. Integrating current knowledge from extant literature about the phenomena of leadership into research evaluating PBRN infrastructures can help guide studies necessary to create rich descriptions of leadership behaviors and test relationships of effective leadership behaviors necessary for maximizing PBRNs' success.

A Brief Introduction to Leadership Research

Even though leaders have been described throughout the course of human history, leadership is a relatively new term in conceptualizing how leaders influence subordinates. Many definitions of leadership exist. One of the most comprehensive definitions of leadership developed from a consensus committee of representatives from 62 countries is: "leadership was the ability to influence, motivate, and enable others to contribute to the effectiveness and success of the organizations of which they are members (House, Hanges, Javidan, Dorfman, & Gupta, 2004)." This definition captures the relationship between leadership and organizational effectiveness and describes the extent to which that relationship could be mediated through individual interactions with other members of their organization.

Early Concepts of Leadership

Since the time of Greek philosophers, people have been curious about the role of individuals in shaping the success and failures of groups. Leadership qualities and errors when these qualities are overused were described by Homer through four exemplar leaders: Agamemnon (leadership quality: legal authority/justice; error: vengeance), Zeus (judgment; misjudgment), Nestor (wisdom), and Achilles (valor; half-heartedness) (Sarachek, 1968). The ancient civilizations of Egypt and China wrote of leaders who were authoritative and provided moral example for people to follow (Bass & Bass, 2008).

As ancient times gave way to modern man, new techniques based in science gathered evidence supporting the phenomena of leadership. Groundbreaking work in leadership at the turn of the 20th century provided observational evidence about leadership presence and consequences in animals, primitive humans, and children (Terman, 1904). In that work, leaders were shown to be distinct roles in social groups and were given special privileges by other members of the group.

Great Man and Trait-based Theories

Early theories of leadership placed emphasis on personality and other trait-based characteristics of leaders. These "great man" theories of leadership described leaders in terms of static qualities. These leaders were seen as warriors in battle, presidents with power and privilege, or unique individuals with great talents and traits (Bass & Bass, 2008). These theories also emphasized the lineage of a leader that insinuated a majority of leadership is emulated in individuals with a pedigree suited for such distinction.

A fundamental shift in the era of researching personality effects in leadership is based on Stogdill's comprehensive review (Stogdill, 1948). In his review of the literature, he summarized six distinct categories of personal aspects

that have associations with leadership, including capacity (e.g., intelligence and judgment), achievement (e.g., knowledge and scholarship), responsibility (e.g., dependability and initiative), participation (e.g., sociability and activity), and status (e.g., popularity and socioeconomic status) (Stogdill, 1948). However, the relationship with these traits only partially describes the effect of leadership success. It is only through combinations of personal aspects, interactions of situational factors, and the implementation of leadership behaviors that more fully describe a leader's effectiveness. Ever since this pivotal review, leadership has not lost interest in personal aspects of leaders, but has begun to emphasize the importance of other factors that affect leadership success.

Behavioral Theories

As empirical tests highlighted the inability of personality and other trait-based theories to describe the major effects of leadership, newer theories took adopted a behavioral lens to identify meaningful actions and tactics used by effective leaders. Studies conducted by researchers at Ohio State found that leaders performed two basic functions, initiating tasks and providing individual consideration (Bass & Bass, 2008). University of Michigan researchers expanded on this paradigm by adding the concepts of work and interaction facilitation (Bowers & Seashore, 1966). Yukl advanced the idea of behavioral measurement in leaders further by explicating a list of behaviors (Yukl, 2010). He also strongly suggested linkages between leadership behaviors and contingent situations (Yukl, 2008).

Situational Theories of Leadership

One large category of leadership theories that focus on situational contexts is the focus of this dissertation. As Stodgill (1948) argued in his review of personal aspects influencing of leadership effectiveness, *situation* has a powerful association with leadership that represents an interactive effect between a

leader's environment, and context, on how leadership helps influence performance and effectiveness. Thus, the ability for leadership to be contingent on aspects unique to the contexts for which leaders lead is placed under closer examination.

Contingency Theory

Fiedler proposed a model to describe success of leaders based on two factors, the behaviors exhibited by the leader and the match with the situation the leader confronts (Fiedler, 1971). In that theory, leaders were identified as being oriented to task or relationships (Fiedler, 1971). This orientation then was matched with the situation they faced to determine to effectiveness of that leader. Situations were defined according to three dimensions: task structure, leader-member relations, and positional power (Fiedler, 1971). These dimensions were evaluated dichotomously according to a median score, producing a total of 8 contingent situations. Laboratory experiments and field studies were conducted to provide evidence for the model. Field tests provided stronger evidence supporting the theory than experiments (Fiedler, 1971). One major drawback of Fielder's contingency theory is that leader orientation remains static. This required leaders to be placed in favorable situations or change situations in such ways that leaders could function most effectively (Bass & Bass, 2008).

Path-Goal Theory

Another contribution to situational leadership was made when House (1971) developed a path-goal theory of leader effectiveness that sought to explain why leaders were successful when they initiated structure and provided consideration to followers. In this theory, leaders motivated subordinates toward goal attainment through clarification of processes or paths necessary for achieving task goals (i.e. the path-goal relationship). A leader aligned their behavioral strategy according to either the ambiguity of the task or subordinate

characteristics to achieve the most success; thus, the path-goal theory of leadership is contingent on the situation.

Refinements to the theory identified four specific types of leadership behaviors: achievement-oriented, supportive, directive, or participative (House & Mitchell, 1974). Achievement-oriented behaviors encourage subordinates toward higher performance (e.g., emphasizing excellence and showing confidence). Supportive behaviors react to subordinates' needs and preferences (e.g., demonstrating concern and being friendly). Directive behaviors provide a structure for what needs to be done (e.g., coordinating work tasks and creating policies, rules, and procedures). Finally, participative behaviors encourage subordinate decision making (e.g., asking for opinions and consulting before deciding). These behaviors are used in situations determined by the leader to be most effective based on the needs of the situation. While other theories of leadership stemmed from the work on path-goal expectancies, such as charismatic and value-based leadership, few dealt with one of the most fundamental ingredient in work performance, the act of decision making and the leader's role in facilitating that process.

Participative Decision Making vs. Leader Directiveness

One important consideration for any organization is how decisions are made. Since often time, positional leaders are given the authority to oversee the allocation and use of resources within an organization, how a leader facilitates decision making is pivotal. For many years there were two schools of thought on how a leader could facilitate decision making. In this sense, directive and participative leader behaviors were thought to exist on opposite ends of a single continuum.

Several studies have shown the benefit of directive leadership on performance. Directive leaders have been shown to have the most influence in an

organizational setting (Thiagarajan & Deep, 1970). Performance increases are associated with directive leadership behaviors. These performance increases are associated with increasing unity and creating agreement in teams completing tasks (Katzell et al., 1970). Directive leaders also prevent disruptive behaviors, e.g., antagonism, tension, and absenteeism, from occurring in teams (Burke, 1966). However, directive leadership behaviors can come at a cost. Job satisfaction can be decreased in the presence of a directive leader (Katzell et al., 1970; Thiagarajan & Deep, 1970).

Several studies have identified reasons why participative leadership is effective at increasing satisfaction and commitment. Subordinate participation in planning increased morale resulting in fewer turnovers, less aggression, and more production (Coch & French, 1948). Thus, participation appears to create strong attitudinal and emotional connectivity between subordinates and leaders supporting better results in performance and productivity. Additionally, evidence supporting situational contingencies in participative leadership has been identified. Participative leadership success hinges on the ability to have willing and prepared followers (Muczyk & Reiman, 1987).

Vroom and Yetton created a decisional model for leaders to determine the best behavior to choose for a given decisional situation (Bass & Bass, 2008). This highly complex algorithm based on the answers to 10 questions essentially supported directive behaviors when the leader had a clear vision and subordinates could implement actions necessary to enact that vision or using participative behaviors when the task was less defined and subordinates were trained enough to overcome such ambiguities (Bass & Bass, 2008). This model suggests that participative and directive behaviors exist on a single continuum, with either one being selected. Newer research supports the notion that leaders with behavioral flexibility are able to produce superior outcomes than those

without (O'Shea, Foti, Hauenstein, & Bycio, 2009; Sumner-Armstrong, Newcombe, & Martin, 2008).

As more research was conducted more evidence was generated and meta analyses were performed. These meta-analyses showed that both participative and directive leadership behaviors produced desirable results on productivity and performance (Miller & Monge, 1986; Sagie, 1994). A study found that certain aspects of decision making, such as strategies are best developed through directive leadership while others such as tactics to complete the task are best accomplished when members of the team are allowed to participate in decision making (Sagie & Koslowsky, 1994; Sagie, 1995). Additionally, both participative and directive leadership behaviors can increase task accuracy (Sagie, 1996).

Loose-Tight Leadership Theory

The model of loose-tight leadership was proposed by Sagie and to reconcile emergent paradoxes in leadership-performance literature as a means to further the path-goal theory of leadership. Earlier studies of leadership had conceptualized leader directiveness and participative decision making as opposite concepts on a single continuum of leadership behavior. Many leadership studies demonstrated that teams and organizations with directive leaders often achieved more. That is, leader directiveness was associated with better performance and productivity outcomes. However, participative leaders also were able to motivate subordinates and provide them with a greater sense of satisfaction and commitment to the organization.

Loose-tight Leadership

In describing his model of leadership, Sagie (1997a) proposed that leaders could be both *loose* and *tight*, thus reconciling the distinction between leaders who allow more *participation* and those providing extensive amounts of *direction*. The theory of loose-tight leadership postulates that leadership can be a fluid or

dynamic approach that involves simultaneous integration of directive and participative interactive behaviors between a leader and their subordinates as decisions are made in what work to accomplish and efforts are made to complete that work. That is, leaders can be *directive* in initiating communication with subordinates, soliciting ideas for tasks to be accomplished, assessing and providing feedback to subordinates in accomplishing tasks, and providing stewardship of organizational mission, vision and values, while also being *participative* in terms of providing subordinates with discretion and autonomy in completing work tasks.

Directive versus participative leadership styles as distinct constructs not on a single continuum can be described through the notion of framework and substance (Sagie, 1997a). The *framework* refers to the structural aspects of decision making within the organizational environment. This can include what is being decided, how it will be discussed, and what resources are available to see through implementation of such decisions. The *substance* refers to how a decision gets implemented, who is involved, and what are people doing. A leader can provide an organization with a strong sense of vision and purpose, while the members can decide how things get done.

The leader is believed to exert his or her influence on proximal and distal outcomes; though the separation in temporality of the outcomes is implicitly assumed and not necessarily sequential. These outcomes can include psychological and performance constructs. Psychological outcomes or work-related attitudes of loose-tight leadership behavior include commitment and satisfaction. Commitment describes the bond between the individual and the organization while satisfaction describes the extent of happiness in a job on the basis of expectation, affect, or equity. Individual performance is also positively influenced by loose-tight leadership. It is believed that these outcomes are

strongest in the presence of both leader directiveness and participative decision making.

Mediating the relationship between loose-tight leadership and outcomes are cognitive and motivational mediators. That is, loose-tight leadership creates increases in performance outcomes vis-à-vis cognitive and motivational processes of individuals. For example, loose-tight leadership can increase an employee's sense of motivation to work hard on a task and this motivation causes their performance to increase. This illustrates a motivational path for increasing outcomes through loose-tight leadership. Another example could be the provision of information to employees. Through the provision of additional information about a task, an employee can form realistic expectations of involvement and effort needed to be successful on a task. These clear expectations can be easily matched during the employee's work resulting in a more satisfied work experience. This illustrates a cognitive path for increasing outcomes through loose-tight leadership.

In addition to the model of loose-tight leadership, the theory described levels of analysis for which these relationships would hold true. Sagie (1997a) proposed four levels of analysis applicable to his theory of loose-tight leadership: dyad, group, organization, and environment. The simplest of the relationships tested are those between a leader and their follower. This dyadic relationship contains the cognitive processes and behavioral outcomes for both the leader and the follower. That is, a leader can possesses certain traits, abilities, and cognitive beliefs, as can a follower, and these combinations interact in meaningful ways to produce performance gains at the dyadic level. Also, certain constructs can be aggregated up to the level or measured precisely at the level of the group. As loose-tight leadership provides support to groups of members within a team, their shared motivations and cognitions can result in group-level outcomes.

At the dyadic or group level of analysis various moderators may influence the relationship between loose-tight leadership and outcomes. Leader characteristics including, seniority, education level, functional background, technical expertise, flexibility, need for achievement, and commitment are considered dyadic or group level moderators. Participant characteristics such as education level, qualifications, jobs, and need for independence are also considered dyadic or group level moderators. These moderators may neutralize, substitute, or complement the effects of loose-tight leadership. For example, the participant characteristic of need for independence is an enhancer if expressed highly in followers while it is a neutralizer if it is expressed in low amounts. That is, as a follower's need for independence increases the effect of loose-tight leaders should be greater in producing better outcomes.

While individual and group level theories are common in leadership literature, Sagie (1997a) went further by explaining the relevance of organization and super-organizational or environmental variables to relationships between loose-tight leadership and organizational outcomes. Organizational variables, such as centralization, bureaucracy, innovation, procedural rigidness, and quality improvement activity could moderate the relationship between loose-tight leadership and outcomes. Furthermore, environmental factors such as market conditions and cultural power distance levels could moderate the relationship between loose-tight leadership and outcomes. In this sense, Sagie was able to propose a model of leadership that described how and why leadership works at increasing individual performance in accounting for influences from a number of levels within and outside the organization.

Research on the Loose-tight Leadership Theory

Some empirical and qualitative studies have been conducted to test or explore the theoretical propositions of Sagie's loose-tight leadership theory. A

cross-sectional study of 108 middle managers was conducted to examine the effects of directive and participative leadership on job satisfaction, work commitment, and intrinsic motivation (Cassar, 1999). Directive leadership was measured as a bi-dimensional construct that included goal setting and problem solving domains. Additionally, interactive effects between directive and participative leadership were tested using moderator analysis. Participation was significantly related to all three dependent variables, but only leader directiveness goal setting was significantly related, albeit weakly, to job satisfaction. Interaction analysis showed a significant relationship for directiveness in goal setting and participation on job satisfaction, such that as when participation was high leader directiveness had less influence on job satisfaction. That study seems to contradict Sagie's loose-tight proposal. However, the measurement model was conceptualized in a manner different than Sagie's original description. That study was focused solely on task level decisions and did not capture relationships across the work continuum as described through framework and substance.

A qualitative and quantitative assessment of the loose-tight leadership model was conducted using a global apparel company (Sagie et al., 2002). The qualitative assessment asked the importance of leader directiveness and participativeness on work-related attitudes vis-à-vis cognitive and motivational mediators by using semi-structured interviews with 20 employees (i.e. division manager, department, managers, and subordinates) of one of the company's divisions. The quantitative assessment of leader directiveness and participation, information sharing, extra effort, job satisfaction, and affective work commitment was conducted using a cross-sectional survey of 101 employees at the company. Qualitative results suggested that many leaders possessed directiveness in their leadership style and that this positively influenced work attitudes. Some support

for combination of styles was useful in that employee's needed direction for certain things, such as providing encouragement, while allowing employees to actively participate in decision making was highly valued. Subordinates and managers differed on the role of directiveness in providing information, but both valued leadership that facilitated information sharing. Performance appeared to be influenced mostly by leader directiveness with a lower degree of participativeness.

In the quantitative analyses, directiveness and participativeness both directly influenced positively job satisfaction and organizational affective commitment. Additionally, moderation analysis suggested that information sharing mediated the significant relationship of leader directiveness with job satisfaction and affective organizational commitment. These studies suggest that cognitive mediation does link leader directiveness and participation on work attitudes of job satisfaction and commitment. However, motivational mediation as hypothesized in Sagie's original model seems less supported, which may be in large part due to the measurement of motivation through a limited operationalization (extra effort). The qualitative interviews did reveal support for the loose-tight phenomena to influence work performance though that study did not test such a relationship empirically.

A cross-sectional study of 140 teams from elementary schools was conducted to examine mediation roles of organizational commitment and empowerment between loose-tight leadership and team in-role performance and innovation (Somech, 2005). Using structural equation modeling, significant relationships were found between leader directiveness and subordinate commitment along with leader participativeness and subordinate empowerment. That finding suggests two distinct motivational pathways exist which necessitates the use of both loose and tight leadership. Additionally, some

support was found for the mediation effects of commitment and empowerment on performance and innovation. That study did not test any proposed moderators.

A cross-sectional study of 136 primary care teams was conducted to examine the effects of leadership directiveness and participativeness as moderators in the relationship of functional team heterogeneity and team reflection (Somech, 2006). Team innovation and team in-role performance were then regressed on team reflection. These results supported the notion that effective leaders should allow for individual creativity and flexibility while also providing the "catalytic" impetus for engaging in such activities.

A cross-sectional study of 100 teachers in seven schools was conducted to examine leadership directiveness and participativeness effects on teacher performance (Somech & Wenderow, 2006). Additionally, constructs of job structuring, person-job integration, decision domain, and leader-member exchange were tested as moderators. Job structuring refers to the level of bureaucracy in the structure of one's job, including the formality of processes and the degree of centralization. Person-job integration captured the fit of the organization to one's personal needs in regards to feedback and autonomy. The decision domain captured the degree of technical versus managerial aspects of one's job. The leader-member exchange captured the degree of trust and likability between principal and teacher. Results of multivariate regression modeling supported the significant positive associations between participative and directive leadership on teacher performance. However, interactive effects were significant only for directive leadership behaviors. Thus, directive leadership was contingent upon job characteristics faced by teachers. That study provides empirical support for Sagie's model and four of the job-related moderators.

These studies illustrate the positive relationship between both leader directiveness and participativeness on performance and other work-related attitude outcomes. Additionally, dyadic, group, and organizational level moderators have influence on the leader behavior-subordinate performance relationship. Participant characteristics did moderate the relationship for directive leadership behaviors at the group level of analysis.

In all, these studies demonstrated empirical support for Sagie's notion that leaders should engage in loose or participative behaviors along with tight or directive ones. Several mediational paths were tested with motivational and cognitive processes both being supported. Moderators related to job aspects and organizational influences were tested and supported. While there is great support for the model of loose-tight leadership not all moderators have been tested. Additionally, organizations distributed across geographic settings in which autonomous professionals are engaging in practice-based research do not match the settings in which the model was previously tested. The theoretical underpinnings exist that describe why loose-tight leadership may be enhanced in such an environment.

Applying Loose-tight Leadership Theory to PBRNs

While leadership has been noted as strengths of PBRNs, others have highlighted the need for studying leadership behaviors and structures conducive in facilitating the generation of successful outcomes (Peterson et al., 2012; Thomas et al., 2001). Some have argued extensively in a *bottom-up* approach to accomplishing the work of PBRNs. In this approach, research ideas and methods to conduct research are exclusively the product of practice site clinicians and other participants at the ground level. Indeed, many of the advantages for conducting healthcare research in a PBRN model are rooted in the idea that current research efforts fail to adequately address real-world questions and

implement relevant research findings in practice settings in a timely manner. However, as securing funding necessary to sustain infrastructures able to implement efficient practice-based research is a major problem many PBRNs face, aligning research goals and proposing sound research methodologies to funding agencies remains important.

Theories describing decision making interactions with leaders and subordinates are especially useful for studying PBRNs. Decisions are made often in fulfilling PBRN goals. Ideas for research need to be evaluated and selected to create grant applications, training and development of practice site participants and implementation plans must be created, and plans for project dissemination and authorship are important initial decisions that PBRN work throughout a research project cycle (Anderko et al., 2005). Shared decision making is touted as a vital piece of the PBRN model and participativeness could produce stronger relationships and more sustainable networks (Westfall et al., 2009). Additionally, it has been suggested that true collaborative PBRN requires a bottom-up approach (Croughan-Minihane, 1999). However, no study has been conducted to test such propositions.

Descriptive evidence and anecdotal information, such as only one out of seven PBRNs develops their own ideas for research, suggests that a *top-down* approach is more useful for PBRNs (Tierney et al., 2007; Zwar, 2006). This top-down approach is similar to leader directiveness described by Sagie in which a framework for completing tasks, such as defining the mission and objectives, is developed by leaders and then passed down to subordinate members of the organization. Some key advantages to a top-down model have been described as securing more monies from federal agencies and better sustaining PBRN infrastructure between studies (Tierney et al., 2007).

One moderator to the loose-tight leadership-performance relationship is the extent of the relationship between members of the dyad. Analyzing this moderator in a PBRN context seems particularly useful as relationships are vital to the success of networked organizations. Two measures that could be used to frame the relatedness between the PBRN director and the PBRN participant are participant activity level and participant tenure in the PBRN. A participant's activity level may moderate the relationship between loose-tight leadership and individual performance. As described, PBRN participants may be described as inactive, passive active, fully active, or hyperactive (Hahn, 1999). As a participant's activity level increases in the PBRN, it could be argued that this involvement reflects an increased trust or degree of relationship sustainability between the PBRN participant and the PBRN director. The same could be true for participants with more tenure in the PBRN.

The provision of greater autonomy may be given by the PBRN director in such a circumstance as well as the participants own self-confidence in completing tasks may be high. Thus, for higher levels of activity within the PBRN, loose-tight leadership may increase outcomes. However, this added benefit may only be supported for highly participative leaders. As it has been shown, participative leaders are more effective when experience and trust in subordinates is high. In such a situation, a leader displaying more directive behaviors would be expected to not influence as positively the participant's performance level.

Performance Measurement

One critical aspect for any organization is the ability of personnel, or members of an organization, to fulfill expected obligations associated with their job or role. The most widely used conceptualization of *individual performance* is specific behaviors completed by personnel to achieve the goals of the

organization (Campbell, Dunnette, Arvey, & Hellervik, 1973). This conceptualization of performance distinguishes it from *effectiveness*, which is an index of outcomes for an organization that many individuals join together to create (Campbell et al., 1973). Thus, individual performance serves as the foundational unit from which all work is accomplished and through which organizational effectiveness is achieved. This distinction is important because it places the judgment of performance solely on what the individual does or does not do and inappropriately defines their performance through collective achievements or failures.

Organizations establish performance appraisal systems to provide feedback to employees and to reward and penalize individuals' good and bad behaviors, respectively. In addition to organizational importance, individual performance is used as an essential criterion in validating many organizational theories, including theories of leadership. Performance measurement is ubiquitous in industrial and organizational psychology literature; however, creation, validation, and use of those measures are difficult, especially in regard to accuracy and reliability. Additionally, healthcare delivery is increasingly relying on performance measurement as a means to reimburse healthcare providers. As such, new methods of evaluating performance including adherence to standards and guidelines are being adopted in addition to traditional ratings-based measurement (Copeland & Hewson, 2000; Southgate et al., 2001; Wenrich, Carline, Giles, & Ramsey, 1993).

Literature summarized in this section of the literature review predominately consists of studies conducted between the 1950s and 80s, a time when measurement of performance was hotly debated and methods for creating performance ratings were refined. In these studies, performance is an independent variable, while operationalized definitions of psychometric

properties, such as halo or inter-rater reliability, are used as criterions. While this is different from using performance is often treated as a criterion, these studies shed light on best practices and guiding principles that should be used when developing performance measures.

Performance Ratings

In Landy and Farr's seminal paper, studies evaluating the construction, use, and validation of performance ratings were reviewed (Landy & Farr, 1980). At the time, more than a half century of research on performance measurement had been conducted and presented in prominent journals such as the *Journal of Applied Psychology*, *Psychological Bulletin*, and *Personnel Psychology*. The most common measures of performance were judgment-based ratings, even though a more accurate measure of performance typically used for performance appraisals within an organization would have included objective information contained in a personnel file or management information system.

Performance Rating Formats

Graphic Ratings were developed to overcome ambiguities in man-to-man comparisons, rankings, and superiority performance measures that predominated use at the turn of the 20th century (Paterson, 1922). The defining feature of a graphic rating scale is a line (similar to a visual analog scale) on which raters would be instructed to place a mark on a point of the line that matches their assessment of the ratee on a particular trait or characteristic. Four alternative approaches to creating graphic rating scales (i.e. provision of only a trait name, provision of only a trait description, provision of a trait name and behavioral descriptions along the scale, or provision of a trait definition and behavioral descriptions along the scale) were tested for reliability, variability and other psychometric properties (Barrett, Taylor, Parker, & Martens, 1958). Researchers found the scale that provided a trait name along with descriptors

possessed better reliability and psychometric properties; however, all graphic rating formats produced the same amount of variability, making it difficult to distinguish across ratees.

Graphic rating scales offer two distinctions from earlier forms of performance measurement: the rater is not forced to numerically evaluate the ratee and the rater can determine the granularity of their judgments (Paterson, 1922). One challenge in graphic scale ratings is alluded to in the enhanced reliability of the measure. Since traits or characteristics are measured as the performance criterion, little change occurs over time. Using graphic ratings implicitly assumes that performance is purely trait or characteristic-based and does not fluctuate over time. Little evidence exists to substantiate a constant performance-time relationship.

Forced-choice Ratings were developed to control for biases (e.g., leniency) a rater might have in rating another's performance by forcing them to select between two descriptors of equal preference, but with different discrimination ability (Staff, Personnel Research and Procedures Branch, Adjutant General's Office, 1946). This means that forced-choice ratings do not allow the rater to directly rate performance, but instead are able to derive a performance score based upon their assessments. An extensive procedure is used to create the forced-choice rating (Travers, 1951). First, comprehensive descriptions are created for two individuals, one believed to exude the highest levels of performance the other believed to exhibit the lowest. Small items representing qualities or traits of the individuals are pulled from the descriptions. Experimentally, the author will then find the discrimination index (i.e. how well an item measures the overall description) and preference index (i.e. how often a rater overrates or underrates others on an item). For each quality or characteristic, pairs or tetrads containing items that discriminate well along with items that do

not discriminate well are formed. Several pairs or tetrads form the performance instrument. Raters then chose which one of the items with each grouping best describes the ratee. A weighting system is then applied based on the discrimination indices of the chosen items to calculate the performance score.

Serious challenges to the forced choice rating have been reported. Often times, raters are making comparisons within a grouping of items that do not match in terms of scaling the quality or characteristic. For example, within a grouping one item could present a frequency description of the quality being rated while other items present descriptions based on relative degrees of the quality being rated (Travers, 1951). This makes it difficult for raters to understand the choice they are making when selecting between alternatives. Additionally, the ability of the forced-choice rating to reduce leniency is mixed (Travers, 1951). A review conducted more than a decade after the development of the rating method was more positive when describing enhancements to the forced-choice measurement approach in that it had demonstrated better psychometric properties (Zavala, 1965). However, that review also stressed the importance of using forced-choice in conjunction with other approaches. This limits the utility of forced-choice ratings in situations where brevity is essential to the collection of performance measurement data.

Mixed Standard Scales (MSS) were created so that an assessment of a performance measurement instrument's reliability could be made (Blanz & Ghiselli, 1972). In this approach, performance dimensions are described using three examples of a specific trait or characteristic; one example is good, one is bad, and one is average. These examples are randomly presented to the rater, so that desired examples are not always first. This prevents the rater from scoring the assessment in a way to produce a desired score. Several performance dimensions often comprise these instruments. A rater scores each ratee by using

a plus (i.e. ratee is better than average), 0 (i.e. ratee is average), or a minus (i.e. ratee is worse than average) for each of the examples. A score from zero to seven is derived from the combination of ratings for each example within a performance domain.

In testing the psychometric properties of MSS, two studies were conducted with one in Finland and the other in the United States (Blanz & Ghiselli, 1972). In both studies, reliability of the performance measure was strong; however leniency, providing overly favorable ratings, and halo, providing ratings that do not discriminate across performance dimensions, were similar to that expected when using other rating approaches. Some challenges with the MSS are inaccuracies of measurement and the rigorousness used to determine the trait examples. The creators of MSS argued that there are only seven error-free possible combinations of plusses and minuses for each performance domain, while the 18 other possible combinations of scores must contain error. This assumes that ratees fall purely in ordinal categorizations of performance and does not reflect degrees of performance raters can more easily provide using graphic rating scales. Additionally, MSS like other trait-based performance measures focus on immutable domains of performance.

The ratings techniques presented above generally focus on traits of individuals and other characteristics. It is posited that raters may be better attuned to traits of workers than actual behaviors, thus improving the ease and accuracy of trait-based scales (Borman, 1979). However, as feedback became an essential aspect of performance appraisal systems, trait-based assessments fell out of favor due to the conflict they create when raters only provide information on seemingly immutable attributes of ratees. Behaviorally-based measures were developed to allow for specific feedback to be provided to ratees and to overcome difficulties in psychometric properties of ratings previously described.

Behaviorally Anchored Rating Scales (BARS) or *Behavioral Expectation Scales (BES)* were created to overcome psychometric issues associated with graphic and other performance rating measures that were less rigorously constructed (Smith & Kendall, 1963). The multi-step procedure for creating a BARS/BES instrument starts with the critical incident technique, in which examples of good and bad behaviors are extracted from case examples scenarios thought to describe important or defining situations of people doing work (Flanagan, 1954). This initial step has been conducted using either an inductive or deductive approach (Campbell et al., 1973; Smith & Kendall, 1963).

In the deductive approach, a group of job holders are asked to think of the domains of performance first and then to supply critical incidents for each domain (Smith & Kendall, 1963). In the inductive approach, job holders are asked to supply critical incidents; and, from these examples, categorizations of performance domains emerge (Campbell et al., 1973). After behavioral items are created, a retranslation step involves assigning behaviors to performance domains and then ascribing a value on how effective or ineffective a behavior represents the assigned performance domain (Smith & Kendall, 1963). This scaling technique is based on Thurstone's approach to measurement where scales represent continuums of comparatively similar attributes (Thurstone, 1929).

Behavior Summary Scales (BSS) were created to overcome challenges reported by raters in using BARS/BES (Borman, 1979). Raters reported challenges in matching a ratee's behavior with the narrowly constructed anchors; thus, they provided invalid assessments of individual performances. Behavioral summary scales avoid this by providing raters summarized behavioral examples spanning a general range of poor, acceptable, and good levels of effectiveness within the performance domain being measured (Borman, 1979).

Summated Scales (SS) or *Behavioral Observations Scales (BOS)* were another alternative to the BARS/BES approach that utilized a Likert-type scale with summated properties (Campbell et al., 1973; Latham & Wexley, 1977). As in BARS/BES development, a critical incident approach is used to solicit important behaviors using contextually bound descriptors and retranslation of those expectations into performance domains. Behavioral examples are then extracted from the provided information. As in BARS/BES development, job incumbents from multiple perspectives should be utilized in critical incident generation (Latham, Fay, & Saari, 1979). Where BOS/SS differ from the expectation measures is the scale construction.

A Likert-type scale with five numeric anchors based on the frequency of observation from almost never to almost always can be used (Latham & Wexley, 1977; Likert, 1932). The BOS/SS is hypothesized to have advantages over other scales for reasons including: BES/BARS scales endorse implicit behaviors believed to lie between the anchors above the midpoint of the scale, the generation of behaviors is emphasized over the criticalness of the incidents, raters are not challenged to match a behavior with narrowly defined anchors, and it avoids the range restriction biases when using judges to create Thurstone scales found in BES/BARS (Latham et al., 1979).

Much research comparing the effectiveness in discriminating employees according to performance domains and psychometric properties of different rating scales for performance measurement has been conducted. One study compared BES ratings with SS (Bernardin, 1977). In that study, a typical BES instrument was created and then a SS were created using the performance dimensions identified during BES development. In testing for significant differences in halo, interater reliability, leniency, and ability to discriminate, no significant effects were identified. This insignificant finding may be explained by

the rigorous developmental phase shared by both measures (Bernardin, 1977). Another study compared anchored behavioral, nonanchored behavioral and trait-based scales on halo, interrater agreement, and restriction of range (Borman & Dunnette, 1975). Behavior-based scales outperformed trait-based scale on every measure; however, the effects were small. Thus, if constructed in a valid and rigorous way with input from those who will use them, the measures of performance using different rating scales will have minimal effect on the accuracy of the performance measurement (Landy & Farr, 1980).

As demonstrated in the literature above, both qualitative and quantitative analyses are used in developing performance measures, regardless of the rating format chosen. Thus, an appropriate study design for any performance measurement development could utilize a mixed methods approach.

Ratee Effects on Ratings

Several ratee characteristics including age, gender, race, and tenure, have been examined to determine their influence on performance measurement. Ratee age was not shown to influence performance ratings in only a couple of studies (Landy & Farr, 1980). Many studies have shown that ratee gender influences performance rating if the job is believed to be more suited (according to the rater) for a particular gender (Landy & Farr, 1980). Ratee race effects on performance measurement are variable and moderated by several variables including gender, performance level, and organizational factors (Landy & Farr, 1980). Job tenure was associated with higher performance ratings especially as the position level and skill related to the job increased (Landy & Farr, 1980).

Two studies examined the role of job specificity in utilizing a BARS instrument to measure performance. One study used numerical rating scales and BARS created in one hospital but used by two large hospitals (Borman & Dunnette, 1975). In that study, they explored the interrater reliability, averages,

standard deviations, and confidence intervals of both formats. They found that separate organizations did have differing scores on confidence level, but mean level reliability, and halo did not differ by organization. Another study explored developing a BARS for all jobs within a single hospital (Goodale & Burke, 1975). In that study, a retranslation analysis was conducted to identify the amount of stability in behavioral items created for a BARS instrument could be used in all jobs. They found that a BARS instrument could be created across jobs.

Performance Rating Psychometric Properties

Halo

One major psychometric problem encountered in performance ratings is halo. Conceptually, halo is when a rater biases performance domain ratings by using a belief in the ratee's overall performance to rate each dimension (Thorndike, 1920). Halo can be identified by looking at intercorrelations of domain scores across ratees (Saal, Downey, & Lahey, 1980). Additionally, looking at the correlation between domain scores and an overall performance score would demonstrate halo effects. This results in a high degree of correlation within a ratee's performance domain scores and reduces the variability within the performance measure. Reduced variability is particularly problematic when using performance rating as the criterion of a regression model, where shared variation is the basis of analyzing relationships between the criterion and the predictors. Analyses for halo should be done for each rater to be consistent with the conceptual definition.

Leniency/Severity

Another set of psychometric problems in performance rating scales is leniency and severity. Conceptually, leniency is when a rater will consistently overvalue a ratee's performance scores, while severity is when a rater will consistently undervalue a ratee's performance scores. This conceptualization

makes it impossible to judge as no one knows a true ratee's performance. Thus, comparing average scores to the scale midpoint is a common process for evaluating leniency and severity (Saal et al., 1980). Any consistent deviations from the midpoint could represent leniency and severity.

Range Restriction

The ability of a performance measure to discriminate between good and bad ratees is essential. Any measurement approach that fails to discriminate likely suffers from the error of range restriction. Calculating the standard deviations of ratees' performance scores can provide evidence of range restriction (Saal et al., 1980).

Framework, Research Questions, and Hypotheses

Three domains of literature have been described in an effort to articulate the significance and innovation of the proposed study. The literature on PBRNs articulated their evolution to laboratories of translational research, their status as complex and diverse organizations, and the need to understand relationships between specialized roles of those working to accomplish the missions of their PBRNs. The literature on leadership described the basic premise of leadership research throughout history using an academic lens, focused on situational interactions that required variations in the applications of leadership behaviors, provided a theoretical rationale for the use of simultaneous loose-tight behaviors in making decisions, and critiqued the application of that theory in developing knowledge on decision making within an organizational context. Finally, the literature on performance was reviewed to identify conceptualizations of valid and reliable performance measurement, the vehicles necessary for measuring performance in individuals, and psychometric problems associated with performance measurement. These literature domains will be used to explicate the

conceptual framework and underlying questions and propositions of the current study.

Conceptual Framework

The completed conceptual framework based upon the literature review and integration of PBRN literature is presented in Figure 2. This model presents the predictors, moderators, and criterion measures anticipated for inclusion in the empirical analysis for completion of Aim 3.

Research Questions and Hypotheses

Based on the guidance of the theoretical and empirical literature previously reviewed and the presented conceptual framework of the study, the following research questions and hypotheses have been established to guide study design, data collection, and data analysis.

Research Questions (RQ) [Aims 1 and 2]

Since there is a dearth of description of decision making and leadership behaviors or styles in the extant PBRN literature, a qualitative inquiry is necessary to address the following research questions:

RQ1) How are decisions (e.g., research questions and practice-site research tactics) made in PBRNs?

RQ2) What leadership styles and behaviors are exhibited by PBRN directors?

Additionally, the conceptualization of PBRN participant performance at the individual level is poorly understood. The necessity of conceptualizing participant performance accurately, reliably, and in a manner that facilitates ease in use cannot be overstated in evaluating effective efforts within PBRNs. A qualitative inquiry is necessary to address the following research questions:

RQ3) What PBRN participant behaviors and characteristics are desirable and undesirable in achieving PBRN goals?

These research questions will guide data collection that can provide the rich descriptions of leader behaviors and styles exhibited in PBRNs by PBRN directors and conceptualize PBRN participant performance that will be used to create a single, reliable measure of individual performance in a PBRN context.

Hypotheses (H) [Aim 3]

Hypotheses are presented in the conceptual framework in Figure 2 to provide a graphical representation of text presented here.

H1) Leader directiveness will be positively associated with individual performance.

H2) Participative decision making will be positively associated with individual performance.

H3) Activity level of clinician members will be positively associated with individual performance.

H4) Tenure in PBRN of clinician members will be positively associated with individual performance.

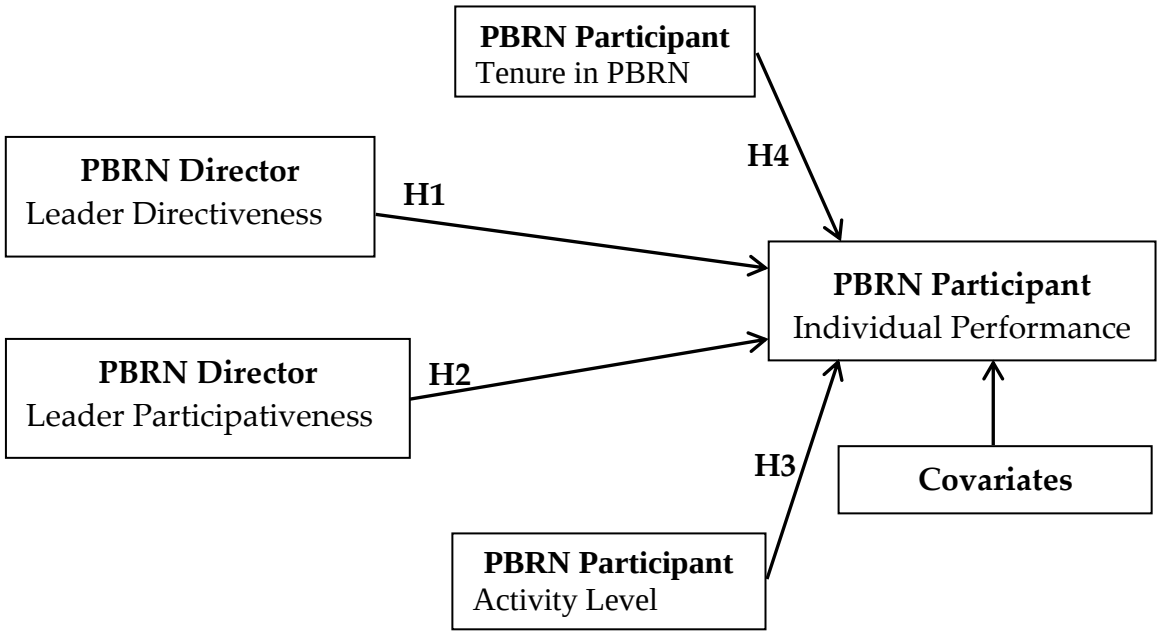

Figure 2. Conceptual Framework and Hypotheses

CHAPTER III

METHODS

The three aims of this research proposal were to: 1) create a measure of PBRN clinician member individual performance, 2) produce a rich description of PBRN directors' leadership behaviors and styles, and 3) identify significant relationships between PBRN director leadership-PBRN clinician member performance. A sequential, exploratory mixed methods design that appears in Figure 3 was used to complete these three aims. Qualitative and quantitative data were collected and analyzed in two phases: a qualitative phase for completion of Aims 1 and 2 and a quantitative phase for completion of Aim 3.

Design Rationale

Mixed methods research has been defined as a philosophically-underpinned model of inquiry combining qualitative and quantitative models of research so that evidence may be mixed and knowledge is increased in a more meaningful manner than either model could achieve alone (Creswell & Plano Clark, 2007; Office of Behavioral and Social Sciences Research, 2001). This method of inquiry was most suited for addressing the research aims of this proposal. First, there was limited evidence informing measurement of PBRN clinician member performance and the leadership behaviors and styles of PBRN directors thought to enable it. This supported the need for explorative qualitative work aimed at describing unknown or inarticulate phenomena, especially in unique contextual settings, such as a PBRN (Morse, 1994; Sofaer, 1999). Also, the need to test leadership-performance relationships to identify significant relationships may be useful in generating tools to guide PBRNs in effective operations supported the use of quantitative methods. Regression-based approaches provide strength in determining relative correlations of measured

variables. This mixed methods research design allowed for rich conceptualization of leadership-performance phenomena and testing for significant relationships between leadership and participant performance within PBRN contexts (Hurley, 1999; Ragin, Nagel, & White, 2004; Shah & Corley, 2006).

The philosophical rationale that compels mixing of qualitative and quantitative models of research into a single study is pragmatism. Simply put, pragmatism is the belief in doing what works best to achieve the desired result. As an underlying philosophy for inquiry, pragmatism supports researchers in choosing between different models of inquiry as research questions being addressed intrinsically determine which methods are best suited (Morgan, 2007). That is, certain research questions are best addressed using qualitative analysis while others using quantitative methods. The pragmatic philosophy underpinning this study allowed for a systematic application of appropriate qualitative and quantitative methods to address each specific aim.

Phase I

Interview Guide Development and Pilot Testing

Guided by research questions presented in the previous chapter, a semi-structured interview guide, for Aims 1 and 2 was prepared. Questions were designed to help elucidate leadership behaviors and styles of PBRN directors (Aim 2), determine the nature of leadership as applied to achieving PBRN goals through decision making (Aim 2), and performance expectations and critical incidents illustrating high and low-performing clinician members' behaviors (Aim 1). Pilot testing of the interview guide was performed with two PBRN directors, a central staff member, and two clinician members from two locally administered PBRNs. Modifications were made to the interview guides based on interviewer experience and feedback from pilot participants. The final interview guide used in the study is presented in Table 3.1.

Sampling

Sampling for Phase I was performed using a two-stage sampling strategy. In the first stage, a *criterion-based purposive sampling* approach was used to identify 16 PBRNs and their directors for study participation using the list of recognized PBRNs on the AHRQ PBRN Registry (PBRN Resource Center, 2012). The criteria strategy is commonly used in qualitative research as a means to select on a characteristic or group of characteristics known to vary within a population (Teddlie & Yu, 2007). This strategy helps collect a more representative or comparative view of a population of interest, thus supporting transferability, or the ability to apply findings to the population at large (Krefting, 1991). As one aim of this study is to create meaningful instruments and representations of leadership and performance behaviors that can be evaluated across PBRNs, this criterion sampling approach is a useful approach.

Our criterion used in this study was geographic dispersion. Variation in the distribution and composition of health care providers across geographies has been shown (Rosenthal, Meredith, & Zaslavsky, 2005). Additionally, organizations that span an entire nation are likely different than those organized around a single city or community. The electronic registry of PBRNs maintained by AHRQ contains a geographic dispersion variable for each PBRN based on the width of dispersion of practice members within each network (i.e. city wide, state wide, regional, national) (PBRN Resource Center, 2012).

Within each of geographic dispersion levels (National, regional, state, and local), all PBRNs were contacted until four PBRNs agreed to participate in the interviews. Many individuals were contacted more than once. Sixteen PBRN directors self-selected for participation in Phase I. This was adequate sample size to ensure accurate saturation could be achieved (F. Smith, 1998).

In the second stage, 16 PBRN participants (i.e. clinician members or central staff), representing themselves as individual members, were selected from those PBRNs agreeing to participate. These 16 non-director members were identified by PBRN directors from the 16 PBRNs identified in the first stage. Sometimes many individuals were identified by each PBRN director to ensure adequate sample size was gathered even if contacted persons did not choose to participate in the study. Some PBRNs provided more than one PBRN participant for this study while others provided none, based on availability for interviews. While not ideal, adequate representation from both groups (i.e. clinician members and central staff) was deemed more important for gathering of data, as 16 different PBRNs were already guaranteed to be represented through completion of the PBRN director interviews.

Our sampling strategy yielded a total sample of a 16 PBRN participant interviews and 16 PBRN director interviews, for a total of 32 study participants. In collecting critical incidents to develop a performance construct for foremen, 20 participants from each level of the organization were interviewed (Latham et al., 1979). This study sample size was adequate based on previous literature.

Data Collection

Interviews of individual PBRN directors and PBRN participants were conducted to generate data. PBRN participants included PBRN central staff and clinician members. The University of Iowa Institutional Review Board awarded this phase of research exempt status and approved all data collection procedures and documents used in Phase I of this study (Appendix A).

Interview questions were asked to gather data related to Aim 1. Specifically, each interviewee was asked to describe up to two critical incidents where they witnessed good or poor performance that seriously affected their PBRN. Interviewees were asked to describe the context of that incident, what

specific behavior or characteristic was performed, and how that behavior or characteristic represented effectiveness or ineffectiveness (Flanagan, 1954; Latham et al., 1979). Additional probing questions were allowed during the course of the interview.

Interview questions also were asked to gather data related to Aim 2. Specifically, each interviewee was asked to describe how decisions were made in the PBRN, what leadership behaviors or styles they have used or experienced in the PBRN, and what factors contributed to using or observing a particular leadership behavior or style. Probing prompts were used to collect more in-depth information for responses that seem ambiguous or confusing. For completion of the interviews, PBRN participants and PBRN directors were provided a modest financial incentive, a $50 Amazon gift card.

Interviews were chosen to collect qualitative data because the format allowed for significant probing vis-à-vis a two-way communication that provided in-depth descriptions of topics being discussed. Additionally, the size of the population of PBRNs is relatively small and qualitative interviews can provided significantly more data around a particular topic than surveys alone. Interviews are also easily conducted over telephonic communication mediums which helped minimize costs associated with the study. The structure of the interviews attempted to maintain focus during the brief scheduled interviews.

These interviews took place over the telephone using conference call technology. Each interview concluded before thirty minutes had passed with a majority completed in the 22-25 minute range. All interviews were audio recorded using a digital voice recorder. In addition to audio recordings, the researcher kept written notes.

Data Coding and Analysis

Interviews were transcribed. Verbatim transcriptions of audio recordings were made using Microsoft Word (Microsoft, 2010a) using a team of research assistants and the main researcher. Transcription creation focused on capturing both interviewer and interviewee whole statements, while not capturing insignificant utterances, such as "uhms," "well," etc. Transcribed data were prepared for analysis by the lead researcher using Microsoft Excel (Microsoft, 2010b). All interview data was first organized into an Excel spreadsheet comprised as a 4x2 matrix in which the columns were labeled as interviewee code, interviewer question, interviewee response, and initial categorization. Each row represented a single question and full response. The lead researcher (BP) categorized each response into initial categorizations based on the topics of interview guide and extant literature. These initial categorizations included: clinician performance, co-investigator/principal investigator performance, coordinator performance, communication, decision making, funding, motivation, PBRN activity, PBRN demographics, personal demographics, PBRN director leadership, role within PBRN, social exchange, and not coded. Exchanges that were not coded were often clarification exchanges in which the interviewee asked for clarification about an interviewer's question. Based on initial categorization, data were ready for more detailed analysis in fulfillment of research aims 1 and 2.

Aim 1

For completion of Aim 1, qualitative data coding and analyses occurred in a manner similar to a previous study that developed a performance measurement rating scale (Latham et al., 1979). A randomization of exchanges that were labeled clinician performance was performed using an online randomization website (random.org) and Microsoft Excel (Microsoft, 2010b). The

lead researcher and a research assistant independently coded the exchanges using an open coding process focusing on creating descriptive codes. This process focused on describing the expectation or behavior conveyed by the interviewee that would be suitable for use on a survey. Behaviors and expectations were to be general enough that they could apply to clinician members of any PBRN. They were also extracted in such a way that they would be observable to either a PBRN director or central support staff member.

Interrater reliability between the lead researcher and research assistant were evaluated using the Perrault-Leigh Index (Perreault & Leigh, 1989). Scores were calculated using a previously constructed macro developed for SAS (Kang, Kara, Laskey, & Seaton, 1993; SAS Institute, 2012). An *a priori* level of acceptability for reliability is set at 0.7 of the lower confidence interval of the PLI. The Perrault-Leigh Index for the independent evaluation of exchanges was 0.80 with a 95% lower confidence bound of 0.76. This satisfied the a priori condition for the test and no further modifications were made to extracted expectations and behaviors.

To ensure adequate coverage of performance expectations and behaviors were being extracted from interview data, an intrinsic test of content validly was conducted. After all exchanges were coded, the final number of behavioral items was noted. Adequate coverage was defined a priori so that at least 80% of the items are generated when 75% of the critical incidents have been reviewed. Failure to meet this goal would have required a different research assistant to repeat item extraction.

After successful item extraction, a consensus forming process was used to identify themes or patterns within the data. Emergent themes were revised until a final set of performance domains were identified. A final set of themes had to satisfy conditions of being supported by three or more extracted behaviors or

expectations while conforming to a consistent definition. Each theme had to stand on its own as a conceptually distinct entity useful for generating items in a performance evaluation survey.

Construction of the initial set of performance survey items, which were piloted later in the study sequence, was informed by survey instrument development best practices. First, each theme had to be represented by three or more items. Second, some items were reverse coded. Finally, items would have to be written in a manner suitable for use in a survey to be completed by PBRN directors observing PBRN clinician member performance. An initial set of performance items were created. These items and the performance domains were face validated by two PBRN directors of local PBRNs. Additionally, member checks were conducted with study participants by providing them a copy of the final measure and asking for feedback on the content.

Aim 2

For completion of Aim 2, a thematic analysis of the data using an iterative process of inductive open coding and deductive conceptual coding occurred. Two researchers including the lead researcher and a research assistant conducted this analysis. The research assistant was a pharmacy student with limited experience in conducting research. An initial three hour meeting occurred in which the research team was presented an introduction to the coding process and future work was divided equally. Instructions for the initial coding were to focus on creating descriptions of the data using an open inductive process. The unit of analysis was a complete idea. As a description of the idea emerged from transcribed data a label describing that data was assigned. Each exchange could have contained multiple ideas. Therefore, exchanges were reformatted so that complete ideas were placed into each row of the data matrix, or set apart within an entire exchange by using highlighted text.

First, open coding was used to label collected data both descriptively and interpretively (Morse, 1994). In this process, two researchers coded descriptions of and PBRN director leadership behaviors and styles (Miles & Huberman, 1994). Additionally, interpretive codes were made using the frameworks of participative decision making and loose-tight leadership theory literature as an initial source of coding language to identify emerging constructs. As constructs emerged, expansion of densely formed codes into smaller descriptive elements occurred.

As codes become more complete with examples, conceptual-based coding was used to identify trends in the data and label taxonomic characteristics, a process in which themes will be identified (Miles & Huberman, 1994). Check coding, a process by which researchers independently code initial data collected and reconcile differences and disagreements was used to ensure reliable coding and thematic identification throughout data analysis. Microsoft Excel (Microsoft, 2010b) was used to code, quantify, and manage all facets of the qualitative data analysis process. A copy of the list of codes can be found in Appendix B.

Credibility of coding also was assessed via member checking, in which results of the analysis were returned to all participants so they could examine inaccuracies in interpretation and ensure clarity of their original thoughts. Additionally, continuous inspection of the original data occurred to determine if coding and thematic analysis stayed true to original data collected during the interviews.

Phase II

Questionnaires Development and Pre-testing

Two questionnaires for PBRN directors, one focused on demographics and another focused on clinician member performance evaluation and one questionnaire for PBRN clinician members, focused on demographics and a

PBRN director leadership assessment, were created. The PBRN director questionnaire collected data about PBRN clinician member performance using a 13-item performance measure for each ratee about specific PBRN participants. The PBRN participant questionnaire collected data about leadership behaviors exhibited by their PBRN director, the opportunity for participation in decision making, information about their activity level, their role, and demographic information. Pre-testing of questionnaires was performed by pilot testing PBRN participant surveys with a few clinicians from a locally administered PBRN and by cognitively interviewing two local PBRN directors. Modifications were made to the questionnaires based on feedback from pilot participants. All pre-tested surveys were conducted online in the same manner the surveys were administered to actual study participants.

Sampling

Sampling for the main data collection of Phase II used a two-stage sampling strategy (Kalton, 1983). The sampling frame was PBRNs listed in the AHRQ PBRN Registry (PBRN Resource Center, 2012). In the first stage, all 160 PBRNs were contacted to participate in the study. Several contacts were made via email and telephone. IRB changes were made halfway through enrollment to help increase non-cash incentives for PBRNs participating in the study. Fourteen PBRN directors self-selected for participation in the study.

In the second stage of sampling, the PBRN directors from each of the participating PBRNs were instructed to select as many clinician members as possible to complete their surveys. They identified clinician members of their PBRNs to complete the study, likely based upon previous experience with clinician members who were more active in their PBRNs. Several participants were identified by PBRN directors to be contacted by the director themselves or by the lead investigator (BP) of this study. Several attempts at recruiting

identified individuals were made. However, in many cases it was impossible to track how many clinician members were contacted to acquire the final participants list. In all, PBRNs were able to successfully enroll between 2 and 19 clinician members to participate. The University of Iowa Institutional Review Board approved consent and data collection procedures used in this study.

Data Collection

Three separate questionnaires were electronically administered to collect data for completion of Aim 3 (Dillman, Smyth, & Christian, 2009). By collecting perceptions of clinician member performance from PBRN directors and perceptions of PBRN directors' leadership behaviors from clinician members, the chance of social desirability bias and common source variance is minimized. Social desirability bias occurs when study participants would rate themselves according to a common expectation (e.g., participants would rate themselves highly on performance regardless of actual performance) (Babbie, 2001). Common source variance is an artificial strengthening of a finding due to perceived consistency in results attributable to an indecipherable combination of truth and bias when data are collected from a single source (Podsakoff & Organ, 1986). PBRN directors and clinician members completing surveys received a modest financial reward (Dillman et al., 2009). The University of Iowa Institutional Review Board awarded this phase of research exempt status and approved all data collection procedures and documents used in Phase II of this study (Appendix C).

PBRN Director Demographic Survey

The first questionnaire was sent to PBRN directors requesting information about their personal background, the membership of their PBRN, the productivity of their PBRN, and their assessment of decision making direction (i.e. top-down or bottom-up). A copy of items comprising this questionnaire can

be found in Table 3.2. Since linking of the data across surveys was necessary for data analysis the PBRN director was asked for their name, or they could use the PBRN name. The PBRN director educational background was measured using a single mark all that applies item: "What is your educational background?" The following options were provided: MD/DO, MPH, DDS, BSN/MSN/DSN, PharmD/BSPharm, DAT/Athletic Training, MS/MA, PhD, and other. For the MS/MA, PhD, and other choices, PBRN directors could fill in a blank indicating the discipline.

Their background in practice-based research and their PBRN was assessed using two items, "Please indicate the year you started your involvement as the director of this PBRN." and "Please indicate the year you started involvement in practice-based research." These items were fill-in-the-blank.

Their PBRN membership status was assessed using three items. The first item, "How is your membership determined (e.g., individuals, practice sites, etc.) in your PBRN?" allowed the PBRN director to indicate how membership was determined (i.e. sites or individuals). The next question, "How many members are in your PBRN at the current time?" allowed an exact count of members to be provided. The final question, "Please indicate the percentage of PBRN members active in your PBRN over the past 12 months," was used to determine the activity level within the PBRN.

Funding was assessed using four items. The first item, "Please indicate the number of grants applied for over the past 12 months to support research within your PBRN," assessed new funding sought during the previous year and was fill-in-the-blank. The second item, "Please indicate the number of grants awarded over the past 12 months to support research within your PBRN," also fill-in-the-blank, documented successful grants over the past year. The third item, "Over the past 12 months, how many active grants have supported research within

your PBRN?" was used to determine the current grant awards that could include on-going support. This item was also fill-in-the-blank. The final item, "Please choose the source of grants over the past 12 months, supporting research within your PBRN," documented the source of grants. This item was a mark all that apply item with the choices of federal government, state government, professional association, industry, and other.

The next three items measured PBRN productivity. The first item, "Please indicate the number of studies conducted by your PBRN over the past 12 months," was a count of projects over the past year and was fill-in-the-blank. The second item, also fill-in-the-blank, documented the number of manuscripts in the past year, "Please indicate the number of manuscripts submitted for publication in the past 12 months based on research conducted in your PBRN." The final item looked beyond scholarly activities to include quality improvement or best practices. This dichotomous choice (i.e. yes, no) question asked, "Does your PBRN support practices with Quality Improvement activities (e.g., dissemination of best practices, organizational evaluation, etc.)?" PBRN directors were able to describe these activities if they answered affirmatively.

The last two items measured the decision making orientation of the PBRN. The first item asked, "Please indicate the amount of decisions made in your PBRN using a top-down approach," and was fill-in-the-blank. The final item was dichotomous and asked, "Would you consider your PBRN led mostly by a top-down (central staff) or bottom-up (practice sites) approach?" The answer choices were: "mostly top-down" or "mostly bottom-up. "

PBRN Clinician Member Survey

As many clinician members as possible from each PBRN were selected by the PBRN director to complete the PBRN clinician member surveys. These surveys asked about the clinician's personal demographics, their involvement in

the PBRN, their desires for future PBRN research, and their assessment of their PBRN leaders' directive and participative behaviors. A copy of items comprising this questionnaire can be found in Table 3.3. Since linking of the data across surveys was necessary for data analysis the clinician member was asked for their name, or they could use the participant ID number provided to them. The clinician member educational background was measured using a single mark all that applies item: "What is your educational background?" The following options were provided: MD/DO, MPH, DDS, BSN/MSN/DSN, PharmD/BSPharm, DAT/Athletic Training, MS/MA, PhD, and other. For the MS/MA, PhD, and other choices, PBRN directors could fill in a blank indicating the discipline.

Their background in practice-based research and their PBRN was assessed using two items, "Please indicate the year you started your involvement as the director of this PBRN," and "Please indicate the year you started involvement in practice-based research." These items were fill-in-the-blank. Additionally, the clinician member was asked, "Please indicate one to three areas of research you wish your PBRN would focus on in coming projects."

Their activity level within the PBRN was assessed four ways. The first item was a single-item scale based on an experienced physician's description of activity levels he had experienced during his tenure in PBRNs (Hahn, 1999). This item asked, "What level of activity listed below best represents your involvement in this Practice-based Research Network?" and had the following options: inactive (does not open practice for research); passive (participates in research, but has minimal involvement); active (participates and involves others at practice site in research and helps collect data); fully active (helps design and implement research); hyperactive (more involved than fully active). Clinician members picked the best description. The next item asked, "Over the past 12 months, on

average how many hours per week did you spend on tasks associated with this Practice-based Research Network?" The third item asked, "If you were to think of all the work you do, on average, what percentage of time is dedicated to PBRN activities?" The final item asked, "How many projects have you been involved in within this PBRN?" These items were all fill-in-the-blank.

The next ten items assessed the leadership directive and participative behaviors of the PBRN director or another designee, whose role was to be specified by the clinician member. These items are measured on a 7-point Likert-type scale that had the following choices, never; hardly ever; seldom; occasionally; often; usually; and, always. These questions were created by Indvik (Northouse, 2007) based on House's Path-Goal Theory of Leadership (House & Mitchell, 1974). Directive behaviors were measured using the following five items: "The leader lets me know what is expected of me," "The leader informs me what needs to be done and how it needs to be done," "The leader asks me to follow standard rules and procedures," "The leader explains the level of performance that is expected from me," and, "The leader gives vague explanations about what is expected from me." The last question was reverse coded during analysis. Participative behaviors were assessed using the following five items: "The leader consults with me when facing a problem."; "The leader listens to my ideas and suggestions," "The leader asks me for suggestions on how to carry out tasks," "The leader asks for suggestions on which tasks should be assigned to me," and, "The leader acts without consulting me." The last question was reverse coded during analysis.

The final five items were based on Sagie's participative decision making scale (Black & Gregersen, 1997; Sagie et al., 2002). These items are measured on a 5-point Likert-type scale that had the following choices: never, rarely, sometimes, often, and all of the time. These items asked the respondent to "indicate the

extent to which you are able to be involved with each of the Practice-based Research Network activities listed below." These activities included: "Determining the mission and vision of your Practice-based Research Network," "Solving problems within your Practice-based Research Network," "Identifying strategic or tactical changes within your Practice-based Research Network," "Identifying research questions for your Practice-based Research Network," and "Monitoring success of your Practice-based Research Network."

PBRN Director Clinician Member Performance Evaluation Survey

The second questionnaire sent to PBRN directors requested their performance evaluations of clinician members of their PBRN who completed the clinician member surveys. The thirteen item performance scale developed in Aim 1 of this study was completed for each clinician member along with a global performance measure. A copy of items comprising this questionnaire can be found in Table 3.4. Since linking of the data across surveys was necessary for data analysis, the PBRN director was instructed to provide the name or participant ID of the clinician member they were rating.

The thirteen clinician member performance items were measured on a 5-point Likert-type scale: never, rarely, sometimes, most of the time, and always. The root of the question asked PBRN directors to, "Please evaluate the PBRN clinician member listed above based upon the frequency they exhibit the following actions or behaviors within your PBRN." Those thirteen behaviors were: "Does not communicate with PBRN staff in a timely manner," "Maintains practice changes after PBRN research studies have concluded," "Helps promote PBRN research throughout their entire practice site," "Takes a leadership role in carrying out PBRN research," "Requires additional support from PBRN staff to complete PBRN research," "Follows through on tasks necessary to complete PBRN research," "Provides leadership or mentoring to develop PBRN staff or

other investigators," "Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research," "Proactively communicates issues and concerns to PBRN staff when completing PBRN research," "Facilitates strategies to overcome problems or barriers in completing PBRN research," "Records or documents requested information necessary for completing PBRN research in a timely manner," "Demonstrates awareness of membership within the PBRN," and, "Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects." The items "Does not communicate…" and "Requires additional support…" were reverse coded for analysis. The final measure was a single-item scale, asking PBRN directors, "How would you rate the overall performance of the PBRN participant listed above?" The choices for response were poor, fair, good, very good, and excellent.

Data Analysis

Data Entry

All survey data were entered into Microsoft Excel (Microsoft, 2010b). Variables were converted for analysis using numerical indicators for labels indicated in the data collection section. A database codebook was created for to assist in analysis and can be found in Appendix D. Manual checks for accuracy of the data entry were made on a randomly sampled 10% of downloaded questionnaire responses. If errors were identified, more checking and correcting occurred. Data were then transferred to SPSS (International Business Machines, 2012) for further analyses.

Variable Descriptive Analysis

Quantitative data analysis was initially descriptive. Statistics including means, percentages, medians, ranges, and variances were calculated, as

appropriate for all variables. This analysis allowed researchers to develop an initial understanding of data collected during the quantitative phase.

Questionnaire Reliability and Validity

An exploratory factor analysis was performed on the thirteen items of the performance scale (Hinkin, 1995). An initial extraction was performed to identify any irregularities in the data. Items were dropped if factors with less than three items are identified. Additionally, an examination of the integrity of the construct was conducted to ensure dropped items did not restrict the range of the concept to be captured in the scale. Since the data were not normally distributed a principal axis extraction method was used (Field, 2009). Since the factors were likely correlated, an oblique rotation (promax) was used during the factor analysis (Field, 2009). Since the data available for analysis were relatively small a higher threshold for meaningful loading scores of 0.512 were used (Field, 2009). Two additional factor analyses were conducted to examine the consistency of the factors. A varimax orthogonal rotation factor analysis was performed to examine stability of the factors.

For performance measures, halo, leniency/severity, and restriction of range were assessed (Saal et al., 1980). The Pearson product-moment correlation between mean performance domain scores with an overall performance score were created for each rater. Visual checks for skewness of data were inspected to identify leniency or severity of rater scores. Finally, the variance and standard deviations of performance scores were compared across raters to identify outliers.

Reliability analysis using Cronbach's alpha, item-total correlations, and Cronbach's alpha if item deleted will be calculated for constructs measured with more than three items to check internal consistency of each construct's measures

(Cronbach, 1951). A Cronbach's alpha of 0.7 is recommended as the minimum cutoff for a reliable measure (Nunnally & Bernstein, 1994).

Correlation and Regression Analysis

Bivariate correlations were calculated to identify significant relationships found across variables in the data (Kleinbaum, Kupper, Muller, & Nizam, 1998). Non-significant and significant (i.e. P-values <0.1, <0.5, and <0.01) findings were reported. Separate correlation matrices were made depending on the level of measurement of collected data. One bivariate correlation matrix contained information concerning individual level data (e.g., personal demographics, performance, leadership behavior) while the other matrix contained information concerning PBRN or organizational level data (e.g., manuscript submission, grant sources, etc.). Additionally, crosstab comparisons were made to explore top-down decision making with age of PBRN and scope of PBRN research. Age of PBRN was identified using the AHRQ PBRN Registry (PBRN Resource Center, 2012). A median cut point dichotomized the data into older and younger PBRNs. Scope of research was identified using the AHRQ PBRN Registry (PBRN Resource Center, 2012). The number of "current or past research interests" was counted. A median cut point dichotomized the data into more generally focused and more narrowly focused PBRNs.

A linear regression modeling approach was used to test hypotheses one through four about leadership behavior-participant performance relationships in a fully specified model based on the theoretical framework of the study. Violations to linear assumptions were tested visually using residuals analysis to identify heteroscedasticity, variance inflation factors (VIF) and tolerance statistics to identify multicolinearity (i.e. VIF>10; tolerance<0.1), and Durbin-Watson (DW) test to identify non-independence of errors (i.e. DW<2>DW) (Field, 2009). Data was excluded listwise based on completeness of variables included in the model.

Alternative modeling procedures including the substitution of performance scores were considered to increase sample size. Additionally, alternative regression models were estimated for removal of outliers (greater than 2 standard deviations from expected residual scores). Alternative regression estimates were also made that allowed for inclusion of non-individual level data (i.e. data measured at the level of PBRNs, such as number of studies completed by the PBRN in last 12 months). Finally, regression models were estimated that included only one predictor variable (leadership directive or participative behaviors) in the model at a time with covariates.

Overall model fit was reported as the coefficient of determination, describing the amount of variation in the criterion described by the predictors. The significance of the overall model was reported using an F-statistic. Regression estimates were reported out to describe significant relationships (Kleinbaum et al., 1998).

Dissemination Plan

Efforts will be made to utilize communication media of the PBRN Resource Center to provide all PBRNs relevant findings from this study. Dissemination will occur in the forms of presentations at national meetings and peer-reviewed manuscripts. Submission of findings to journals with interest in PBRNs, such as the *Journal of the American Board of Family Medicine* and leadership, such as the *Leadership Quarterly* will occur. Presentations will be submitted at annual meetings of the American Pharmacists Association and American Association of Colleges of Pharmacy, both of which have keen interests on developing PBRNs that include pharmacist participants. Additionally, the annual meeting of the North American Primary Care Research Group will be a possible avenue for presenting this dissertation.

Table 3.1 Semi-structured Interview Guide

1. Introduce research project.
2. Gather descriptive data about participant (i.e. PBRN, role in PBRN, age, gender, tenure in PBRN, tenure in position).
3. Ask about 2 critical incidents demonstrating unfavorable and favorable performance by non-director participants of a PBRN that they observed.
a) What was the context of the incident?
b) What was the specific behavior(s) exhibited by the participant?
c) Why was the incident important?
4. How are decisions made in your PBRN?
5. What leadership behaviors or styles by the PBRN director have you expressed or seen expressed in your PBRN?
6. Does the leadership behavior or style fluctuate?
a) What makes it fluctuate?
7. Thank them for participating in the interview.

Note: Prompting questions will be allowed clarify and expand initial interviewee responses.

Table 3.2 PBRN Director Demographic Survey

Instructions: Thank you again for taking the time and effort to participate in this PBRN Director Survey. Questions from this survey will be used to explore associations between leadership provided by PBRN staff and performance by PBRN members. Your name is collected only as a marker to indicate completion in the study. Once data are transferred for analysis, your name will be replaced with a unique identifier known only to the study Principal Investigator. This survey should take no more than 10 minutes. Your response to questions is voluntary.
Q1. What is your name or your Practice-based Research Network name?
Q2. What is your educational training? Select all that apply. MD/DO; MPH; DDS; BSN/MSN/DSN; PharmD/BSPharm; DAT/Athletic Training; MS/MA (Specify discipline); PhD (Specify discipline); Other (Please specify)
Q3. Please indicate the year you started your involvement as the director of this PBRN.
Q4. Please indicate the year you started your involvement with practice-based research.
Q5. How is your membership determined (e.g., individuals, practice sites) in your PBRN.
Q6. How many members are in your PBRN at the current time?
Q7. Please indicate the percentage of PBRN members active in your PBRN over the past 12 months. Please indicate the percentage in the box below. Active participation means active involvement in research or activities to sustain PBRN efforts.
Q8. Please indicate the number of grants applied for over the past 12 months to support research within your PBRN. These can be grants from any source. These should be new applications only, not renewals.
Q9. Please indicate the number of grants awarded over the past 12 months to support research within your PBRN. These can be grants from any source. These should be new applications only, not renewals.
Q10. Over the past 12 months, how many active grants have supported research within your PBRN? These can be grants from any source and can include new and renewed grants.
Q11. Please choose the source of grants over the past 12 months, supporting research within your PBRN. Select all that apply. Federal Government; State Government; Professional Association; Industry; Internal
Q12. Please indicate the number of studies conducted by your PBRN over the past 12 months. These should be studies emanating from within the PBRN you direct.
Q13. Please indicate the number of manuscripts submitted for publication in the past 12 months based on research conducted in your PBRN. These should be based on studies emanating from within the PBRN you direct.
Q14. Does your PBRN support practices with Quality Improvement activities (e.g., dissemination of best practices, organizational evaluation). If yes, please provide examples.
Q15. Please indicate the amount of decisions made in your PBRN using a top-down approach? Here a top-down approach refers to the PBRN central coordinating staff making a decision (e.g., what to research, how to conduct research, etc.) versus the practice sites and members of the PBRN making decisions. Please indicate the percentage of decisions in the box below.
Q16. Would you consider your PBRN led mostly by a top-down (central staff) or bottom-up (practice sites) approach? Mostly top-down; Mostly bottom-up

Table 3.3 PBRN Clinician Member Demographic Survey

Instructions: Thank you again for taking the time and effort to participate in this PBRN Member Survey. Questions from this survey will be used to explore associations between leadership provided by PBRN staff and performance by PBRN members. When completing this survey, fill it out based upon your participation in the PBRN mentioned in the email with your survey link. This is the PBRN that recommended your name for completing the survey. Your name is collected only as a marker to indicate completion in the study. Once data are transferred for analysis, your name will be replaced with a unique identifier known only to the study Principal Investigator. This survey should take no more than 7 minutes to complete. Your response to each question is voluntary.
Q1. What is your name or participant ID?
Q2. What is your educational training? Select all that apply. MD/DO; MPH; DDS; BSN/MSN/DSN; PharmD/BSPharm; DAT/Athletic Training; MS/MA (Specify discipline); PhD (Specify discipline); Other (Please specify)
Q3. Please indicate the year you started your involvement with this PBRN.
Q4. Please indicate the year you started your involvement with practice-based research.
Q5. Please indicate one to three areas of research you wish your PBRN would focus on in coming projects.
Q6. What level of activity listed below best represents your involvement in this Practice-based Research Network? Inactive (does not open practice for research); Passive (participates in research, but has minimal involvement); Active (participates and involves others at practice site in research and helps collect data); Fully Active (helps design and implement research); Hyperactive (more involved than fully active)
Q7. Over the past 12 months, on average how many hours per week did you spend on tasks associated with this Practice-based Research Network?
Q8. If you were to think of all the work you do, on average, what percentage of time is dedicated to PBRN activities? Please indicate the percentage in the box below.
Q9. How many projects have you been involved in within this PBRN?
Q10. Please indicate the name and role (e.g., PBRN director, network coordinator, practice facilitator) of the person in this Practice-based Research Network who most often conveys leadership on behalf of the PBRN to you.
Q11-Q20. Indicate how often each statement is true of your Practice-based Research Network leader with regard to your involvement in this Practice-based Research Network. Never; Hardly Ever; Seldom; Occasionally; Often; Usually; Always
Q11. The leader lets me know what is expected of me.
Q12. The leader consults with me when facing a problem.
Q13. The leader listens to my ideas and suggestions.
Q14. The leader informs me what needs to be done and how it needs to be done.
Q15. The leader acts without consulting me.
Q16. The leader asks me to follow standard rules and procedures.
Q17. The leader asks me for suggestions on how to carry out tasks.

Table 3.3 Continued

Q18. The leader explains the level of performance that is expected from me.
Q19. The leader asks for suggestions on which tasks should be assigned to me.
Q20. The leader gives vague explanations about what is expected from me.
Q21-Q25. Please indicate the extent to which you are able to be involved with each of the Practice-based Research Network activities listed below. Keep in mind this question is not asking about your participation in each of the activities, but should reflect the extent to which the leader conveys to you the ability to be involved in such activities.
Never; Rarely; Sometimes; Often; All of the Time
Q21. Determining the mission and vision of your Practice-based Research Network.
Q22. Solving problems within your Practice-based Research Network.
Q23. Identifying strategic or tactical changes within your Practice-based Research Network.
Q24. Identifying research questions for your Practice-based Research Network.
Q25. Monitoring success of your Practice-based Research Network.

Table 3.4 PBRN Director Clinician Member Performance Evaluation Survey

Instructions: Thank you again for taking the time and effort to participate in this PBRN Director Survey. Questions from this survey will be used to explore associations between leadership provided by PBRN staff and performance by PBRN members. In this survey you will be providing assessments of performance evaluation of clinician members from your PBRN. The list of clinicians you should evaluate is contained in the email with the survey link. This survey should take no more than 10 minutes to complete. Your response to each question is voluntary.
Q1. What is the name or participant ID of the person you are rating?
Q2-Q14. Please evaluate the PBRN clinician member listed above based upon the frequency they exhibit the following actions or behaviors within your PBRN. Never; Rarely; Sometimes; Most of the Time; Always
Q2. Does not communicate with PBRN staff in a timely manner.
Q3. Maintains practice changes after PBRN research studies have concluded.
Q4. Helps promote PBRN research throughout their entire practice site.
Q5. Takes a leadership role in carrying out PBRN research.
Q6. Requires additional support from PBRN staff to complete PBRN research.
Q7. Follows through on tasks necessary to complete PBRN research.
Q8. Provides leadership or mentoring to develop PBRN staff or other investigators.
Q9. Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.
Q10. Proactively communicates issues and concerns to PBRN staff when completing PBRN research.
Q11. Facilitates strategies to overcome problems or barriers in completing PBRN research.
Q12. Records or documents requested information necessary for completing PBRN research in a timely manner.
Q13. Demonstrates awareness of membership within the PBRN.
Q14. Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.
Q15. How would you rate the overall performance of the PBRN participant listed above? Poor; Fair; Good; Very Good; Excellent

Note: This survey was repeated for each clinician member the PBRN director was evaluating

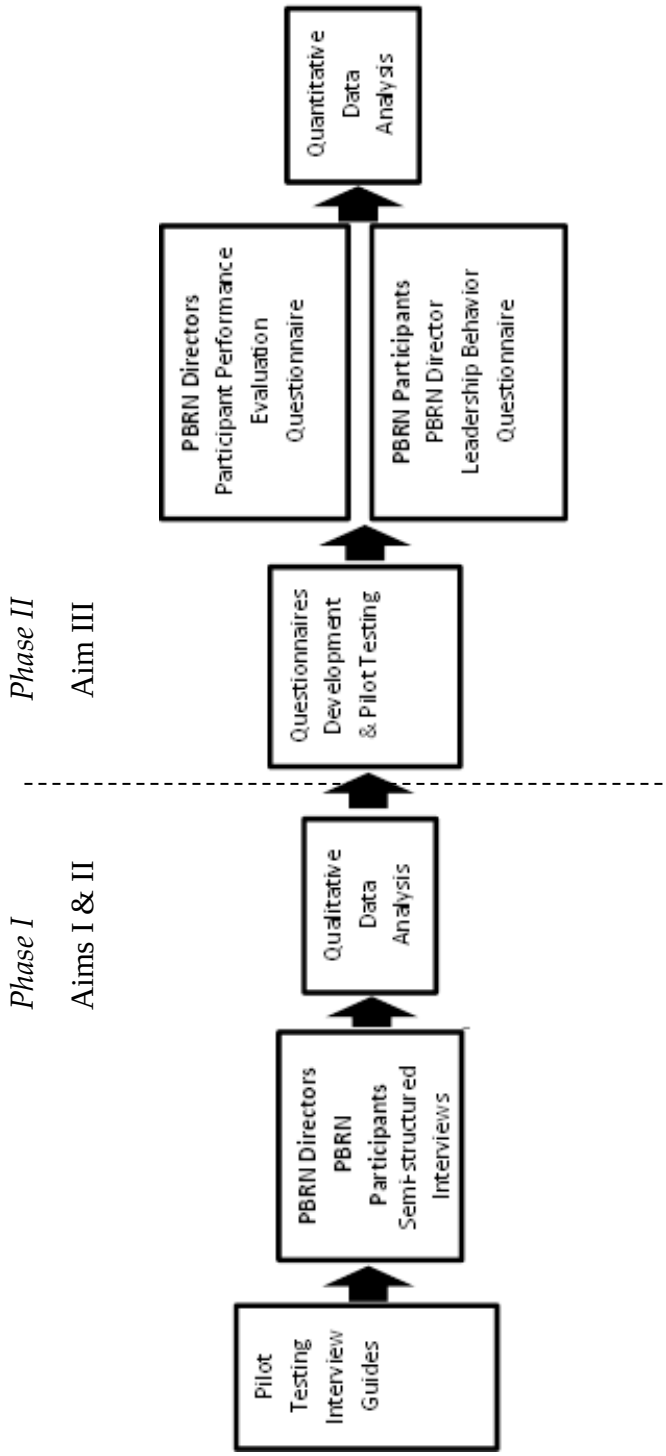

Figure 3. Methods Sketch

CHAPTER IV

RESULTS

This chapter discusses data analysis findings for each of the three study aims: 1) create a measure of PBRN clinician member individual performance; 2) produce a rich description of PBRN directors' leadership behaviors and styles; and, 3) identify significant relationships between PBRN director leadership-PBRN clinician member performance. Initial data processing for each type (i.e. qualitative and quantitative) will be discussed in detail along with study results. This allows readers to examine the thought process behind research decisions and minimizes the chance of researcher bias being embedded in the research method without transparency.

Phase I: Data Preparation

Thirty-two interviews were conducted with 16 PBRN directors and 16 PBRN participants (6 clinician members/10 central staff). These interviews averaged 26.3 minutes in length with a range of 13.9 minutes to 32.7 minutes. Data were obtained from interviews via transcription. Interviews were transcribed, excluding non-meaningful utterances such as uh, uhm, etc., by the lead researcher and several volunteer research assistants. Interviews were transcribed into Word files (Microsoft, 2010a). The lead researcher then prepared a qualitative data matrix using the spreadsheet processor, Excel (Microsoft, 2010b). To prepare this data matrix, the lead researcher used three column labels: ID, interviewer, and interviewee. Each row of data contained a verbal exchange between the interviewer and the interviewee, so that one row contained a question or statement made by the interviewer and a statement or question response made by the interviewee. This data matrix contained 650 rows

representing 649 recorded interviewer-interviewee exchanges during the course of the 32 interviews.

An initial categorization of the data matrix was performed to enable ease of further analysis. Exchanges were given one of fourteen categorizations: clinician performance, communication, coordinator performance, decision making, demographics - PBRN, demographics - personal, funding, motivation, PBRN activity, PBRN director leadership, principal investigator/co-investigator performance, role within PBRN, social exchange, and ZZZ not coded (note that the ZZZ allow for sorting convenience). These categorizations were derived from the interview guide questions and extant literature on leadership, motivation, and performance. The relative frequency of each category in this initial categorization is presented in Table 4.1. The three largest categorizations were clinician performance (19.3% of the exchanges), not coded (14.9%), and PBRN director leadership (12.3%). An examination of not coded exchanges revealed that these exchanges consisted of clarifying questions asked by the interviewee or tangential information. The most prevalent domains of discussion were specifically focused on PBRN director leadership and clinician member performance, as one would expect based upon the construction of the interview guide. This frequency check of most common exchanges provides evidence supporting the adequacy of the interviews to discuss the domains of interest.

Demographic information about the 32 study participants was gathered during the interview. Sample demographics obtained from the interviews included years involved in their current role within their PBRN, years involved in practice-based research within and outside of their current PBRN, and their educational background. Sample demographic information is presented in Table 4.2. All PBRN directors had a practice degree in their respective health profession. Nearly one-third of PBRN directors interviewed also had a Masters in Public

Health degree or some other form of advanced educational training. All but 2 PBRN participants had a first-professional degree in their health care field. All PBRN participants possessed collegiate education at least at the Baccalaureate level.

Demographic information about the 16 PBRNs from which the 32 interviewees came are presented in Table 4.3. Data collected during the interview and from the AHRQ PBRN Registry (PBRN Resource Center, 2012) included years in operation, PBRN size in terms of individual members and practice sites, and practitioner mix. Of the 12 PBRNs with an educational sponsor organization, one-third mentioned being a component of the institutions' Clinical and Translational Science Awards from the National Institutes of Health. National PBRNs had the most individual members and local/city PBRNs had the fewest.

Aim 1 Analysis

Exchanges categorized as "clinician member performance" focused were extracted to a separate data matrix for completion of Aim 1 analysis. This dataset included 101 rows containing 100 exchanges. After analysis, 139 single behavioral items were labeled using 23 codes. The 23 codes included: "This clinician takes a leadership role in carrying out PBRN projects of interest to them," "Did not complete tasks agreed upon," "Follows through on tasks necessary for completing the study," "Discusses difficulties in and strategies for maintaining engagement of staff/clinicians/practice sites," "Encounters patient/ clinician recruitment issues," " Identifies problems in practice and conveys these to PBRN staff as potential research projects," "Helps promote PBRN research throughout their entire practice site," "Encounters a range of performance levels," "Demonstrates buy-in toward PBRN research," "Demonstrates focus necessary to complete PBRN research tasks in a timely manner," "Forgets to communicate in a timely manner with PBRN staff," "Required additional

support from PBRN to complete the project," "Forgets to record or document requested information necessary to complete study in a timely fashion," "Communicated with PBRN staff about project during a challenging time," "Necessitated additional external resources in completing the research," "Awareness of PBRN membership," "Is engaged throughout the entire course of the research study," "Conducts PBRN research using a higher standard than what is minimally required," "Demonstrates care in PBRN research projects," "Maintains practice changes after PBRN research study has concluded," "Comments on the influence of the quality of the manager/coordinator on the performance of the PBRN," and, "Encounters disagreements with the physicians." Representative quotes and relative frequency of behavioral items extracted during this analysis are presented in Table 4.4.

The adequacy of the coding schema to fully represent the full range of behaviors of clinician member performance was assessed using the principal of adequate coverage as described by Latham, Fay, and Saari (1979). Accordingly, 100% of our behavioral codes were generated after coding 75% of the data, satisfying the conditions of this validation check. Additionally, Interrater reliability was assessed using the calculated lower bound of the 95% confidence interval of the Perreault-Leigh Index, of which 0.70 is a threshold of convention (Perreault & Leigh, 1989). Our Perreault-Leigh Index was 0.80 with a lower bound of 0.76, satisfying the condition of reliability of the coding schema.

Based upon a consensus-forming second-wave thematic analysis, four domains of clinician member performance were identified: "Follow-through or Commitment," "Leadership Role," "Awareness or Buy-in," and, "Communication." The behavioral items associated with each performance domain are presented in Table 4.5. Follow through or commitment items

comprised 42.4% of the data, leadership role items comprised 20.9%, awareness or buy-in items comprised 11.5% and communication items comprised 5.0%.

Behavioral item 8, "Encounters a range of performance levels," was not assigned to a performance domain as this item merely reflected the variation of performance of clinician members in completing PBRN work. As expected, clinician performance was variable across individuals, as reported by a PBRN director:

> So [in] some practices the [clinician] is basically doing everything getting folks in, data collection, and recording review forms, etc. In others, it is very much a team approach and staff has a lot of buy in in to the study, they are glad to be doing it they think it is something interesting and different and a practice builder for some of their patients. I think that would be an answer there. So, it [performance] really runs the gamut.
>
> Director 1

While in other PBRNs clinician member performance was less stable in individuals, as over time some participants were less engaged, as reported by a PBRN director:

> What we have seen is different levels of engagement of practitioners, so we may see at a particular point in time one of our site investigators is very motivated and willing to participate. And then even at that same site that same person at a different point in time, we may have difficulty getting them re-engaged or having them complete some of the work that they had promised to do. I think it has a lot to do with this being a secondary role for them and they're all clinicians and so they have responsibilities at their sites that sometimes override what we're trying to accomplish.
>
> Director 13

Thirteen items were included in a final clinician member performance scale. These items are presented in Table 4.6. PBRN directors of two local PBRNs face validated the items. Changes in wording were suggested and accepted prior to utilization in further analysis.

Aim 2 Analysis

Data analysis for Aim 2 began with 427 exchanges between the interviewer and interviewees. As analysis occurred and individual ideas were labeled, 923 ideas were labeled with one of the more than 200 codes found in Appendix B. Second round coding and condensing was used to remove codes that overlapped or did not accurately represent the data. Three overarching themes were identified from the interview data: 1) The importance of a collaborative leadership style, modeled by PBRN directors and exhibited by all PBRN members; 2) Restrictions on time and funding create significant barriers that hinder motivational and communication process across staff and practice partners within the PBRN; and, 3) A variety of communication styles and approaches are used by PBRNs to engage in decision making and complete PBRN projects. In addition, a taxonomy of characteristics, roles, expectations, enablers, barriers, and outcomes emerged for each position within the PBRN.

Overarching Themes

Collaboration

Collaboration was directly reported as the leadership approach of choice by 62.5% of the PBRN directors and indirectly mentioned during the interviews of all PBRN directors and 75.0% of the non-directors. PBRN leaders with the ability to integrate opinions and experiences from a wide array of partners appeared to be a very valuable asset, as PBRNs are conglomerates of practice and research personnel from various organizations, including their host organizations and other external entities. The ability for a PBRN to operate as a collaborative was reported as being central to its very existence, as reported by a PBRN director:

> We only survive through collaboration. So some of the examples I mentioned previously, collaboration with other PBRNs like the sleep study and this medication error study, etc. we can bring a lot to the table in terms of mix of patients and doctors, etc. from our region, but it is only [through] the collaboration were we able to pull it off.
>
> Director 8

Collaboration was reported as being important for doing better research and taking part in larger more meaningful projects. As reported by one PBRN director:

> My philosophy is that all research and this is not just in PBRN research is better if it is conducted by a team rather than an individual. It's essential. I mean, I see research is sort of a team activity. And so, my personal feeling is that I alone am probably not a very good researcher, but I know how to pull together a really good team. And that team is a good research unit.
>
> Director 3

Better research may be attributable to better problem solving through collaboration. A PBRN director's collaborative approach was valuable in problem solving, as recalled by one study participant:

> I am trying to think…he is very collaborative…you know again on the flip side of that if somebody else comes up with a bad idea…well let me rephrase that there is not really such a thing as a bad idea and it is always well it may not be the best fit so how do we make it fit. And he is really that kind of problem solver.
>
> Non-director 6, central staff

One director reported that collaboration on big projects is also valued by funding agencies that pay for PBRN research activities and infrastructure:

> The same thing now for some of the projects where we had to collaborate with other outside entities to create teams, convincible to the funders. Collaboration is the one word that is the biggest proponent.
>
> Director 8

Collaboration reportedly worked through a motivational mechanism creating commitment and enthusiasm in practice partners and central support staff. One PBRN director reported:

> I would say my style is very consensus building and collaborative because one of my main goals is to get practitioners fired up about studies and getting them to have meaningful input into study design and data collection because I think that is an important ingredient in getting follow through.
>
> Director 12

This was also reported by non-director participants, such as this one:

> … her collaborative spirit and she is extremely dedicated to having this be a collaborative process with our sites, including our member practices, including our champions every step of the way in the research process.
>
> Non-director 5, central staff

Although collaboration was seen as a positive force by many study participants, others reported its tradeoffs of extra time and effort that it takes to form collaborative relationships and make consensus-based decisions. As one non-director reported:

> I think [collaboration is] good and bad. It's, it's a little bit slow for some of the projects to take off, but good in that hopefully people will feel involved and feel part of the whole, you know, decision process, a little bit more collectively.
>
> Non-director 12, clinician member

A similar sentiment was expressed by one of the PBRN directors:

> And so it takes a little bit more time to do [collaboration] because you know if you make decisions unilaterally you can do that very quickly, whereas if you do things collaboratively, it can take a little bit longer. But, I want to have fun when I do research and it's a lot more fun to do in collaboration with others.
>
> Director 3

In both of these cases, the tradeoff favored collaboration in the amount of motivational and job satisfaction created compared to a non-collaborative alternative.

Collaboration was not solely the responsibility of the PBRN director, as several study participants indicated that coordinators, principal/co-investigators, and clinician members shared roles as collaborators within the PBRN. As one non-director stated about the network coordinator:

> She'll [coordinator] help if we have an outside organization that is collaborating with us she [coordinator] will be the liaison with that outside coordinator, coordinating organization so if it's the [University], we've done things with [another university], we've done a collaboration with [another university], so she'll be kind of the contact person for their process.
>
> Non-director 9, central staff

Principal/co-investigators collaborate with PBRNs by being inclusive in their study processes, as reported by a PBRN director:

> We have expectations that [principal investigators] will include our coordinating center and at least one of our staff members on their grant. So we also seek them out to collaborate on projects that are of importance to our sites. So our expectations really are that they uphold our standard of working with our practices. Which means for us, actively engaging our practices in the generation and design of the research, including them as authors is appropriate on publications, compensating them adequately, compensating the sites adequately both for taking the time to participate in the project, as well as the actual research procedures themselves.
>
> Director 3

In summary, collaborative leadership was reported as being distributed to all positions within a PBRN, but is primarily inculcated by a collaborative PBRN director. This collaboration may increase productivity of the PBRN, in terms of research quality and quantity, through motivational and communication channels. Additionally, being collaborative appears to require trade-offs with greater amounts of time, but these tradeoffs favor collaboration due to the satisfaction and motivational gains experienced through the process of collaboration.

Barriers of Time and Funding

Time and funding were often reported as two major barriers to conducting research within PBRNs. Nearly half of the PBRN director (43.8%) and slightly over a half of the non-director (56.3%) study participants brought up time or funding during the course of their interviews. A lack of funding and time

reportedly inhibit many processes necessary for successful PBRN functioning. The primacy of external funding to their PBRN and the challenges they faced in obtaining funding was eloquently described by one director:

> I think this is a very challenging time for, well, I think networks have always been challenged in terms of getting funding for the work that they do. But I think this is an extremely challenging time because of the NIH budget constraints. Our survival is really dependent on our ability to garner external funding. So this balance, I think, the balance between internally generated projects and working with co-investigators that can bring in external funding is a challenge that at least our PBRN is going to be facing. It's just really tough to get funding right now. So you can only write so many grants. I think that's probably our biggest challenge at this point is just getting funded in setting up a structure that's the other thing they were working towards the setting up of a structure that has some self-sustaining funding, whether a data sharing infrastructure, for example. When we work with investigators, we're exploring how can we actually bring in some of the infrastructure to help sustain our PBRN long-term.
>
> Director 3

One funding mechanism commonly reported by PBRN directors affiliated with academic host organizations, was the Clinical and Translational Science Awards (CTSA) program of the NIH. Sometimes the CTSA provides a "whole structure…that has been very helpful" (Director 10). Some PBRNs were directly funded though the CTSA mechanism as a component of their external or community-oriented mission.

And while host organizations are often a PBRN's biggest ally, sometimes funding issues stem from internal policy makers within host organizations, as reported by one PBRN director:

> As I've said, this is only our fourth year and we have only had one fall membership meeting. And a lot of what we do is to site visits and phone calls. So we need to do another all-member visit, but it is just a matter of timing and money. I don't have money to support an all member thing. I have to scrounge the money from the micromanaging CFO of the institution.
>
> Director 2

Time and funding influence many aspects related to completing research within the PBRN. Both time and funding influence study design decisions as reported by one non-director:

> And having them come and say okay so these were our ideas and we identified what we think is the best approach once that best approach was decided upon we tried to decide on the best methods to do that like qualitative comparative analysis versus a different type of analysis what really is going to work best among the population, what is going to work best for the team, and then what is going to work best based on the budget and time constraints of the grant that we submitted.
>
> Non-director 6, central staff

Decisions related to data collection tool development were affected by limited funding, as reported by one non-director:

> So we listen to that and we hear the wishes of the group and we often had them take several surveys to figure out what they need to help or what could be added to the EMR to make it even better. And reprioritize and then tried to add things as we have funding.
>
> Non-director 11, central staff

Time also inhibits communication about research from clinician members to central staff, as reported by non-director:

> No, actually I have not because as I said this all popped about a week and a half ago. I have been spending a lot of time, I guess more than two weeks now, spending a lot of time putting my spreadsheets together on my computer and mining the data off the web that is out there that just became available to me.
>
> Non-director 16, clinician member

Time and funding issues are experienced by most positions within the PBRN and all of the people in these positions are tasked with finding ways to creatively expend time and financial resources and acquire more funding. Network coordinator motivation was affected by time constraints, as reported by one non-director:

> … I always wish I could do more. I wish I could find the answer to that one particular problem. We've brainstormed many ideas and are thinking of many things and trying to make changes but a lot of it takes time too. I guess certainly I wish there is more time to devote to every project, but I also feel like I'm doing what I can.
>
> Non-director 11, central staff

Clinician members of PBRNs also reported time as a major limitation of motivation to participate in more research studies, as reported by two non-directors:

> The other thing is I have no buy out on time. I am currently at 140% work FTE now because I have got grants. I get grants, I write grants. I am obligated to execute the grants but I have still got all my clinical academic administrative teaching responsibilities that my job calls for as a residency faculty so it's frustrating.
>
> Non-director 15, clinician member

> Well, the biggest one of course is time, where you're trying to incorporate this kind of work into your practice so it's time to do it, time recruiting the correct patients, or just patient recruitment. There are a lot of people who want to do research in our practices just because it's where the patients are. Trying to balance what you get involved in and what not, but it is more just really time to devote to the effort. That's what it comes down to.
>
> Non-director 8, clinician member

In summary, time and funding were reported as important resources necessary for the completion of PBRN activities, and are increasingly becoming more limited in their availability. Study design, data collection, and communication can be hampered or completed in less desirable ways if time and financial resources are restrictive. Everyone working within a PBRN structure has responsibilities to consume these resources in ways that maximize their effectiveness and identify opportunities to garner more resources.

Communication and Decision Making

Communication was reported as being the means through which PBRN activities get accomplished. However, there was large variation in how these communications occur, through which medium they were communicated, for

what purposes they were conducted, and with what results came about. Additionally, communication is how decisions are made within PBRNs. Who was involved, what decisions were made, and what barriers to decision making encumbered PBRN members making them were described by study participants. A visual representation of codes associated with communication and decision making are presented in Figure 4, while a visual representation of PBRN activity codes are presented in Figure 5.

Communication Frequency

There was a wide range of communication frequency used in PBRNs. Two types of communication frequency patterns exist, communication that was regular and those that were infrequent or more project-specific. Regular communication was often reported as occurring daily between members of the central staff, although since some of the directors or other PBRN leaders were off-site or even in other states, the in-person communication amongst central staff varied from every week to every other month. Regular communication between central staff and practice sites occurred weekly to every-other year, with a majority occurring every month or every other month. The frequency of communications was often linked to specific research projects. As one non-director stated, communication is about balancing a fine line between giving people adequate information and burdening them with too much:

> It varies depending on the project I would say. But I do have a lot of interaction with [practice] staff members and clinicians. It just depends on what needs to get done and why am I contacting with them today or you just don't want be in someone's practice all the time.
>
> Non-director 2, central staff

Communication Mode

There was a wide range of communication modes used in PBRNs. The most efficacious communication mechanism was face-to-face, as one non-director

recalled, "'Cause it really forces you to really come together and decide on what you want to do." (Non-director 12, clinician member) However, that communication mode was inefficient for all communication, especially when trying to convey opportunities for research endeavors, which primarily occurred via a listserv or regular newsletter. However, newsletters and listservs are asynchronous communication modes. A cheaper synchronous alternative that allowed PBRN members to collaborate and provide differing opinions was teleconferencing. In regard to teleconferencing, one director said, "And so we meet by teleconference but all of us in the office here meet him, so everybody is involved in the same conversation, instead of one-on-one." (Non-director 13, central staff)

Communication Processes

Different PBRN processes were reported as occurring during the communication described by study participants. The most frequently reported process of communication was reporting feedback to practice partners as research was being conducted. This provided clinicians and their sites motivation and encouragement to continue on the project and also provided them with knowledge gained from the study to incorporate in their practices. As one director said, "I want to maintain people's interest so they don't get disengaged and drop out." (Director 12) Also, one PBRN reported using communication to provide an award or recognition to a successful practice partner, which was widely communicated to other PBRN colleagues through their newsletter.

Educating people about PBRN activities and trying to recruit clinicians were the next most frequently reported communication processes. Education became a means to illustrate the supportive nature of the PBRN to potential practice partners and to help get everyone up to speed on current PBRN

activities and goals. This educational communication had to occur often, as practice partners were in a constant state of flux, as reported by one non-director:

> So, I initially had sent out emails to contacts that were in the system when I started and I realized that that didn't work so well. A lot of people of left and wasn't replaced… I send an email, I make a phone call, and we go visit. And it is really the combination of all those three, not necessarily in that order but it is really about combining those three. And people are starting to recognize us is something that we are doing our best to reach out. And while we don't want to burden them and we don't want our emails to be oh another email from that group, we don't want to be that. But we want to make sure that they know that we are here and that we are trying to do what we can to support them rather than vice versa.
>
> Non-director 6, central staff

Finally, networking within and external to PBRNs occurred as members collaborated on research, met at annual summits, and read disseminated findings from completed PBRN research efforts.

Communication Barriers

The two major barriers to communication reported by study participants were time and funding, as previously described in the second theme. Additional barriers included staff changes within the PBRN and the challenges associated with maintaining an active list of PBRN members. As one non-director stated, "…it is a matter of we are trying to update our system here and get people just so when we are sending the emails to the right people and things like that." (Non-director 6, central staff)

Decisions

Having effective communication is important for deciding what to do and how to do it. PBRNs are multi-organizational entities working on creative projects and make a vast number of decisions every year. The main decisions PBRNs reportedly made concerned which projects would be conducted, usually assessed through a vetting process. Vetting included assessing scientific rigor of

a proposal, but primarily focused on determining the appropriateness of the project with their PBRN members. Vetting was described by one director:

> They're working in collaboration with whoever they are and then the proposal needs to either be vetted by myself or our director of research just to make sure that the way they intend to use members of the PBRN is adequate and really doesn't go above and beyond what we've initiated when we have sites that join the PBRN, so that we're not asking too much of the clinicians and that it's working within their scope of practice and something we think they can handle … as long as the research methodology is sound and the use of the PBRN is what we consider adequate, the investigator will then take the protocol through our IRB and work with any other IRBs that need to be in the loop.
>
> Director 11

Project decisions, including the study design, delegation of tasks, and ways to provide feedback to PBRN members when the study is complete were also reported.

Other decisions were more strategic and focused on which funding to go after, how to improve the PBRN, and other future directions for the PBRN. One director discussed the utilization of other networks' experiences to help guide them on strategic decisions:

> We have a set of operating procedures for the PBRN that we developed early on, and those operating procedures, we basically had our network coordinator, go out and look at operating procedures at other PBRNs. We went to the PBRN Resource Center, which at that time was at the University of Minnesota. We went to the AAFP National Research Network. We contacted other networks that we thought were similar to ours and asked them to send us their operating procedures. Then we basically sat down together and worked through what we thought made the most sense for our network.
>
> Director 3

Decision Makers

As reported by study participants, most decisions are made by consensus using internal and external advisory boards. Composition on these boards differed across PBRNs in the sample. External advisory boards sometimes

included patients and members of community organizations with which a PBRN was trying to establish a working relationship. Other times it consisted of practice partners representing different disciplines of clinician members within the PBRN. One PBRN even mentioned that a particular funding agency had representation on their external advisory board. What PBRNs in this study used the external advisory boards for was mostly as a sounding board for strategic directions the PBRN would set and a vetting group that provided input on which projects the PBRN should participate.

The internal advisory boards usually consisted of the PBRN director and additional staff, as necessary. In some PBRNs, the major decision makers were the director and the network coordinator. While in other larger PBRNs, the internal advisory board was comprised of several director-level positions and representatives from higher administration levels with the PBRN's host organization. Once a project has been identified and a principal investigator has been named, however, development of the protocol and any changes to the design and implementation of the study generally go through that principal investigator.

Decision Making Barriers

As mentioned previously, the two biggest barriers to decision making reportedly made by study participants were time and funding. These resource limitations reduced the capacity of the PBRN and even resulted in some PBRNs in the study being short staffed. Other barriers included poor communication and a lack of organization. As one director reported, "Right now it is just everybody is all over the place talking to all the practices, and it isn't very conducive." (Director 2)

PBRN Activities

The work that was accomplished in PBRNs was coded as PBRN activities. Study participants reported research project topics, data collection processes, and PBRN building as activities they engage in when completing PBRN work.

Research Projects PBRNs in the study engaged in a variety of research projects. Some projects were clinically focused on specific disease-state management of conditions, such as diabetes, hypertension, asthma, depression, Alzheimer's, sports-related injuries, and obesity. Other projects were related to medications, such as bisphosphonate-associated necrosis of the jaw, selective serotonin reuptake inhibitors (SSRIs), polypharmacy, medication error prevention, and drug shortages. Some projects focused on provider-level issues, such as clinical decision making, provider sanitary practices, dentist blood glucose monitoring, clinical pharmacist activities, and provider responses to difficult patients. Finally, a few projects were reported in the area of public health or prevention, including immunizations and patient-community connectedness. This disparate list of project types speaks to the variety of research foci PBRNs and their members have in aim of advancing patient care through research activities. Within and across networks many ideas exist for new directions for health care delivery, the breadth of activities may also speak to the diverse interest of funding organizations, but that was not well represented in the data.

Data Collection In addition to a diverse set of research foci, PBRN members reported utilizing an assortment of means to collect data. Two data collection sources predominately used were providers and the patients they served. As PBRN leaders tried to minimize efforts of clinicians in completing research projects, the more common methods of data collection were techniques that lessened time requirements by physicians and their practice staff. These methods could include chart reviews conducted by PBRN staff or research assistants, card

studies, and surveys. More complex data collection procedures included PBRN projects that required clinical data collection, patient samples, or follow-up data.

PBRN Building There is a range of activities that leaders of a PBRN must engage in to create and maintain the infrastructure necessary to operate their PBRNs. Recruiting staff, developing advisory boards, determining goals, developing relationships with clinicians and other stakeholders, developing policies and procedures, and completing an initial project were reported by several study participants.

One reason why the initial project is so important for a PBRN was the need to give co-investigators experience in conducting practice-based research, as expressed by one non-director:

> I think they kind of got things started with the initial project, and with a couple others they want to do. They wanted to give some people experience with going through the PBRN. So then investigators would fill a little more comfortable going to the PBRN to conduct the research because they have folks that have kind of done it before and have worked out the kinks with that first project, too.
>
> Non-director 14, clinician member

Recruiting clinicians to participate in research can be very difficult. By utilizing existing relationships within the host organization, some PBRNs were able to connect with practice sites that already had expectations and trust based on previous collaborative experiences. Even though these relationships have already existed, developing them into a more focused research collaborative required substantial time and effort, as reported by one PBRN director:

> And we spent 3 ½ to 4 years developing the PBRN before we started to formalize it. We built upon the relationships that we had with family medicine practices, we had throughout the region the [PBRN] region.
>
> Director 3

Recruiting staff members for the PBRN is another important aspect for any leader of a PBRN. There are many staff positions to fill in a PBRN. And while

roles were not given the same title from one PBRN to another, the list of potential staff roles reported included, community liaisons, clinical directors, medical assistants, administrative assistants, postdoctoral fellows, practice facilitators, research assistants, research coordinators, researchers, and study coordinators.

The fluctuating movement of personnel, both fixed and volunteer, in and out of PBRNs was reported by a few study participants, as a limitation. However, one PBRN director explained how they utilized that known migration to better enhance their social network and possible help bring about future collaborations:

> Well, because we are grassroots oriented, and because of my own kind of background and orientation very much think to capacity building of my staff, and as a clinician and empowerment approaches to management and work, preparing our staff to move on to other places. I typically hire young graduate students and we have a pretty good record at this point, we've had vast numbers of people from [PBRN] end up in [Non-profit orgs] one of our staff right now is entertaining offers from [ivy leagues], etc. So in truly we're only looking at building, the path that we are really helping are staff people, they're on their way to somewhere that will hire them. That comes off of the social network we can draw on later…
>
> Director 6

One important relationship to develop and maintain is with external funding agencies. As reported by one director, making these organizations aware of your existence can offer both benefits in awareness and prestige:

> Some of it is participation, participation, participation. So participating in AHRQ meetings, being seen, being visible, so they know we exist, and they know we of capabilities and they know we got stuff that they don't have we've got doctors we've got patients we've got a ton a data. All of our docs on electronic health records, so in many ways you at the forefront there. The others are being recognized. So in some of this comparative effectiveness work we have done AHRQ recognizes us as being on the edges some of that research on multiple chronic condition patients. So, participation, visibility those are probably some of the key strategies.
>
> Director 8

In summary, PBRNs engage in a variety of projects and other activities carried out and monitored through ongoing communication and decision making efforts. PBRN members participating in this study identified a range of communication modes and frequencies used and barriers that prevented successful communication. Additionally, they described the varied decision making bodies internal and external to their PBRNs and the decisions they made. PBRN activities and infrastructure development were identified by study participants.

Positional Characteristics, Roles, and Motivations

In addition to the three overarching themes, rich descriptions of a PBRN directors, network coordinators, principal/co-investigators, and clinician members emerged. Thinking about these findings in the context of an Input-Process-Output model helps frame these data in ways that might benefit other PBRNs.

PBRN Director Leadership Findings

While collaboration appears to be the dominant overarching theme describing leadership styles of PBRN directors, several study participants also provided deeper insights on the characteristics, delineation of roles, and behavioral expectations of PBRN directors they had experienced or desired to experience in working with their respective PBRNs. A visual display of PBRN director leadership codes is presented in Figure 6.

Leadership Characteristics

As collaboration was central to a PBRNs existence, the most frequently reported PBRN director characteristics were those that helped enable collaborative process. One such characteristic was having experience as a practitioner, as reported by one director:

> I think it helps that I'm a family doctor and that I'm in practice. So when I talk to practices, I always try to be sensitive to their needs, because I know what that is, from first-hand point of view.
>
> Director 2

Experience with research was a similarly useful characteristic. Another PBRN director characteristic that helped in collaboration was an ability to admit mistakes, as described by one non-director:

> He is also very open to being incorrect. That if he has made a mistake or if maybe there is a better idea he is very willing to say you know what I was wrong you were right let's explore this new idea. And that is something that I really admire about him.
>
> Non-director 6, central staff

Respectful and supportive PBRN director characteristics reportedly fueled cooperation within and external to their PBRNs and helped orient them to provide growth opportunities for central staff and practice partners. One non-director described her PBRN director's ability to motivate and inspire practice partners as a means of psychological support:

> … she is motivational for practices and practice champions, especially those who don't have a lot of previous experience with research, in terms of making this seem like something that is really possible. They can really do this. They can take part at whatever level, and they can make it happen at the sites. That they can be involved on a larger than just being part of effective recruiting for a trial or something like that, that they can be active collaborators.
>
> Non-director 5, central staff

Being recognized as accessible helped practice partners and PBRN staff communicate openly about issues and moved projects forward, as reported by one non-director:

> …he really makes sure that he is available for any questions that we have, any items that we need from him to complete the tasks that we've been assigned. And so it even goes so far as to after each action item we assign, and we come back to give him an update on the progress, [the director] has a habit just of asking is there, what items do you need from me, meaning himself, so he provides help to get our task accomplished.
>
> Non-director 14, clinician member

Additionally, non-directors reported that approachability of the PBRN director induced comfort and confidence in handling difficult situations.

Beyond characteristics associated with collaborative processes were those that demonstrate an acumen one would expect of an organization director. For example, one non-director described the organizational awareness of their PBRN director:

> She knew what was going on with the PBRN, so any question I ever asked her; she knew exactly how to answer that question. She definitely was in tune to the day-to-day operations of the PBRN to some of the challenges of the PBRN.
>
> Non-director 14, clinician member

Additionally, being intelligent and organized were characteristics that purportedly enabled PBRN directors to break research down into workable tasks and create a division of labor that was seen as fair to central staff.

Leadership Roles

Some of the leadership roles identified by study participants were linked to motivational processes within their PBRNs. Being a cheerleader, a visionary, a facilitator, and an inculcator of research culture fit this paradigm. As one non-director reported, the inculcation of a customer service-oriented or supportive environment was motivating for central staff:

> …the environment is very supportive. We support our sites and a lot of times our practices will pick up on that and they will support you in their endeavors. [The director] is supportive with staff, and that motivates us to become better researchers and move forward. We call it; our network director likes to call it, generating evidence.
>
> Non-director 4, central staff

Other roles focused on communication process, such as being a communicator and an external face. As expressed by one director, the communicator and external face roles are important aspects to running the PBRN:

> I represent both the institution and then I represent the clinicians that I work with. And so, on the day to day, I find it my responsibility that if a clinician emails me and says 'I've been approached by a researcher, who says 'would you like to work on my project' and I don't know if you've reviewed the study, so I don't know how to respond,' basically I have to intervene, take that email and figure out how to, how to make that collaboration work and see if that investigator approached us if…or worked with primary care or if it's a new investigator that doesn't know about our network and needs to learn about, you know, why we try to free up the times of the busy clinicians to review research projects, and also give feedback to investigators about how to make their project work in a community setting. So, you know, I feel like that's my, my role is basically to be the day to day manager and the face of all, both the good and bad things that happen to the network.
>
> Director 16

Finally, some of the leadership roles appeared more administrative and focused on being a manager, a problem solver, a protector, or a writer. One director reported having to protect their PBRN from investigators looking for data, without having the PBRN involved in study design:

> Because there are other medical school investigators that want to get their hands on their PBRN to test drugs or do this or do that. But I have been very cautious about that, emphasized both directly and subtly that the ideas for the projects have to come from the group. It has to be a group generated process.
>
> Director 10

Leadership Behaviors

Two major groupings of leadership behaviors emerged. Some of them focused on communication, delegation, negotiation, and the leading of meetings. The importance of leading meetings was described by one non-director:

> For instance, [PBRN] director he was very much more involved. He had a little bit more time on his hands and he would even be willing to write the minutes at a meeting if I wasn't there. He was very hands-on and was a very good leader of meetings. Sometimes he would get off track of the agenda but for the most part he was very good about following the agenda and calling on people and moving the meeting forward. One of the other directors that I worked with at the [host organization], she was less like that and that was a little harder because the meetings would really start to go off on tangents and we wouldn't get what we wanted to get done.
>
> Non-director 1, central staff

Other behaviors focused on the acquisition and allocation of resources. Financial and human resources were reportedly scarce in PBRNs. Therefore, many study participants reported the importance of having a director that could seek new funding, staff, and practice partners. Additionally, a good amount of time was spent prioritizing study projects and infrastructure needs for resource allocation. As reported by one director, being able to match PBRN goals with funding priorities is necessary for success:

> …there is an additional important role in identifying continuing funding for the infrastructure, which is of course a challenge and requires figuring out how to merge the identified priorities with funding opportunities.
>
> Director 9

There were examples of leadership directive, participative, and mixed behaviors provided by study participants, but they were mentioned very few times. An example of PBRN director flexibility was reported by one non-director:

> And, I really think she does allow us to use our strengths… You know she doesn't come with me or oversee everything I am doing. She asked me to design, when I started, she said design some kind of a document or a form or a blog that you want to use to keep track of what you are doing so I can keep track of where you are and what you are at and I report back to her. But she designs the structure but then we have freedom within that structure.
>
> Non-director 3, central staff

Coordinator Findings

Network coordinators fill an important administrative bridge in PBRNs, at times being even more involved in the management of the organizations than the PBRN directors. As such, characteristics, roles, and motivations revolve around split functionality ensuring the research efforts are completed in a satisfactory manner and making sure that people are motivated and moving forward. A visual display of network coordinator codes is presented in Figure 7.

Coordinator Characteristics

The dynamic nature of tasks a coordinator handles in their job defines a large number of the desirable coordinator characteristics reported by study participants. Coordinators were expected to be well educated, usually in a health or research related field, possess a diverse skill set, and be adaptable. One coordinator described their need to be adaptable:

> For example, a study coordinator may decide to leave. Or a project might not go the way you had planned. And that has happened. Sometimes it becomes a study you don't give up, but you learn lessons. And you have to publish that information, and try to help others. There have been studies where the outcomes are more lessons learned than let's say the positive outcomes we had in the hypotheses or had expected.
>
> Non-director 4, central staff

Additionally, as overseers of accountability for PBRN activities, network coordinators were expected to model accountability of task completion, commitment to the PBRN's mission and projects, and involvement in most PBRN activities to other staff and practice partners. As reported by one coordinator:

> I've done as much as write grants, establish collaborations with universities for new grants, anything down to the point of project management, trying to distribute letters to patients for participation, helping people do IRB applications etc. I have a mish mosh of rolls. I can basically take on whatever is needed at the time for the projects.
>
> Non-director 10, central staff

Coordinator Roles

In many ways, network coordinators provided PBRN director-level leadership in the absence of a PBRN director. As such, coordinator roles overlapped somewhat with those of the PBRN directors. Coordinators had to be communicators within and external to the PBRN, they had to help solve problems and acquire resources. As one director, with experience of having several coordinators over the years, described what an ideal coordinator was like they stated:

> They have to really present a good face for your network, be personable, be able to convey enthusiasm about the network and projects and also be a good face for you to your fellow investigators as well. That's really critical.
>
> Director 5

Slightly different from most PBRN directors in this study, network coordinators were more involved in the day-to-day operations of the PBRN, especially as it related to research activities. Reportedly, network coordinators had roles in ensuring practice sites were up and running during all phases of research efforts, that additional staff, investigators, and practice partners were coordinated in their research efforts, and in helping disseminate study findings back to members of the PBRN once studies were complete. As such, it was described that network coordinators were leaders in their own right; and, practice partners and PBRN directors valued their coordinators' service. As one non-director coordinator reported:

> I basically have overall supervision of our PBRN and that includes the day to day operations, helping with study design and protocol development for both projects that are funded internally and those that come to us from our spectral stakeholders, collaborators, links that work with the PBRN. I also have, act as a PI for certain projects within the PBRN, or have project oversight for those projects that are ongoing collaborations with external investigators. I participate in grant writing, manuscript development and other certain writing components in my job, and then assist with site training and support for our sites that are participating in various PBRN studies.
>
> Non-director 13, central staff

Coordinator Motivators/Demotivators

While not mentioned often, there were a few aspects of the PBRN that influenced a coordinator's ability to complete their tasks. A positive motivator for coordinators was being surrounded by an available staff. Negative demotivators reported for network coordinators were time constraints and travel stressors, as reported by one director:

> I think the only issues we have seen in terms of performance of our staff on the negative side has been that we are a big state and we ask these outreach folks to try and travel and put a lot of miles on and sometimes be away from home and reaching out to clinicians and that can become wearing on the outreach staff after a couple of years or so.
>
> Director 9

Principal/Co-investigator Findings

Less than half of the study participants described the characteristics, roles, and motivational factors of principal/co-investigators. Despite the principal/co-investigators significant emphasis on project-driven functions and research related manners, a number of the roles and characteristics overlapped with the PBRN director and network coordinators. The results below identify significant similarities and nuances in this import position. A visual display of principal/co-investigator codes is presented in Figure 8.

Principal/co-investigator Characteristics

As supportive and collaborative culture is inculcated by leaders within the PBRN, principal/co-investigators, desiring to utilize PBRN resources to accomplish their research programs, had to embody those cooperative virtues, especially being inclusive when developing research projects. As one director said:

> We expect [co-investigators] to do their work with our network through our coordinating center. So at this point because were new. We don't just connect them with our sites and say go to it or go after it. We basically participate with them as collaborators on their projects.
>
> Director 3

Strikingly different from other positions in the PBRNs, was the independence principal/co-investigators needed to be successful. In their description, there was a need for the principal/co-investigator to be a self-starter in getting the project running.

Principal/co-investigator Roles

As with the PBRN directors and network coordinators, principal/co-investigators had responsibilities to acquire funding, solve problems, communicate, and be a collaborator. One co-investigator solved a data collection problem in their PBRN, as described by a director:

> So, their thought of what to do was to be try to empower people to say managing without the fasting lipid profile was perfectly feasible. Don't wait for a fasting value, just simply get a value when they are there and then base the treatment on that non-fasting value. So that was kind of what they suggested.
>
> Director 15

Unlike network coordinators, who provided oversight to all the research activities within their PBRNs, principal/co-investigators provided oversight for individual studies. One non-director recalled the following:

> …but by the time the project is here on site and they're working on logistics, if there's any tweak in the plan after we've started, then it's all directly with the [principal] investigator.
>
> Non-director 7, clinician member

Principal/co-investigator Motivational Factors

Motivators for PBRN efforts of principal/co-investigators were mostly project specific. Being aware of the PBRN was the first hurdle potential co-investigators faced. Once aware of a PBRN, the PBRN needed to have adequate resources for the co-investigators to conduct studies. As previously mentioned, a lack of funding hampered co-investigators' abilities to conduct research. One unique demotivator for a principal investigator was a lack of experience in conducting practice-based research. As reported by one director,

> We find that many co-investigators haven't worked with practices they don't understand what the constraints are and so we see part of our job is sort of being like translators for them into this real-world research.
>
> Director 3

If a principal investigator was not adaptive to practice needs and allowed for changes to be made, more negative outcomes of their initial efforts were likely, as reported by one director:

> …over the ten years, we've had issues where, investigators have had problems with the practices. I think they had high expectations and poor communication and less flexibility, or were unwilling to sort of try and fix things.
>
> Director 16

Clinician Member Motivational Factors

Performance expectations of clinical members were described in the Aim 1 findings. In addition to those, motivational factors that influenced the participation in research emerged as a separate construct. These motivational factors are presented visually in Figure 9.

A number of clinician member motivational factors focused on the identity the clinician member had for themselves as a clinician. They viewed

patient care as their primary activity and saw research in PBRNs as a way to self-actualize and help improve in their own care delivery. As reported by one non-director:

> If it captures [clinician members'] interest, if they realize it will be a benefit to their patients, in kind of more of immediate kind of way or if they have a real interest in the process, those are the times, if they have a real interest in the topic itself.
>
> Non-director 9, central staff

Another frequently reported motivator was minimizing clinician members' efforts necessary to participate in the research, while an opposing demotivator reported was study requirements that were too oppressive. For example, a clinician reported:

> The least amount of, I guess, disruption to the practice. So we really can't have…It can't be too disruptive. I think that's probably the biggest criteria. It's got to be seamlessly kinda, intertwined with our current work, otherwise I just don't think it will work.
>
> Non-director 12, clinician member

As many practice partners with PBRNs reported experiencing work overload, other incentives such as economic or access to educational resources became more important as motivators. Conversely, having a "What's in it for me attitude" often reduced clinician member efforts in PBRN work. As reported by one clinician member, financial compensation is often necessary to buy time away from patient care activities:

> None of these projects have offered any compensation to our staff. No, none of the ones that we [participated] have offered any kind of compensation to the staff so you know, for that reason, and even if they did, quite honestly I'm not sure we would do it anyway, because we need our staff to take care of our patients. So, we don't agree to doing any projects that require a lot of our staff.
>
> Non-director 7, clinician member

At the end of the day, most clinician members were excited to be a part of something bigger than their own practices. This was fostered largely by the

collaborative processes of doing research with shared goals. This need for affiliation was expressed by one clinician member:

> … the bottom line is sometimes it's hard to get people's involvement because they feel like it's gonna be a lot of work, but I think that's more of a misperception. And once they're involved, they often don't feel like it's that much work. So there's a little bit of dragging of heels, like getting, getting other people involved, like we, we would ideally like to double our size, but getting other people involved is hard because there's a sense that it's so much work and so much time. And it's really not that much time and not that much work. So, probably the hardest thing, but the most fulfilling thing is that when you kind of work together and that's a, that's a fun part when you can kind of work together and share ideas and we're all sort of working toward the same goal. So that collaboration is pretty fun.
>
> Non-director 12, clinician member

Input-Process-Output Model of Positional Performance

McGrath's (1964) input-process-output model helps frame the positional descriptions and performance experiences collected in this study in a manner that may help generate hypotheses for future research. A visual representation of that model is found in Figure 10. Each person fulfilling a position with the PBRN brings characteristics, performs expected roles, and engages in job-related behaviors. One important caveat is that in some PBRNs, people may serve in several positions. This seemed especially likely for smaller PBRNs or those completing fewer projects. Communication processes and motivational process are used to accomplish PBRN activities. The level of accomplishment results in performance outcomes. Collective individual performance contributes to an organization's overall effectiveness.

Phase II: Aim 3 Analysis

Data analysis for Aim 3 began with 94 survey pairs. That is, both PBRN directors and participants completed their respective surveys. The analysis reported below was conducted to identify significant associations between PBRN director leadership and clinician member performance. Descriptive analyses are

presented first. Then the scales were analyzed for dimensionality and reliability. Bivariate correlations are discussed presenting unadjusted associations across variables collected. A regression modeling approach was used to test the formal hypotheses of the study.

Descriptive Statistics of Demographic Variables

Descriptive statistical analysis was performed on all items of the three surveys. Information has been put into tables for easy reference. The tables corresponding to descriptive analysis include Table 4.7 through Table 4.14.

Clinician Member Demographics

Sample clinician member demographics are reported in Table 4.6. Most of the clinician members completing surveys were physicians (72.3%) or pharmacists (12.8%). No survey respondents were inactive according to Dr. Hahn's activity level single-item scale. Most of the sample was active to varying degrees (60.6%), while the rest of the respondents self-reported as being passively involved in PBRN activities. The average number of hours a clinician member spent on PBRN activities a week was 2.0 (± 2.6), while the average percentage of time spent on PBRN activities was 3.9 (± 6.0). Survey respondents indicated that they had completed 5.5 (± 11.6) projects, on average, since joining the PBRN. The average number of years participating in practice-based research was 8.3 (± 7.2) and the average number of years of being a member of their current PBRN was 6.4 (± 4.6).

The future research interests of clinician member study participants are reported in Table 4.8. The top three research areas clinician members indicated as potential areas for future PBRN projects were disease state management (21.8%), medical home or practice redesign (12.4%), and outcomes or quality improvement (11.8%). Disease state management included a variety of conditions including diabetes, asthma, hypercholesterolemia, osteoporosis,

hypertension, obesity, chronic obstructive pulmonary disease, and acute conditions. Medical home or practice redesign included patient-centered medical home, empowered patient models, longer hours of care delivery, and team-based care. Outcomes or quality improvement included diverse activities, such as clinical indicators, costs, quality of life, patient satisfaction, provider satisfaction, disability status, and comparative effectiveness.

PBRN Director Demographics

Sample PBRN director demographics are reported in Table 4.9. Most of the directors completing surveys were physicians (50.0%), possessed a Ph.D. (35.7%), or had other training (2.4%). The average number of years participating in practice-based research was 15.6 (± 9.9) and the average number of years of being a member of their current PBRN was 7.3 (± 5.1). This means that the PBRN directors had more experience than their clinician members in practice-based research and in service to their PBRN, on average.

PBRN Demographics

Sample PBRN demographics are reported in Table 4.10. Most PBRNs in this sample measured membership based on sites, with an average of 136.8 (Range: 14-366) sites per PBRN. PBRNs that reported individual membership had an average of 143.6 (Range: 15-240) individual members. The average percentage of members active was 73.0% (Range: 10%-100%). In the previous year, these PBRNs had applied for 4.9 (± 3.8) grants, been awarded 2.6 (± 2.5) grants, and had 6.1 (± 5.8) active grants, on average. Most PBRNs utilized federally funded grants (78.6) with state (57.1) and internal (50.0) grants being the next most abundant funding sources. In the past year, these PBRNs had published 6.0 (± 4.7) manuscripts and had 7.7 (± 10.6) projects ongoing, on average. Slightly over three-fourths of these PBRNs provided quality improvement actions for their practice partners. These QI activities included best

practices in multiple disease states, research methods training, information technology implementation, patient-centered medical home transformation, shared decision making and comprehensive primary care initiatives, implementing standard operating procedures, developmental screening, literacy initiatives, National Committee for Quality Assurance recognition support, assistance with meaningful use, patient safety metrics, and other reports to stakeholders. Most of these PBRNs considered themselves top-down organizations and indicated, on average, 63.7% (± 30.8%) of their decisions were made using a top-down approach. This study over represented National (35.7% in sample versus 22.5% in population), Regional (35.7% vs. 30.6%), and State (28.6% vs. 26.3%) PBRNs, but under represented Local or City (0.0% vs. 20.6%) PBRNs. Additionally, this study over represented Family Medicine (57.1% vs. 30.0%), Pediatric (14.3% vs. 11.9%), and Pharmacy (7.1% vs. 2.5%) PBRNs, but under represented Mixed (14.3% vs. 36.3%) and Other (7.1% vs. 10.0%) PBRNs.

Scale Items Descriptive Statistics

Participative decision making scale item descriptive statistics are presented in Table 4.11, along with a histogram in Figure 11. A majority of study participants indicated they were able to help determine the mission of their PBRNs (51.1%), solve problems within their PBRN (51.1%), identify strategic or tactical changes within their PBRN (51.0%), identify research questions within their PBRN (52.3%), and monitor the success of their PBRN (58.5%), often or all of the time.

Clinician member perceptions about their PBRN leader's directive leadership behaviors are reported in Table 4.12, along with a histogram in Figure 12. Most clinician members reported having experienced a high frequency of directive leadership behaviors with all items ranging from 67.4% to 80.5% in the "usually" or "always" levels. The most frequently reported directive behavior

was "the leader asks me to follow standard rules or procedures," while the least frequently reported directive behavior was "the leader gives vague explanations about what is expected from me," which was reverse coded.

Clinician member perceptions about their PBRN leader's participative leadership behaviors are reported in Table 4.13, along with a histogram in Figure 13. Most clinician members reported having experienced a high frequency of participative leadership behaviors with four of the five items ranging from 52.2% to 78.3% in the "usually" or "always" levels. The most frequently reported participative behavior was "the leader listens to my ideas and suggestions."

The 13 performance item descriptive statistics are reported in Table 4.14. All but one of the items had frequencies reported "most of the time" and "always" for a majority of the clinician members, indicating a relatively high levels of performance. The most frequently performed behavior was "follows through on tasks necessary to complete PBRN research."

Performance Scale Analysis

Performance items were validated using several statistical approaches. Results of the factor analyses and reliability analysis are summarized in Table 4.15 through Table 4.20. Additionally, psychometric property tests are described.

Factor Analysis

The initial factor analysis with a principal components extraction is presented in Table 4.15. This analysis identified three factors that explained 62.86% of the variance in the performance measures. However, with the third factor only represented by a single item and having an eigenvalue <1.00 (after rotation), this item was dropped from subsequent analysis. Removal of that item did not affect conceptual representativeness, as follow-through was the only scale measured using 4 items (compared to others measured by 3) and this dropped item was not conceptually distinct from the three remaining items.

The main factor analysis of the remaining 12 performance items was conducted using principal axis extraction and promax rotation. The pattern matrix is presented in Table 4.16 and the structure matrix is presented in Table 4.17. The Bartlett's Test of Sphericity was statistically significant and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was 0.86. These values indicate factor analysis was appropriate to conduct. With a cutoff score of 0.51, 11 of the 12 item loaded onto two factors. The rotation sum of squared loadings were 5.40 and 5.18 for each extracted factors, respectively. The correlation between the two factors was 0.65. The most explanatory factor identified in the factor analysis merged the awareness or buy-in and leadership role items identified in the Aim 1 analysis. This factor appears to represent ownership a clinician member could take in being a PBRN member. The second factor extracted included items from the follow-through or commitment and communication scales identified in the Aim 1 analysis. This factor appears to represent engagement a clinician member could take in being a PBRN member. The six items of the ownership and engagement performance scales are used in subsequent analyses, and are referred to as such.

An additional orthogonal exploratory factor analysis with the 12 performance items was performed to examine the stability of the factors across methods. Its results are summarized in Table 4.18. While the order of factor loadings changed, the same two factors were identified with all of the same items.

Reliability Analysis

The ownership performance scale reliability analysis results are presented in Table 4.19, along with a histogram in Figure 14. The Cronbach's alpha for the scale was 0.89. All items had moderate item-total correlations ranging from 0.61-0.80, thus all items were retained in subsequent analyses.

The engagement performance scale reliability analysis results are presented in Table 4.20, along with a histogram in Figure 15. The Cronbach's alpha for the scale was 0.91. All items had moderate item-total correlations ranging from 0.69-0.82, thus all items were retained in subsequent analysis.

All but 2 PBRN directors had evidence of halo in their provided performance ratings. All but 1 director had evidence of severity or leniency in their ratings. Ranges varied similarly across PBRN directors. Thus all directors' performance ratings were used in subsequent analyses, since sample size would have been insufficient to conduct statistical analyses without.

Other Scales Analyses

Leadership participative and directive behavior and participative decision making scales were also analyzed for reliability. Results of the reliability analysis are summarized in Table 4.21 through Table 4.23.

The participative decision making reliability analysis results are presented in Table 4.21. The Cronbach's alpha for the scale was 0.92. All items had moderate item-total correlations ranging from 0.73-0.87, thus all items were retained in subsequent analysis.

The PBRN leadership directive behavior scale reliability analysis results are presented in Table 4.22. The Cronbach's alpha for the scale was 0.79. Items had item-total correlations ranging from 0.32-0.72. Upon inspection of the low performing item, it was determined that removal would not limit measurement of the entire domain. Thus, one item was dropped, resulting in a Cronbach's alpha for the four remaining item scale of 0.84.

The PBRN leadership participative behavior scale reliability analysis results are presented in Table 4.23. The Cronbach's alpha for the scale was 0.80. Items had item-total correlations ranging from 0.40-0.71. Upon inspection of the low performing item, it was determined that removal would not limit

measurement of the entire domain. Thus, one item was dropped, resulting in a Cronbach's alpha for the four remaining item scale of 0.82.

Bivariate Correlations

Relationships between the measured variables were identified using Phi, Point-biserial, or Pearson's product-moment bivariate correlations, where appropriate. Results of the correlation analyses are presented in Appendix E and selected relationships are summarized in Table 4.24 and Table 4.25.

Selected bivariate correlations for individual level variables are reported in Table 4.24. Clinician member length of time in their PBRN was significantly and positively associated with ownership performance (0.39; $p<0.01$) and number of projects completed (0.31; $p<0.01$). Clinician member length of time conducting practice-based research was significantly and positively associated with ownership performance (0.36; $P<0.01$). Clinician member self-reported activity level on the Dr. Hahn scale was significantly and positively associated with the global performance item (0.24; $p<0.05$). Clinician member number of projects was significantly and positively associated with ownership performance (0.28; $p<0.05$) and the global performance item (0.27; $p<0.05$). Finally, the participative decision making scale was significantly and positively associated with PBRN director directive (0.25; $p<0.05$) and participative (0.47; $p<0.01$) leadership behaviors.

Selected bivariate correlations for PBRN level variables are reported in Table 4.25. Top-down PBRNs were significantly associated with fewer PBRN members (-0.71; $p<0.01$), fewer grant applications in the past 12 months (-0.65; $p<0.05$), fewer active grants in the past 12 months (-0.68; $p<0.05$), and fewer internal grants in the past 12 months (-0.60; $p<0.05$). The percentage of top-down decisions made by a PBRN were significantly and negatively associated with PBRN members (-0.73; $p<0.05$), grant applications in the past 12 months (-0.70; $p<0.05$), grants awarded in the past 12 months (-0.72; $p<0.05$), active grants in the

past 12 months (-0.81; p<0.01), and manuscripts submitted in the past 12 months (-0.62; p<0.05). The number of grant applications made in the past 12 months was significantly and positively associated with PBRN members (0.73; p<0.01), studies conducted in the past 12 months (0.63; p<0.05), and manuscripts submitted in the past 12 months (0.88; p<0.01). The number of grants awarded in the past 12 months was significantly and positively associated with PBRN members (0.67; p<0.05), studies conducted in the past 12 months (0.77; p<0.01), and manuscripts submitted in the past 12 months (0.71; p<0.01). The number of active grants during the past 12 months was significantly and positively associated with PBRN director length of tenure with current PBRN (0.56; p<0.05). PBRNs with federal grants were associated with offering more quality improvement activities with practice partners (0.67; p<0.05).

Two by two tables were created exploring the interaction of top-down decision making with age of PBRN and scope of PBRN research. A trend, in which younger PBRNs often made top-down decision making as opposed to bottom-up decisions, as well as PBRNs with more limited research foci made more top-down decisions, was identified. However, these results were statistically insignificant.

Regression Modeling

Formal testing of hypotheses 1-4 was conducted using ordinary least squares regression. Results of the regression analyses are summarized in Table 4.26 through Table 4.31.

Ownership Performance

Regression models for ownership performance are presented in Table 4.26, Table 4.27, and Table 4.28. An initial regression analysis (Table 4.26) was conducted on ownership performance using data from all subjects excluded listwise for missing data resulting in an n of 61. The overall model F test = 2.18

(p=0.07) indicating the model had poor predicting power. The model R^2 was 0.17 indicating that this model predicted 17% of the variance in the ownership performance scale. The Durbin-Watson statistic was 1.95 indicating no serial correlations exist between errors. All variance inflation factors (VIF) were less than 10, but the average was greater than 1; however, no tolerance statistics were less than 0.2, indicating multicollinearity was not likely. In this model, clinician members length of years in current PBRN was the only statistically significant variable (0.29; p=0.03). That is, as a clinician member increases the length of PBRN membership by a year, their score on the ownership performance scale will increase by 0.29. An outlier analysis revealed 1 outlier which was removed in subsequent analysis. Outliers were defined as being outside of two standard deviations of expected residuals.

A regression analysis with the outlier removed (Table 4.27) was conducted on ownership performance resulting in an n of 60. The overall model F test = 3.12 (p=0.02) indicating the model had adequate predicting power. The model R^2 was 0.23 indicating that this model predicted 23% of the variance in the ownership performance scale. The Durbin-Watson statistic was 1.92 indicating no serial correlations exist between errors. All variance inflation factors (VIF) were less than 10, but the average was greater than 1; however, no tolerance statistics were less than 0.2, indicating multicollinearity was not likely. In this model, clinician members length of years in current PBRN was the only statistically significant variable (0.35; p<0.01). That is, as a clinician member increases the length of PBRN membership by a year, their score on the ownership performance scale will increase by 0.35.

A regression analysis with the outlier removed and a PBRN level variable (number of studies conducted in the previous 12 months) (Table 4.28) was conducted on ownership performance to examine the robustness of the estimates

of the previous model resulting in an n of 60. The overall model F test = 2.88 (p=0.02) indicating the model had adequate predicting power. The model R^2 was 0.25 indicating that this model predicted 25% of the variance in the ownership performance scale. The Durbin-Watson statistic was 1.72 indicating no serial correlations exist between errors. All variance inflation factors (VIF) were less than 10, but the average was greater than 1; however, no tolerance statistics were less than 0.2, indicating multicollinearity was not likely. In this model, clinician members length of years in current PBRN was the only statistically significant variable (0.34; $p<0.01$). That is, as a clinician member increases the length of PBRN membership by a year, their score on the ownership performance scale will increase by 0.34. This model indicated that the previous model was robust even in presence of additional covariates.

Alternative regression models based on one predictor variable (i.e. leadership directiveness or participativeness) included at a time did not change the directionality or significance of their estimates on either clinician member performance outcome variable. The estimates remained insignificant. Additionally, regression models with imputed performance data to remove missing data and increase sample size did not significantly alter estimates.

For ownership performance, only hypothesis 4 had evidence supporting rejection of the null hypothesis, hypotheses 1-3 only had evidence that supported failing to reject each null hypothesis.

Engagement Performance

Regression models for engagement performance are presented in Table 4.29, Table 4.30, and Table 4.31. An initial regression analysis (Table 4.29) was conducted on engagement performance using data from all subjects excluded listwise for missing data resulting in an n of 79. The overall model F test = 0.92 (p=0.47) indicating the model had poor predicting power. The model R^2 was 0.06

indicating that this model predicted 6% of the variance in the ownership performance scale. The Durbin-Watson statistic was 1.71 indicating no serial correlations exist between errors. All variance inflation factors (VIF) were less than 10, but the average was greater than 1; however, no tolerance statistics were less than 0.2, indicating multicollinearity was not likely. In this model, a clinician member's education as a physician was the only statistically significant variable (-2.31; p=0.05). That is, compared to non-physician clinician members of PBRNs, physician clinician members, on average had 2.31 points lower on engagement performance scale. An outlier analysis revealed 2 outliers which were removed in subsequent analysis.

A regression analysis with the outliers removed (Table 4.30) was conducted on engagement performance resulting in an n of 77. The overall model F test = 1.47 (p=0.21) indicating the model had poor predicting power. The model R^2 was 0.09 indicating that this model predicted 9% of the variance in the ownership performance scale. The Durbin-Watson statistic was 1.75 indicating no serial correlations exist between errors. All variance inflation factors (VIF) were less than 10, but the average was greater than 1; however, no tolerance statistics were less than 0.2, indicating multicollinearity was not likely. In this model, a clinician member's education as a physician was the only statistically significant variable (-2.53; p=0.02). That is, compared to non-physician clinician members of PBRNs, physician clinician members, on average had 2.53 points lower on engagement performance scale.

A regression analysis with the outlier removed and a PBRN level variable (number of studies conducted in the previous 12 months) (Table 4.31) was conducted on engagement performance to examine the robustness of the estimates of the previous model resulting in an n of 77. The overall model F test = 1.60 (p=0.16) indicating the model had poor predicting power. The model R^2 was

0.12 indicating that this model predicted 12% of the variance in the ownership performance scale. The Durbin-Watson statistic was 1.83 indicating no serial correlations exist between errors. All variance inflation factors (VIF) were less than 10, but the average was greater than 1; however, no tolerance statistics were less than 0.2, indicating multicollinearity was not likely. In this model, a clinician member's education as a physician was the only statistically significant variable (-2.41; p=0.02). That is, compared to non-physician clinician members of PBRNs, physician clinician members, on average had 2.41 points lower on engagement performance scale. This model indicated that the previous model was robust even in presence of additional covariates.

Alternative regression models based on one predictor variable (i.e. leadership directiveness or participativeness) included at a time did not change the directionality or significance of their estimates on either clinician member performance outcome variable. The estimates remained insignificant. Additionally, regression models with imputed performance data to remove missing data and increase sample size did not significantly alter estimates.

For engagement performance, hypotheses 1-4 only had evidence that supported failing to reject each null hypothesis.

Table 4.1 Phase I Qualitative Data Initial Categorization and Abundance

Category	Percentage of Exchanges Category is Mentioned
Clinician Performance	19.3
Not Coded	14.9
PBRN Director Leadership	12.3
Decision Making	9.7
Demographics - PBRN	9.6
Demographics - Personal	7.6
PBRN Activity	7.4
Motivation	4.8
Communication	4.6
PI/Investigator Performance	2.8
Coordinator Performance	2.5
Role Within PBRN	2.0
Social Exchange	1.4
Funding	1.2

Note: n=32.

Table 4.2 Sample Participant Demographics for Phase I

Variable	n	Mean	Median	Range	%
Educational Training	32				
Physician					59.4
Masters - Public Health					31.3
Pharmacist					6.3
Athletic Training					6.3
BS/BA					6.3
Dentist					3.1
Nurse					3.1
PhD					3.1
Years in PBRN	17	5.0	3.0	1-16	
Years in Practice-based Research	10	13.5	12.0	4-25	

Note: n does not equal 32 in all cases due to interviewee non-response.

Percentages add up to more than 100% due to categories being non-mutually exclusive.

Table 4.3 Sample PBRN Demographics for Phase I

Variable	n	Mean	Median	Range	%[a]	%[b]
Years in Operation	16	8.4	8.5	2-16		
PBRN Size						
Individuals	6	1083.7	285	15-5000		
Practice Sites	11	51.1	58.0	8-80		
Sponsor Organization Educational	16				75.0	
Practitioner Mix	16					
Mixed					37.5	36.3
Family Medicine					31.3	30.0
Other					12.5	10.0
Pediatric					6.3	11.9
Dental					6.3	2.5
Pharmacy					6.3	2.5

Note: n does not equal 16 in all cases due to interviewee non-response.

PBRN Size was defined two ways. Some PBRNs provided information only about individuals, only about practice sites, or both individuals and practice sites.

Educational sponsor organization as shown in table compared to other sponsor organizations mentioned that only included non-profit, non-educational sponsor organizations.

a Sample percentage; n = 16.

b National percentage, if available; n = 160.

Table 4.4 Clinician Member Performance Behavioral Item Codes, Representative Quotes, and Frequency

Behavioral Item	Representative Quote	Participant	Percent
1. This clinician takes a leadership role in carrying out PBRN projects of interest to them.	Well she [clinician member] would send emails "What should we be doing next?" She made a strong effort to keep things pushing along. Everybody is really busy and when she hits one of those road blocks, it's easy for things to fall off the table, but she really didn't allow that to happen.	Director 5	36.7
2. Did not complete tasks agreed upon.	And we certainly had one practice that wanted to participate but then never really wanted to do anything. So you know we would be out talking to them about options and how we could support this and what would you like to do for your QI work this next few months. You know, we've got the practice facilitator and she is yours for a lot of this time and they never came up with anything. So they never did anything. So that's kind of frustrating.	Director 2	30.0
3. Follows through on tasks necessary for completing the study.	And regardless of what we ask, whether it's just to assure adequate medical records are kept, to do a little bit more of collecting the patient-centered outcome forms, they're always ready and willing to do that because they see, I think, the greater good besides collecting. Then within the PBRN structure, they can see how it facilitates their own clinical practice and makes them a better clinician and makes them able to provide better care to their patients.	Director 11	30.0
4. Discusses difficulties in and strategies for maintaining engagement of staff/clinicians/practice sites.	Once they've bought into a particular study they're usually "gung ho" about it. One of the weaknesses might be if an entire practice is participating we might find that only one or two of the providers are truly "gung ho" about it and others are not. That may be because they don't have the full patient population that we would require. We don't know yet.	Non-director 10, central staff	30.0
5. Encounters patient/ clinician recruitment issues.	Well, a lot of what we've done is supposed to be involved in engaging patients, so finding patients to participate in studies, and most of the other effort really has just been involved around surveys clinicians have to complete. That's part of the study, but most of it really has been recruiting patients.	Non-director 8, clinician member	26.7

Table 4.4 Continued

Behavioral Item	Representative Quote	Participant	Percent
6. Identifies problems in practice and conveys these to PBRN staff as potential research projects.	So we have a…well we have one going on right now…he is a family doctor in [city] and he has a particular interest in Vitamin D deficiency because he has a large Somali population. And he has been pushing us to do a project.	Director 4	26.7
7. Helps promote PBRN research throughout their entire practice site.	So there has to be some I think that demonstrates buy-in on their side and belief in what we're trying to do because again they had to train their staff to use the system to be able to incorporate in the coursework. They've obviously had to make sure that any preceptors that they know how to use the system to so that it's used in clinical sites as well.	Non-director 11, central staff	26.7
8. Encounters a range of performance levels.	Yes, we have the whole gamut [of performers].	Non-director 4, central staff	20.0
9. Demonstrates buy-in toward PBRN research.	Definitively so in my experience, it is the clinicians that show up to the meetings are usually the ones that are well vested in the study. And more dedicated to recruiting others.	Non-director 1, central staff	16.7
10. Demonstrates focus necessary to complete PBRN research tasks in a timely manner.	Because it was relatively easy in a sense that….this is a good point about PBRNs…in the sense that they were just asked to do I think 20-25 I forget the exact number consecutive patients. In other words, we weren't selecting patients for difficulty, non-difficulty, for age or anything, it is just 20 straight patients. So the clinician simply had to remember to do the card. That becomes an issue later.	Director 10	16.7
11. Forgets to communicate in a timely manner with PBRN staff.	Well, sort of what I started to talk about with one site they basically started working on a project with them. They said that they were interested and we started to try to set up initial meetings to discuss that. And they just never respond to setting something up or we have call and they don't ever follow up with any of the things that they needed to look into. And when I try to contact them and follow up to see what is going on. There is just dead air, no response to emails, no response to voice mails, that sort of thing.	Non-director 5, central staff	16.7

Table 4.4 Continued

Behavioral Item	Representative Quote	Participant	Percent
12. Required additional support from PBRN to complete the project.	Some study coordinators you have to hand-walk them through. Where others you can decide on the next step and let them go after it themselves.	Non-director 4, central staff	13.3
13. Forgets to record or document requested information necessary to complete study in a timely fashion.	For this clinical trial, I am looking in the database. For this study we are using the online data web-based capturing system, called [name]. You can look in there you can see all the activities you can see queries. If queries are not being answered, if data is not being entered, patients are not being enrolled. So many metrics you can look at. And it is hard for the sites to fake it.	Non-director 4, central staff	10.0
14. Communicated with PBRN staff about project during a challenging time.	But I was busy at the time and probably did not have, basically the focus to really pursue that, but that probably could have been one instance where I wish I would have, maybe followed through a little bit and persisted and called or made some connections to determine what I could of done to probably get it more successful.	Non-director 12, clinician member	10.0
15. Necessitated additional external resources in completing the research.	The other really liked the program but didn't have as much success in their recruiting process, and from what we understood part of that was a difference in, we think, part of this was an intervention study and the intervention was including nurse practitioners that were not involved with our PBRN, they were from an outside resource. And from what we understood the context that APRN differed between these practices. So what we did we said for the new study we're trying to have nurse practitioners available that had the same training but closer in locale to each of these participating practices.	Non-director 10, central staff	10.0
16. Awareness of PBRN membership.	I guess I would maybe expect them to know they were members of the PBRN, which I know is not the case.	Director 2	6.7

Table 4.4 Continued

Behavioral Item	Representative Quote	Participant	Percent
17. Is engaged throughout the entire course of the research study.	I think part of what helped was that she is actually a faculty member in one of our resident practices that is part of the network. She had done a little bit of early looking at this when she was doing her faculty development fellowship at [University]. So she came to the table with a pretty well formed idea, so I think that really helped. It didn't take a whole lot of work to flush things out and I think the other thing that has really been helpful is that she has stayed very engaged with this all the way along.	Director 5	6.7
18. Conducts PBRN research using a higher standard than what is minimally required.	I would say their documentation practices, the completeness of their medical records is definitely more thorough. I think they probably just take a greater pride and responsibility in ensuring that what they're doing meets basic standards for documentation, but they have had to go above and beyond.	Director 11	6.7
19. Demonstrates care in PBRN research projects.	Just a physician that cares.	Non-director 4, central staff	6.7
20. Maintains practice changes after PBRN research study has concluded.	I think we're most proud of the projects where the practices sort of take what we've done and, you know, embraced it and implemented it in their practices.	Director 16	6.7
21. Comments on the influence of the quality of the manager/coordinator on the performance of the PBRN.	It was the least effective of all the sites for that project as far as getting any change initiated. Because she [the manager], not being able to respond to emails, she didn't try to set up a meeting, and she wouldn't come back with schedules or she canceled at the last minute, you know what I mean.	Non-director 3, central staff	3.3
22. Encounters disagreements with the physicians.	I attended one of the last annual meetings for one of these networks and I gave a transitional time talk, they mention their unhappiness in the thought process and the outcome etc. but it ended up going okay because they ended up enrolling in the network anyway. They have been fine since.	Director 1	3.3

Note: For percentages, n = 30.

Table 4.5 Clinician Member Performance Domain and Corresponding Behavioral Items

Performance Domain	Behavioral Items
Follow-through or Commitment	2, 3, 4, 5, 10, 12, 13, 15, 19
Leadership Role	1, 6, 17, 18, 21
Awareness or Buy-in	7, 9, 16, 20
Communication	11, 14, 22

Note: Behavioral item numbers can be found in Table 4.4.

Table 4.6 Final Items in Clinician Member PBRN Performance Evaluation Scale

Performance Items
Does not communicate with PBRN staff in a timely manner. (R)
Maintains practice changes after PBRN research studies have concluded.
Helps promote PBRN research throughout their entire practice site.
Takes a leadership role in carrying out PBRN research.
Requires additional support from PBRN staff to complete PBRN research. (R)
Follows through on tasks necessary to complete PBRN research.
Provides leadership or mentoring to develop PBRN staff or other investigators.
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.
Facilitates strategies to overcome problems or barriers in completing PBRN research.
Records or documents requested information necessary for completing PBRN research in a timely manner.
Demonstrates awareness of membership within the PBRN.
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.

Note: R is reversed for analysis.

Table 4.7 Sample Clinician Member Demographics for Phase II

Variable	n	Mean	Median	Range	Std. Dev.	%
Educational Training	94					
Physician						72.3
Pharmacist						12.8
Athletic Training						7.4
Masters						7.4
Nurse						4.3
Other						4.3
Masters - Public Health						3.2
PhD						1.1
Dentist						0.0
Activity Level						
Dr. Hahn Scale	94	1.8	2.0	1-4	0.73	
Inactive						0.0
Passive						39.4
Active						47.9
Fully Active						10.6
Hyperactive						2.1
Hours Per Week	87	2.0	1.0	0-20	2.65	
Percentage of Time	86	3.9	2.0	0-50	5.98	
Number of Projects	93	5.5	3.0	0-100	11.59	
Years in PBRN	92	6.4	5.5	0-19	4.61	
Years in Practice-based Research	91	8.3	7.0	0-34	7.17	

Note: For percentages n = 94.

Educational training percentages may exceed or fail to exceed 100% due to non-mutually exclusive categories or non-response.

Std. Dev. = standard deviation.

Table 4.8 Future Research Interests and Frequencies of Clinician Members

Research Idea Code	Frequency
Disease State Management	21.8
Medical Home/Practice Redesign	12.4
Outcomes/Quality Measurement	11.8
Technology/EMR	9.4
Prevention	6.5
Mental Health	5.9
Pediatric	5.3
Student/Resident Education	4.7
Social Determinants of Health	4.1
Patient Adherence	2.9
Medication Management	2.4
Controlled Substance/Alcohol Use and Abuse	1.8
Patient Safety	1.8
Rural Care	1.8
Care Transitions	1.2
Shared Clinical Decision Making	1.2
Translational medicine	1.2
Women's Health	1.2
End of Life Care	0.6
Geriatric	0.6
Provider Shortages	0.6
Reimbursement	0.6
Staff Satisfaction	0.6

Note: Percentages are reported.

n = 170.

Table 4.9 Sample PBRN Director Demographics for Phase II

Variable	n	Mean	Median	Range	Std. Dev.	%
Educational Training	14					
Physician						50.0
PhD						35.7
Other						21.4
Pharmacist						7.1
Athletic Training						7.1
Nurse						7.1
Masters - Public Health						3.2
Masters						0.0
Dentist						0.0
Years in PBRN	14	7.3	5.5	1-18	5.08	
Years in Practice-based Research	14	15.6	12.0	4-33	9.87	

Note: Percentages may exceed or fail to exceed 100% due to non-mutually exclusive categories or non-response.

Std. Dev. = standard deviation.

Table 4.10 Sample PBRN Demographics for Phase II

Variable	n	Mean	Median	Range	%[a]	%[b]
PBRN Membership						
Individuals	5	143.6	150.0	15-240		
Practice Sites	9	136.8	125.0	14-366		
Active Percentage	13	73.0	79.5	10-100		
Grant Status						
Applied[c]	13	4.9	3.5	0-12		
Awarded[c]	13	2.6	2.5	0-8		
Active[c]	13	6.1	5.5	0-20		
Grant Sources	14					
Federal[d]					78.6	
State[d]					57.1	
Professional Associations[d]					35.7	
Industry[d]					42.8	
Internal[d]					50.0	
Productivity						
Studies[c]	14	7.7	4.5	0-42		
Manuscripts[c]	14	6.0	5.5	0-13		
Quality Improvement[d]	14				78.6	
Decision Making						
Top-down[d]	14				71.4	
Top-down Percentage	11	63.7	75.0	1-100		
Geographic Dispersion	14					
National					35.7	22.5
Regional					35.7	30.6
State					28.6	26.3
Practitioner Mix						
Family Medicine					57.1	30.0
Mixed					14.3	36.3
Pediatric					14.3	11.9
Other					7.1	10.0
Pharmacy					7.1	2.5

Note: Percentages may exceed or fail to exceed 100% due to non-mutually exclusive categories or non-response.

a Sample percentage; n = 14.

b National percentage, if available; n = 160.

Table 4.10 Continued

c In the previous 12-month period.

d Dichotomous variable with yes/no response.

Table 4.11 Descriptive Statistics of Clinician Members Participative Decision Making Scale

Item	n	Never	Rarely	Sometimes	Often	All of the Time
Monitoring success of your Practice-based Research Network.	94	6.4	16.0	19.1	34.0	24.5
Determining the mission and vision of your Practice-based Research Network.	94	8.5	21.3	19.1	27.7	23.4
Identifying research questions for your Practice-based Research Network.	94	4.3	15.2	28.3	31.5	20.7
Solving problems within your Practice-based Research Network.	94	7.4	12.8	28.7	33.0	18.1
Identifying strategic or tactical changes within your Practice-based Research Network.	94	7.4	17.0	24.5	34.0	17.0

Note: Percentages reported in columns 3-7.

Table 4.12 Descriptive Statistics of PBRN Directors Leadership Directive Behavior Scale as Rated by Clinician Members

Item	n	Never	Hardly Ever	Seldom	Occ.	Often	Usually	Always
The leader lets me know what is expected of me.	93	0.0	1.1	1.1	7.5	11.8	25.8	52.7
The leader asks me to follow standard rules and procedures.	92	3.3	0.0	1.1	4.3	10.9	28.3	52.2
The leader informs me what needs to be done and how it needs to be done.	93	3.2	1.1	1.1	8.6	12.9	24.7	48.4
The leader explains the level of performance that is expected from me.	93	4.3	1.1	5.4	9.7	10.8	29.0	39.8
The leader gives vague explanations about what is expected from me. (R)	92	5.4	2.2	3.3	6.5	15.2	28.3	39.1

Note: Percentages reported in columns 3-9.

R item is reverse coded.

Occ. is occasionally.

Table 4.13 Descriptive Statistics of PBRN Directors Leadership Participative Behavior Scale as Rated by Clinician Members

Item	n	Never	Hardly Ever	Seldom	Occ.	Often	Usually	Always
The leader listens to my ideas and suggestions.	92	2.2	0.0	0.0	8.7	10.9	26.1	52.2
The leader consults with me when facing a problem.	92	6.5	5.4	4.3	15.2	14.1	19.6	34.8
The leader asks for suggestions on which tasks should be assigned to me.	90	6.7	0.0	10.0	16.7	14.4	20.0	32.2
The leader asks me for suggestions on how to carry out tasks.	92	4.3	0.0	3.3	21.7	13.0	29.3	28.3
The leader acts without consulting me. (R)	91	11.0	8.8	13.2	20.9	15.4	16.5	14.3

Note: Percentages reported in columns 3-9.

R is reverse coded.

Occ. is occasionally.

Table 4.14 Descriptive Statistics Clinician Member Performance Items as Rated by PBRN Directors

Item	n	Never	Rarely	Sometimes	Most of the Time	Always
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.	88	0.0	6.8	18.2	34.1	40.9
Does not communicate with PBRN staff in a timely manner. (R)	91	0.0	3.3	20.9	36.3	39.6
Facilitates strategies to overcome problems or barriers in completing PBRN research.	88	0.0	6.8	27.3	29.5	36.4
Demonstrates awareness of membership within the PBRN.	88	4.5	5.7	26.1	27.3	36.4
Follows through on tasks necessary to complete PBRN research.	91	1.1	3.3	13.2	47.3	35.2
Helps promote PBRN research throughout their entire practice site.	88	0.0	3.4	20.5	42.0	34.1
Takes a leadership role in carrying out PBRN research.	88	0.0	5.7	31.8	30.7	31.8
Records or documents requested information necessary for completing PBRN research in a timely manner.	90	0.0	3.3	20.0	46.7	30.0
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.	77	0.0	14.3	26.0	31.2	28.6

Table 4.14 Continued

Item	n	Never	Rarely	Sometimes	Most of the Time	Always
Provides leadership or mentoring to develop PBRN staff or other investigators.	77	0.0	14.3	26.0	31.2	28.6
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.	84	8.3	7.1	16.7	44.0	23.8
Maintains practice changes after PBRN research studies have concluded.	71	0.0	5.6	39.4	39.4	15.5
Requires additional support from PBRN staff to complete PBRN research. (R)	91	3.4	12.6	40.2	34.5	9.2

Note: Percentages reported in columns 3-7.

R is reverse coded.

Table 4.15 Initial Factor Analysis of Clinician Member Performance Ratings

Item	Factor 1	Factor 2	Factor 3
Follows through on tasks necessary to complete PBRN research.	0.79		
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.	0.76		
Records or documents requested information necessary for completing PBRN research in a timely manner.	0.74		
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.	0.70		
Does not communicate with PBRN staff in a timely manner. (R)	0.68		
Facilitates strategies to overcome problems or barriers in completing PBRN research.	0.65		
Takes a leadership role in carrying out PBRN research.		0.88	
Helps promote PBRN research throughout their entire practice site.		0.77	
Demonstrates awareness of membership within the PBRN.		0.73	
Maintains practice changes after PBRN research studies have concluded.		0.63	
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.		0.61	
Provides leadership or mentoring to develop PBRN staff or other investigators.		0.56	
Requires additional support from PBRN staff to complete PBRN research.			0.74
Eigenvalue	3.70	3.66	0.82
Percent of Variance	28.42	28.16	6.28

Note: All factor loadings, eigenvalues, and percent variance are post varimax rotation, with principal axis extraction.

Loading scores less than 0.51 are not reported.

n = 66.

Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Table 4.16 Final Factor Analysis (Oblique) of Clinician Member Performance Ratings - Pattern Matrix

Item	Factor 1	Factor 2
Takes a leadership role in carrying out PBRN research.	0.93	
Helps promote PBRN research throughout their entire practice site.	0.85	
Demonstrates awareness of membership within the PBRN.	0.84	
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.	0.68	
Maintains practice changes after PBRN research studies have concluded.	0.62	
Provides leadership or mentoring to develop PBRN staff or other investigators.	0.54	
Records or documents requested information necessary for completing PBRN research in a timely manner.		0.90
Follows through on tasks necessary to complete PBRN research.		0.89
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.		0.71
Does not communicate with PBRN staff in a timely manner. (R)		0.70
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.		0.64
Facilitates strategies to overcome problems or barriers in completing PBRN research.[a]		
Rotation Sum of Squared Loadings	5.40	5.19

Note: All factor loadings, eigenvalues, and percent variance are post promax rotation with principal axis extraction, while communalities are from the initial solution.

Loading scores less than 0.51 are not reported.

n = 66.

Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

a Did not load on pattern matrix, but did load on structure matrix.

Table 4.17 Final Factor Analysis (Oblique) of Clinician Member Performance Ratings - Structure Matrix

Item	Factor 1	Factor 2
Takes a leadership role in carrying out PBRN research.	**0.82**	
Helps promote PBRN research throughout their entire practice site.	**0.86**	0.57
Demonstrates awareness of membership within the PBRN.	**0.76**	
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.	**0.70**	
Maintains practice changes after PBRN research studies have concluded.	**0.73**	0.57
Provides leadership or mentoring to develop PBRN staff or other investigators.	**0.67**	0.55
Records or documents requested information necessary for completing PBRN research in a timely manner.		**0.73**
Follows through on tasks necessary to complete PBRN research.	0.53	**0.86**
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.	0.65	**0.83**
Does not communicate with PBRN staff in a timely manner. (R)		**0.72**
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.	0.66	**0.80**
Facilitates strategies to overcome problems or barriers in completing PBRN research.	0.69	**0.73**
Rotation Sum of Squared Loadings	5.40	5.19

Note: All factor loadings, eigenvalues, and percent variance are post promax rotation with principal axis extraction, while communalities are from the initial solution.

Loading scores less than 0.51 are not reported.

n = 66.

Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Bolded values correspond to higher loading scores.

Table 4.18 Final Factor Analysis (Orthogonal) of Clinician Member Performance Ratings

Item	Communalities	Factor 1	Factor 2
Takes a leadership role in carrying out PBRN research.	0.63	0.81	
Helps promote PBRN research throughout their entire practice site.	0.70	0.81	
Demonstrates awareness of membership within the PBRN.	0.63	0.75	
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.	0.51	0.65	
Maintains practice changes after PBRN research studies have concluded.	0.66	0.64	
Provides leadership or mentoring to develop PBRN staff or other investigators.	0.63	0.58	
Records or documents requested information necessary for completing PBRN research in a timely manner.	0.62		0.76
Follows through on tasks necessary to complete PBRN research.	0.71		0.81
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.	0.77		0.73
Does not communicate with PBRN staff in a timely manner. (R)	0.51		0.66
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.	0.69		0.69
Facilitates strategies to overcome problems or barriers in completing PBRN research.	0.71		0.59
	Eigenvalue	3.84	3.51
	Percent of Variance	31.97	29.27

Note: All factor loadings, eigenvalues, and percent variance are post varimax rotation with principal axis extraction, while communalities are from the initial solution.

Loading scores less than 0.51 are not reported.

n = 66.

Table 4.18 Continued

Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Table 4.19 Clinician Member Ownership Performance Scale Reliability Analysis

Item	Mean	Corrected Item-total Correlation	Cronbach's Alpha if Item Deleted
Provides leadership or mentoring to develop PBRN staff or other investigators.	2.7	0.61	0.88
Maintains practice changes after PBRN research studies have concluded.	2.6	0.66	0.87
Identifies problems or issues in their own practice site and conveys these to PBRN staff as potential PBRN research projects.	3.0	0.67	0.87
Demonstrates awareness of membership within the PBRN.	3.2	0.70	0.86
Helps promote PBRN research throughout their entire practice site.	3.1	0.80	0.85
Takes a leadership role in carrying out PBRN research.	2.9	0.77	0.85
Scale Mean	17.5		
Scale Standard Deviation	4.21		
Cronbach's Alpha	0.89		

Note: Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Table 4.20 Clinician Member Engagement Performance Scale Reliability Analysis

Item	Mean	Corrected Item-total Correlation	Cronbach's Alpha if Item Deleted
Does not communicate with PBRN staff in a timely manner. (R)	3.1	0.69	0.90
Demonstrates willingness to communicate with PBRN staff and other investigators in completing PBRN research.	3.3	0.76	0.89
Proactively communicates issues and concerns to PBRN staff when completing PBRN research.	3.1	0.76	0.89
Facilitates strategies to overcome problems or barriers in completing PBRN research.	2.9	0.72	0.89
Records or documents requested information necessary for completing PBRN research in a timely manner.	3.0	0.72	0.89
Follows through on tasks necessary to complete PBRN research.	3.1	0.82	0.88
Scale Mean	18.6		
Scale Standard Deviation	4.30		
Cronbach's Alpha	0.91		

Note: R is reverse coded.

Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Table 4.21 Clinician Member Participative Decision Making Scale Reliability Analysis

Item	Mean	Corrected Item-total Correlation	Cronbach's Alpha if Item Deleted
Identifying research questions for your Practice-based Research Network.	2.5	0.73	0.92
Monitoring success of your Practice-based Research Network.	2.5	0.76	0.91
Determining the mission and vision of your Practice-based Research Network.	2.4	0.79	0.91
Solving problems within your Practice-based Research Network.	2.4	0.87	0.89
Identifying strategic or tactical changes within your Practice-based Research Network.	2.4	0.85	0.89
Scale Mean	12.2		
Scale Standard Deviation	5.22		
Cronbach's Alpha	0.92		

Note: Scale used: 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Often; 4 = All of the Time.

Table 4.22 PBRN Director Leadership Directive Behavior Scale Reliability Analysis

Item	Mean	Corrected Item-total Correlation	Cronbach's Alpha if Item Deleted
The leader gives vague explanations about what is expected from me. (R)	4.6	0.32	0.84
The leader lets me know what is expected of me.	5.3	0.56	0.76
The leader asks me to follow standard rules and procedures.	5.1	0.60	0.74
The leader explains the level of performance that is expected from me.	4.7	0.72	0.70
The leader informs me what needs to be done and how it needs to be done.	5.0	0.72	0.69
Scale Mean	24.6		
Scale Standard Deviation	5.30		
Cronbach's Alpha	0.79		

Note: R is reverse coded.

Scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Table 4.23 PBRN Director Leadership Participative Behavior Scale Reliability Analysis

Item	Mean	Corrected Item-total Correlation	Cronbach's Alpha if Item Deleted
The leader acts without consulting me. (R)	3.4	0.40	0.82
The leader consults with me when facing a problem.	4.3	0.58	0.76
The leader asks for suggestions on which tasks should be assigned to me.	4.3	0.62	0.75
The leader listens to my ideas and suggestions.	5.1	0.71	0.74
The leader asks me for suggestions on how to carry out tasks.	4.4	0.68	0.73
Scale Mean	21.5		
Scale Standard Deviation	6.06		
Cronbach's Alpha	0.80		

Note: R is reverse coded.

Scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Table 4.24 Selected Bivariate Correlations for Individual Level Variables

Variable	1	2	3	4	5	6	7
1. Clinician Member PBRN Tenure Years	1.00						
2. Clinician Member Practice Based Research Tenure Years	0.64**	1.00					
3. Activity Level Dr. Hahn Scale	0.17	0.13	1.00				
4. Clinician Member Hours per Week in PBRN Work	0.13	0.07	0.31**	1.00			
5. Clinician Member % Time in PBRN Work	0.21	0.10	0.24*	0.86**	1.00		
6. Clinician Member Ownership Performance	0.39**	0.36**	0.17	-0.02	0.09	1.00	
7. Clinician Member Engagement Performance	-0.08	-0.06	0.10	0.08	0.13	0.66**	1.00
8. Clinician Member Total Performance	0.21	0.22	0.08	-0.04	0.08	0.92**	0.91**
9. Clinician Member Global Performance Item	0.05	-0.08	0.24*	0.15	0.12	0.75**	0.68**

Table 4.24 Continued

Variable	8	9
1. Clinician Member PBRN Tenure Years		
2. Clinician Member Practice Based Research Tenure Years		
3. Activity Level Dr. Hahn Scale		
4. Clinician Member % Time in PBRN Work		
5. Clinician Member Hours per Week in PBRN Work		
6. Clinician Member Ownership Performance		
7. Clinician Member Engagement Performance		
8. Clinician Member Total Performance	1.00	
9. Clinician Member Global Performance Item	0.74**	1.00

Note: n ranges from 11 to 14.

For dichotomous variable pairs, Phi correlation is reported.

For dichotomous and continuous variable pairs, Point-biserial correlation is reported.

For continuous variable pairs, Pearson's product-moment is reported.

* - significant at the $\alpha = 0.05$ level and ** - significant at the $\alpha = 0.01$ level.

Activity level Dr. Hahn scale was measured using 1 item with a 0 = Inactive; 1 = Passive; 2 = Active; 3 = Fully Active; 4 = Hyperactive.

Clinician member ownership and engagement performance ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Clinician member total performance ranged from 0-48 based upon 12 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Clinician member global performance was measured using 1 item with a 5-point scale ranging from 0 = Poor; 1 = Fair; 2 = Good; 3= Very Good; 4 = Excellent.

Table 4.25 Selected Bivariate Correlations for PBRN Level Variables

Variable	1	2	3	4	5	6	7
1. PBRN Member Count	1.00						
2. PBRN Member % Active	0.00	1.00					
3. Number of Grant Applications	0.73**	-0.17	1.00				
4. Number of Grants Awarded	0.67*	-0.12	0.72**	1.00			
5. Number of Grants Active	0.53	0.01	0.57*	0.81**	1.00		
6. Federal Grant	0.28	0.44	0.16	0.29	0.31	1.00	
7. State Grant	0.56	-0.09	0.60	0.70*	0.62*	0.43	1.00
8. Professional Association Grant	-0.08	-0.43	0.44	0.53	0.48	-0.36	0.24
9. Industry Grant	-0.01	0.20	-0.13	0.36	0.51	0.30	0.00
10. Internal Grant	0.36	0.10	0.46	0.28	0.44	-0.26	0.48
11. PBRN Number of Studies	0.44	0.36	0.63*	0.77**	0.54	0.17	0.40
12. PBRN Manuscripts Submitted	0.81**	0.10	0.88**	0.71**	0.53	0.37	0.52
13. PBRN Top-down	-0.73*	-0.11	-0.70*	-0.72*	-0.81**	-0.33	-0.58
14. PBRN Top-down %	-0.71**	0.03	-0.65*	-0.53	-0.68*	-0.21	-0.50

Table 4.25 Continued

Variable	8	9	10	11	12	13	14
1. PBRN Member Count							
2. PBRN Member % Active							
3. Number of Grant Applications							
4. Number of Grants Awarded							
5. Number of Grants Active							
6. Federal Grant							
7. State Grant							
8. Professional Association Grant	1.00						
9. Industry Grant	0.17	1.00					
10. Internal Grant	0.37	-0.17	1.00				
11. PBRN Number of Studies	-0.19	-0.20	0.30	1.00			
12. PBRN Manuscripts Submitted	-0.04	-0.16	0.21	0.66**	1.00		
13. PBRN Top-down	-0.34	-0.44	-0.62	-0.51	-0.62*	1.00	
14. PBRN Top-down %	-0.12	0.00	-0.60*	0.00	-0.46	0.86**	1.00

Note: n ranges from 11 to 14.

For dichotomous variable pairs, Phi correlation is reported.

For dichotomous and continuous variable pairs, Point-biserial correlation is reported.

For continuous variable pairs, Pearson's product-moment is reported.

* - significant at the $\alpha = 0.05$ level and ** - significant at the $\alpha = 0.01$ level.

All variable were based upon previous 12 month period.

Variables 6, 7, 8, 9, 10, and 13 are dichotomous.

Table 4.26 Initial Regression Analysis for Clinician Member Ownership Performance Scale as Rated by PBRN Directors

Variable	B	Standard Error	Beta	t	Significance
Intercept	15.66	2.59		6.07	0.00
Leader Directiveness	0.00	0.15	0.00	0.02	0.98
Leader Participativeness	0.00	0.14	0.00	0.00	1.00
Years in PBRN	0.29	0.13	0.33	2.31	0.03
Number of Projects	0.05	0.04	0.18	1.36	0.18
Clinician Education -MD	-0.55	1.32	0.06	-0.42	0.68
Model $R^2 = 0.17$; Adjusted $R^2 = 0.09$					

Note: n = 61.

Ownership performance scale ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Leadership directiveness and participativeness scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Years in PBRN is based upon clinician member's years in current PBRN and is a count variable.

Number of projects is based upon clinician member's number of projects as member of PBRN and is a count variable.

Clinician education is a dichotomous variable with 1 = MD or DO degree.

Table 4.27 Regression Analysis for Clinician Member Ownership Performance Scale as Rated by PBRN Directors with Outlier Removed

Variable	B	Standard Error	Beta	t	Significance
Intercept	15.75	2.36		6.68	0.00
Leader Directiveness	0.10	0.14	0.12	0.73	0.47
Leader Participativeness	-0.13	0.14	-0.15	-0.93	0.36
Years in PBRN	0.35	0.12	0.42	3.01	0.00
Number of Projects	0.05	0.04	0.18	1.42	0.16
Clinician Education -MD	-0.24	1.20	-0.03	-0.20	0.84
Model $R^2 = 0.23$; Adjusted $R^2 = 0.15$					

Note: n = 60.

Ownership performance scale ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Leadership directiveness and participativeness scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Years in PBRN is based upon clinician member's years in current PBRN and is a count variable.

Number of projects is based upon clinician member's number of projects as member of PBRN and is a count variable.

Clinician education is a dichotomous variable with 1 = MD or DO degree.

Table 4.28 Regression Analysis for Clinician Member Ownership Performance Scale as Rated by PBRN Directors with Outliers Removed with Organizational Factor

Variable	B	Standard Error	Beta	t	Significance
Intercept	15.61	2.35		6.64	0.00
Leader Directiveness	0.07	0.14	0.09	0.53	0.60
Leader Participativeness	-0.10	0.14	-0.13	-0.76	0.45
Years in PBRN	0.34	0.12	0.41	3.00	0.00
Number of Projects	0.03	0.04	0.11	0.76	0.45
Clinician Education -MD	-0.26	1.20	-0.03	-0.22	0.83
PBRN Study Count	0.06	0.05	0.16	1.22	0.23
Model $R^2 = 0.25$; Adjusted $R^2 = 0.16$					

Note: n = 60.

Ownership performance scale ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Leadership directiveness and participativeness scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Years in PBRN is based upon clinician member's years in current PBRN and is a count variable.

Number of projects is based upon clinician member's number of projects as member of PBRN and is a count variable.

Clinician education is a dichotomous variable with 1 = MD or DO degree.

PBRN study count is a PBRN level variable representing the number of studies conducted in a clinician member's PBRN during the past 12 months.

Table 4.29 Initial Regression Analysis for Clinician Member Engagement Performance Scale as Rated by PBRN Directors

Variable	B	Standard Error	Beta	t	Significance
Intercept	20.30	2.35		8.64	0.00
Leader Directiveness	0.00	0.14	0.00	0.00	1.00
Leader Participativeness	-0.01	0.12	-0.01	-0.05	0.96
Years in PBRN	0.02	0.11	0.03	0.21	0.83
Number of Projects	0.03	0.04	0.07	0.60	0.55
Clinician Education -MD	-2.31	1.16	-0.26	-1.99	0.05
Model $R^2 = 0.24$; Adjusted $R^2 = 0.06$					

Note: n = 79.

Engagement performance scale ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Leadership directiveness and participativeness scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Years in PBRN is based upon clinician member's years in current PBRN and is a count variable.

Number of projects is based upon clinician member's number of projects as member of PBRN and is a count variable.

Clinician education is a dichotomous variable with 1 = MD or DO degree.

Table 4.30 Regression Analysis for Clinician Member Engagement Performance Scale as Rated by PBRN Directors with Outliers Removed

Variable	B	Standard Error	Beta	t	Significance
Intercept	20.21	2.08		9.74	
Leader Directiveness	0.05	0.12	0.06	0.41	0.68
Leader Participativeness	-0.03	0.11	-0.04	-0.25	0.80
Years in PBRN	0.02	0.10	0.02	0.19	0.85
Number of Projects	0.03	0.04	0.08	0.69	0.49
Clinician Education -MD	-2.53	1.04	-0.31	-2.44	0.02
Model $R^2 = 0.09$; Adjusted $R^2 = 0.03$					

Note: n = 77.

Engagement performance scale ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Leadership directiveness and participativeness scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Years in PBRN is based upon clinician member's years in current PBRN and is a count variable.

Number of projects is based upon clinician member's number of projects as member of PBRN and is a count variable.

Clinician education is a dichotomous variable with 1 = MD or DO degree.

Table 4.31 Regression Analysis for Clinician Member Engagement Performance Scale as Rated by PBRN Directors with Outliers Removed with Organizational Factor

Variable	B	Standard Error	Beta	t	Significance
Intercept	20.28	2.06		9.85	0.00
Leader Directiveness	0.07	0.12	0.09	0.57	0.57
Leader Participativeness	-0.04	0.11	-0.05	-0.35	0.73
Years in PBRN	0.01	0.101	0.02	0.13	0.90
Number of Projects	0.05	0.04	0.17	1.26	0.21
Clinician Education -MD	-2.41	1.03	-0.30	-2.34	0.02
PBRN Study Count	-0.07	0.05	-0.18	-1.47	0.15
Model $R^2 = 0.12$; Adjusted $R^2 = 0.05$					

Note: n = 77.

Engagement performance scale ranged from 0-24 based upon 6 items with a scale of 0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always.

Leadership directiveness and participativeness scale used: 0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5= Usually; 6 = Always.

Years in PBRN is based upon clinician member's years in current PBRN and is a count variable.

Number of projects is based upon clinician member's number of projects as member of PBRN and is a count variable.

Clinician education is a dichotomous variable with 1 = MD or DO degree.

PBRN study count is a PBRN level variable representing the number of studies conducted in a clinician member's PBRN during the past 12 months.

Communication Frequency
Infrequent (More than a Year)
Annual/Semiannual
Three Times Annually
Quarterly
Every Other Month
Monthly
Twice Per Month
Weekly
Project Dependent

Communication Mode
Project-based
Face-to-face
Newsletter
Telephone
Letter
Email

Communication Processes
Networking
Providing Education
Giving Feedback
Giving Reward

Communication Barriers
Workflow Changes
Workload
Funding
Time

Communication Outcomes
Effective Communication
Poor Communication

Decision Makers
Internal Advisory Board
External Advisory Board
Project Dependent
Principal Investigator
PBRN Director

Decisions
PBRN Improvement
Provide Feedback
Pursue Funding
Vetting Projects
Future Planning
Task Delegation
Study Design
Collaborate

Decision Making Barriers
Lack of Qualified Individuals
Lack of Accurate Data
Lack of Organization
Poor Communication
Time Constraints
Capacity
Funding

Figure 4. Phase I Communication and Decision Making Codes

PBRN Projects	Data Collection	PBRN Building	Ongoing Activities
Medication Error Prevention	Patient Specimens	Recruit Staff	Institutional Review Board
Clinical Decision Making	Clinical Encounter	Recruit Clinicians	Research Culture
Provider Sanitary Practices	Focus Groups	Develop Advisory Boards	Letters of Support
Patient-community Connectedness	Observations	Determine Goals	Patient Recruitment
Bisphosphonate Jaw Necrosis	Surveys	Develop Relationships	Project Gaps
Dentist Blood Glucose Monitoring	Cards	Develop Policies and Procedures	
Clinical Pharmacists Activities	Patient Reported	Conduct Initial Project	
Sports-related Injuries	Provider Reported		
Drug Shortages	Longitudinal		
Difficult Patients			
Depression			
Hypertension			
Diabetes			
Asthma			
Obesity			
Alzheimer's			
Immunizations			
SSRIs			
Polypharmacy			

Figure 5. Phase I PBRN Activity Codes

PBRN Director Leadership Characteristics	PBRN Director Leadership Roles	PBRN Director Leadership Behaviors	PBRN Director Leadership Approach
Experienced as Practitioner	Cheerleader	Communication	Team/Collaborative
Experienced as Researcher	Visionary	Lead Meetings	Transformational
Admit Mistakes	Inculcator	Negotiation	Loose-tight/Flexible
Approachable	Communicator	Delegation	
Accessible	External Face	Acquire Resources	
Confident	Facilitator	Allocate Resources	
Engaging	Problem Solver		
Respectful	Protector		
Supportive	Manager		
Consistent	Writer		
Fair			
Organizationally Aware			
Intelligent			
Organized			

Figure 6. Phase I PBRN Director Codes

Coordinator Roles
Practice Site Development
Research Dissemination
Day to Day Operations
Research Coordination
Acquire Resources
Problem Solver
Communicator
External Face
Goal Setting
Leader

Coordinator Characteristics
Diverse Skill Set
Accountable
Committed
Adaptable
Education
Involved

Coordinator Motivators Demotivators
Available Support Staff
Time Constraints
Travel Stressors

Coordinator Performance
Standard
Exemplary

Figure 7. Phase I Network Coordinator Codes

PI/Co-investigator (PIC) Roles
Acquire Funding
Study Oversight
Problem Solver
Communicator
Collaborator

PIC Characteristics
Independent
Supportive
Inclusive

PIC Motivators
Receiving Assistance
Interest in Project
Lack of Choice
Ambition

PIC Demotivators
Lack of Awareness
Lack of Experience
Lack of Interest
Lack of Funding
Indecisiveness

PIC Performance Outcomes
Negative Performance
Positive Performance
Productive

Figure 8. Phase I Principal/Co-Investigator Codes

Motivators	Demotivators
Minimized Expected Effort	Oppressive Study Requirements
Improving Patient Care	What's In It For Me Attitude
Support/Encouragement	Lack of Resources
Economic/Money	Work Overload
Self-actualization	No Follow-up
Resource Access	Poor Science
Publications	Time
Affiliation	

Figure 9. Phase I Clinician Member Motivational Factors

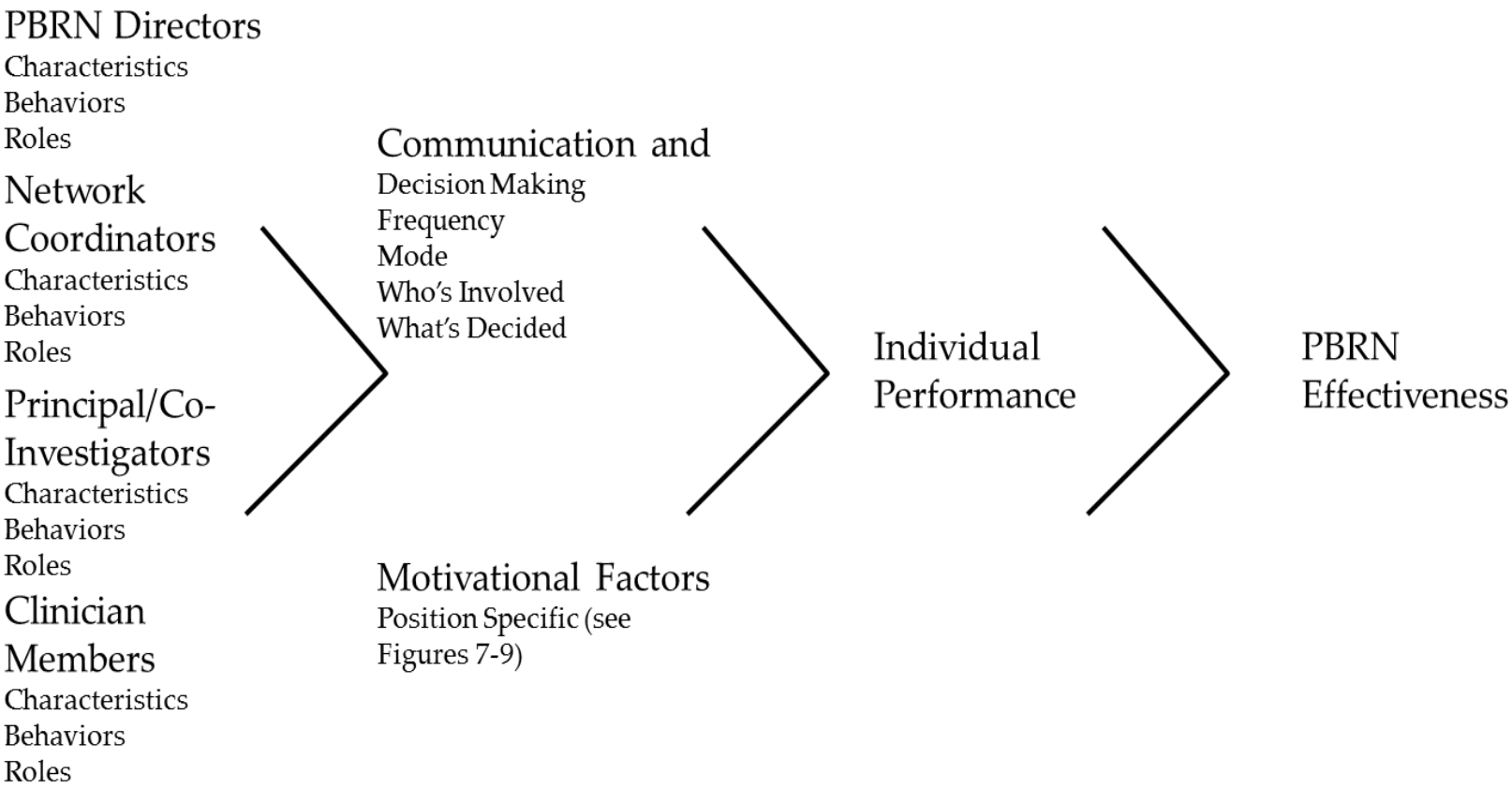

Figure 10. Input-Process-Output Schema for PBRN Positions

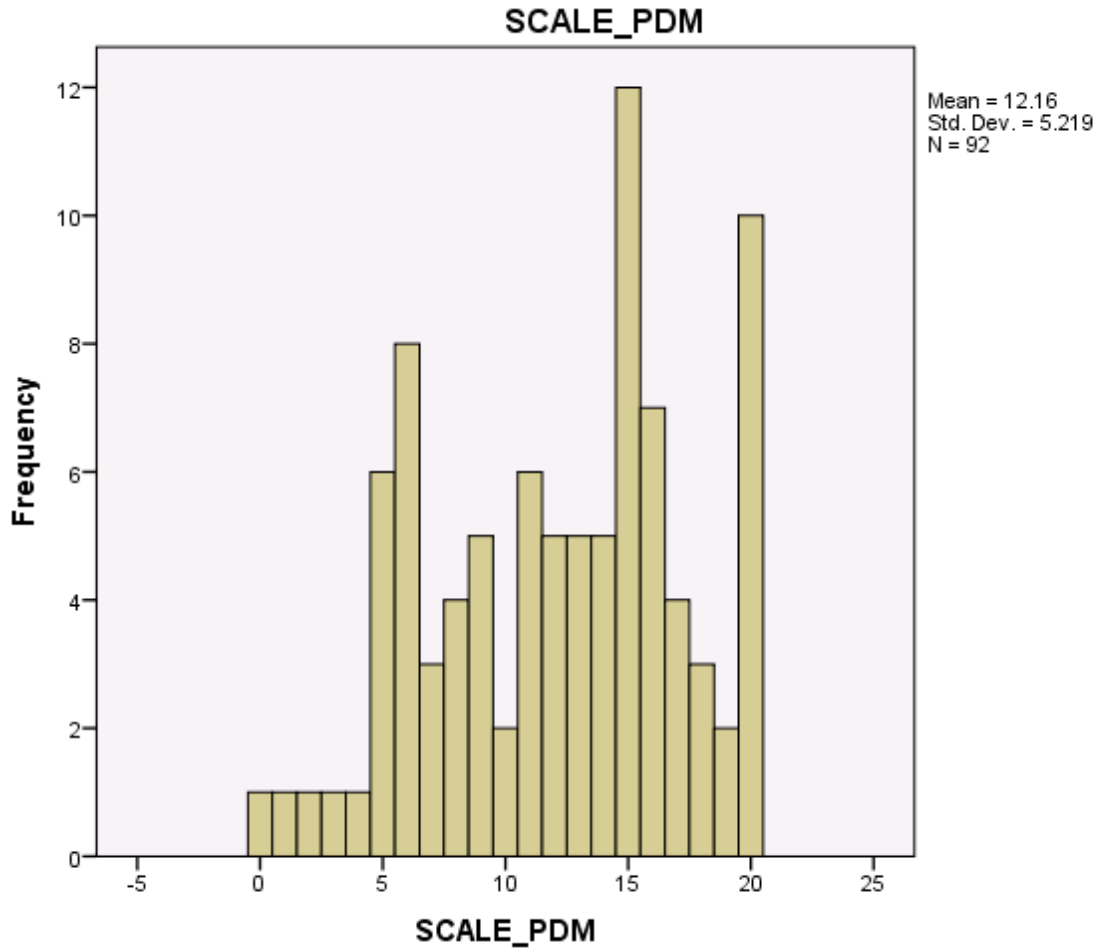

Figure 11. Participative Decision Making Scale Histogram

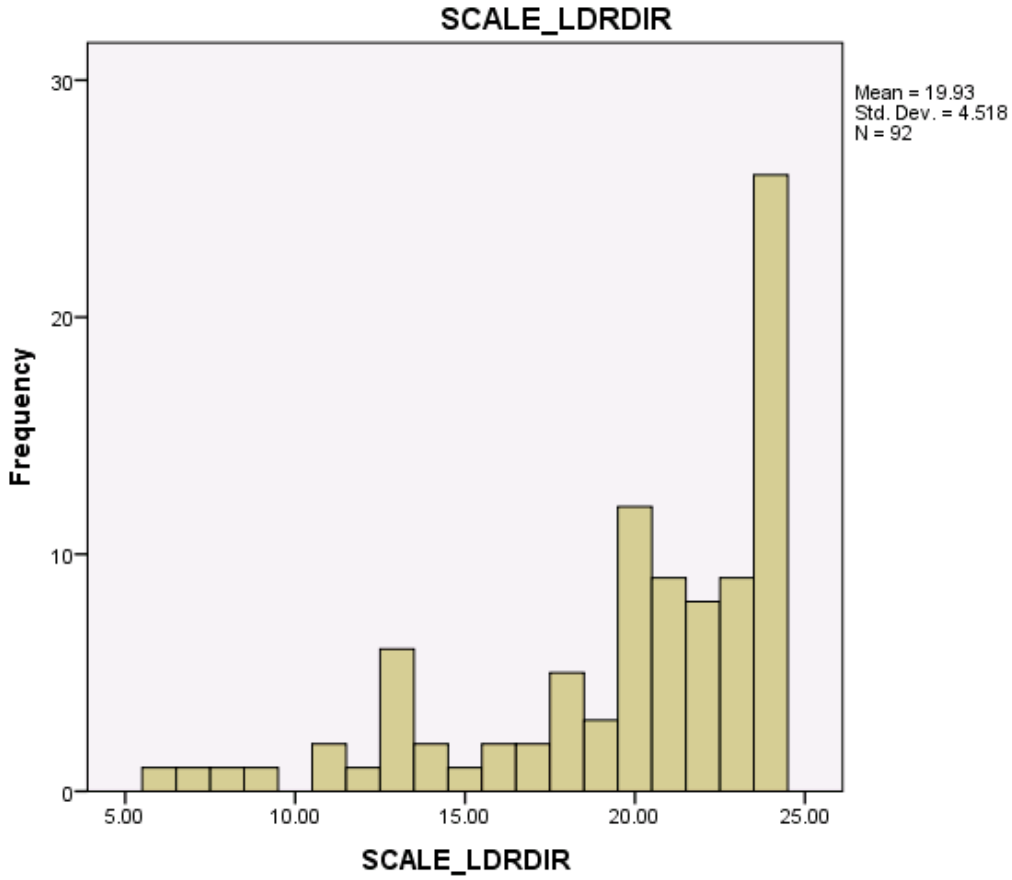

Figure 12. PBRN Director Directive Leader Behavior Scale Histogram

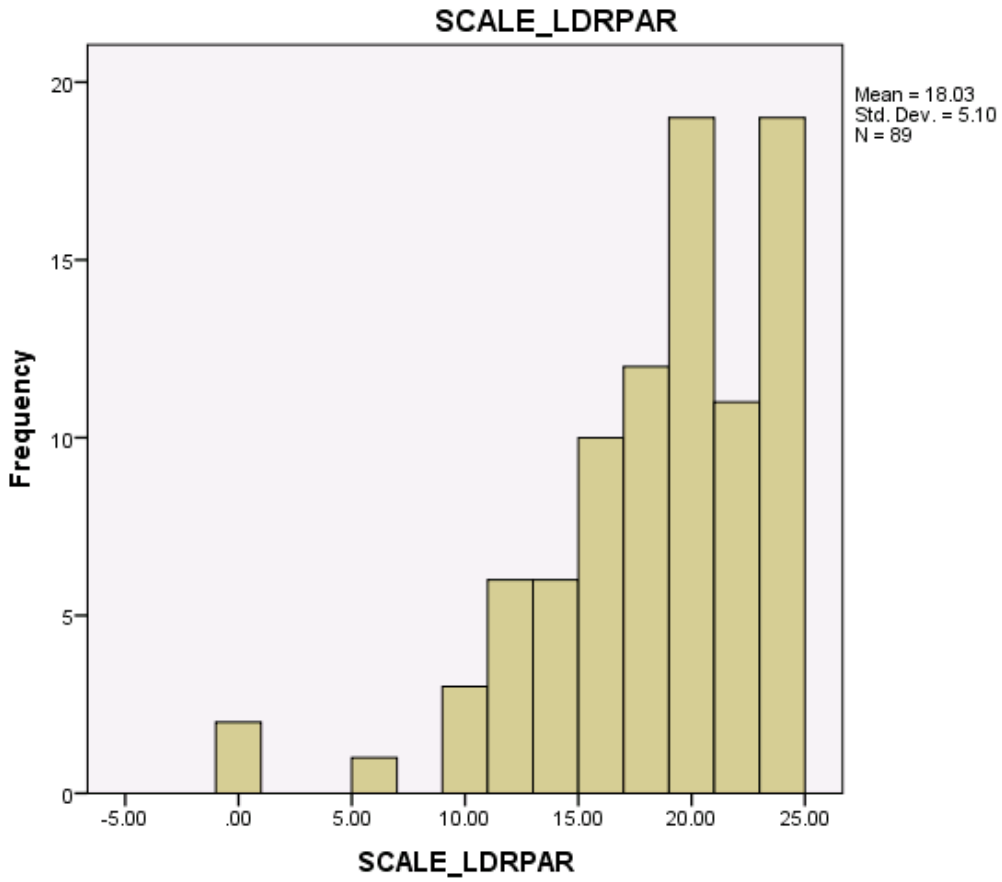

Figure 13. PBRN Director Participative Leader Behavior Scale Histogram

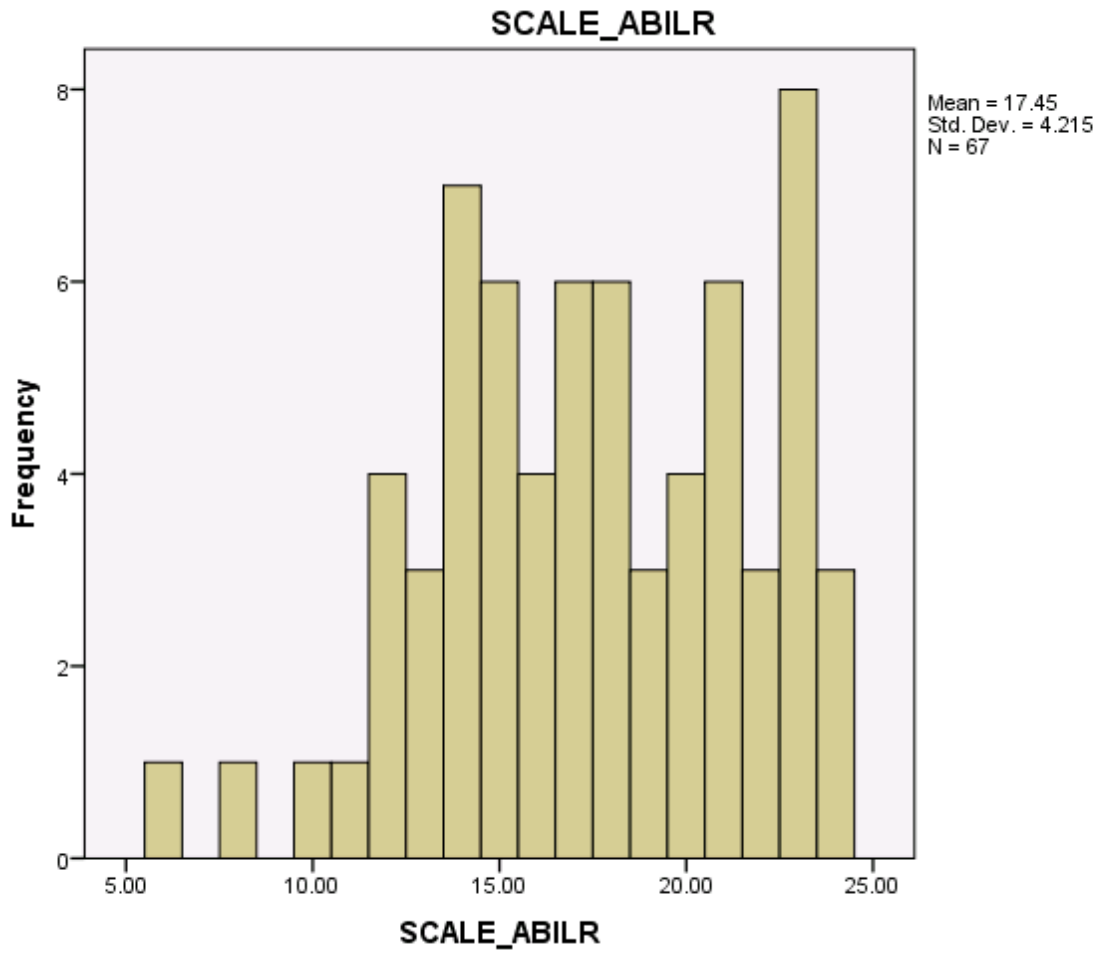

Figure 14. Clinician Member Ownership Performance Scale Histogram

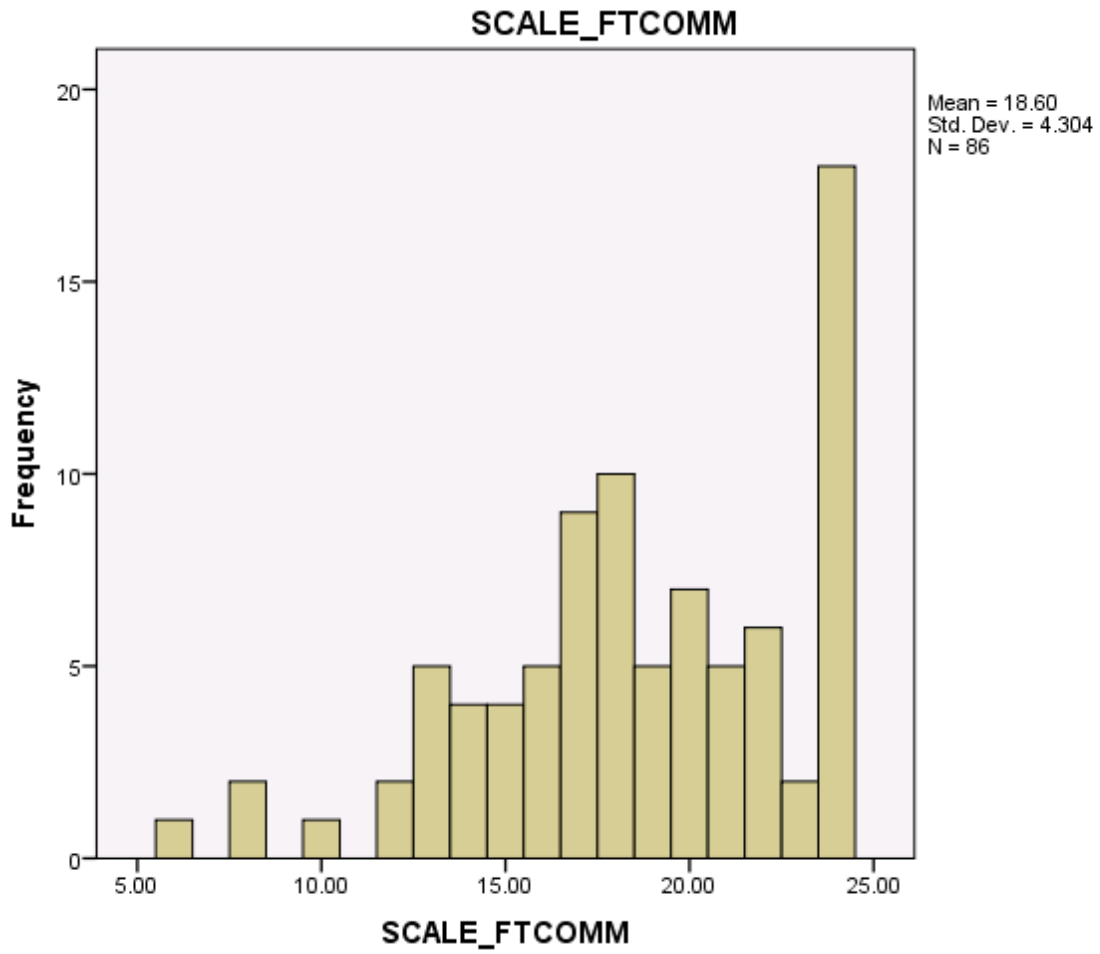

Figure 15. Clinician Member Engagement Performance Scale Histogram

CHAPTER V
DISCUSSION

This study was designed to address the following aims: 1) create a measure of PBRN clinician member individual performance; 2) produce a rich description of PBRN directors' leadership behaviors and styles; and, 3) identify significant relationships between PBRN director leadership-PBRN clinician member performance. Key findings from each phase of the study are presented according to aim. This chapter presents key findings and places them in a larger context using extant literature. Additionally, implications for theory, methodology, and practice are offered. Finally, limitations and conclusions are presented.

Aim 1

Clinician member performance in PBRN work appears to be multidimensional. Clinician member performance within PBRNs was reported to be variable *across* participants and *within* participants. There was a wide variety of expectations and specific behaviors that study participants reported being associated with high and low performance. However, four groupings of these expectations and behaviors emerged from the data: taking on a leadership role, having buy-in for PBRN projects, following-through on agreed upon tasks, and communicating effectively. This marks an important distinction from previous literature that focused predominately on whether a clinician member participates in PBRN research or does not participate. In this study, questions focused on describing clinician members during instances of participation. Thus, participation was assumed to be occurring.

Participation and performance are conceptually distinct constructs. Clinician member participation in PBRN work is influenced by motivations,

including the desire to increase clinical practice knowledge (Armour, Brillant, & Krass, 2007; Bakken et al., 2009; Fagnan, Handley, Rollins, & Mold, 2010; Gibson et al., 2010; Green, Niebauer, Miller, & Lutz, 1991; Simpson et al., 2001; Solberg, 2006), minimizing burdensome project requirements (Green, Niebauer, Miller, & Lutz, 1991; Solberg, 2006), gaining financial rewards (Fagnan, Handley, Rollins, & Mold, 2010; Gibson et al., 2010; Solberg, 2006), obtaining affiliation or self-actualization psychological motivators (Fagnan, Handley, Rollins, & Mold, 2010; Gibson et al., 2010; Solberg, 2006), and reducing participation barriers, including time (Armour, Brillant, & Krass, 2007; Simpson et al., 2001), research skills and knowledge (Armour, Brillant, & Krass, 2007; Simpson et al., 2001), or communication (Armour, Brillant, & Krass, 2007). Motivational and barriers to participation differ from taking a leadership role within the PBRN and following through on tasks agreed upon. However, these participation factors may be similar to buy-in and communication performance domains. Participation is necessary for performance to occur even if there is some degree of overlap. Thus, underpinning factors of motivation may explain some variation in performance; it likely does not explain all variation.

Investigators of this study made efforts to disentangle the act of participation from performance as much as possible. However, discussion of participation remained central to performance. If a clinician member is not participating, then that individual is not performing well. Participation may be most related to buy-in and communication. However, participation alone was not enough to be considered a good performer. Several study participants mentioned instances where clinician members committed to doing something and were unable to follow through with their commitments. While the study participants often minimized the negative performance by reporting that clinician members did not always control all factors influencing meeting their

performance expectation, the fact remained that more effort was incurred by some PBRN members to compensate for a lack of performance by all members. Poor performance did have implications for how successfully members of a PBRN were able to complete projects and, in some cases, altered PBRN director behavior on future projects. One PBRN director reported additional recruitment effort was made to ensure adequate sample size would be attained even if clinician members dropped out. This is common in most research, but can become less of a burden through collaboration in PBRN-conducted research. As clinicians reportedly seek to affiliate with a group in improving their practices, this motivates them to collaborate on mutual goals (McInnes et al., 2012; Maslow, 1943). Future research could explore how participation and engagement by clinician members in PBRNs are intertwined.

A number of study participants had difficulty when trying to think about clinician member performance because they had intentionally minimized clinician member effort to encourage participation. This could imply that measures of clinician member performance within PBRNs suffer from range restriction, positive skewness, and limited variation. Clinician members not performing to a specific threshold often self-select to leave the PBRN; furthermore, PBRN leaders often do not seek those poor performing clinician members' participation on future projects, even if they are interested. Evidence from this study suggests that may be a limited perspective. More than one study participant from different PBRNs reported seeing variation in clinician member performance across PBRN participants. An important caveat to this study was that activity level of clinician member participants was quite high.

Clinician member performance reportedly varied within clinician members. This implied that a clinician member could be a high performer on one project and be a low performer on another project. This evidence suggests that

motivations of clinician members may differ from project to project. At times, a practice partner may be totally invested in a project giving more effort and better performance. However, this individual may be less motivated in other efforts. Again, this brings into question the separation of performance and participation. Tools to stratify members into activity levels may then be useful for targeting motivational differences within clinician members across different projects (Green, Niebauer, Miller, & Lutz, 1991). Alternatively, measuring clinician members' performance levels and providing project-specific feedback may be more useful than broad feedback on performance, even if that broad performance feedback were provided on an annual basis. Most PBRNs conduct more than 1 project per year (Tierney et al., 2007). Thus, performance could shift within clinician members across those projects. Performance improvement gains through project-specific feedback have an additional benefit in that this feedback could result in research skill and knowledge improvements in clinician members. Accordingly, this should remove a barrier to participating in future PBRN projects (Bakken et al., 2009; Solberg, 2006). Future research should examine strategies for providing performance feedback to maximize clinician member efforts in PBRN activities.

Aim 2

Collaboration was the preferred method of leadership applied by PBRN directors. Collaborative leadership reportedly helped position study participants' PBRNs with external funding agencies and helped them produce better research. Collaboration reportedly provided satisfaction and motivational force to sustaining relationships between practice partners and PBRN central staff. Finally, collaborative leadership was reportedly expected from all PBRN positions, including clinician members.

Collaboration was reportedly experienced through the support and enthusiasm directors supplied their PBRNs. This enthusiasm increased the motivation PBRN participants had in completing their projects and helped them feel as though they were valued members of a collaborative team. This could occur through an expectancy process, in which PBRN directors meet the needs of each practice partner or collaborative agent (Isaac, Zerbe, & Pitt, 2001). As such, practice partners' needs are likely more easily expressed in a PBRN that fosters a collaborative culture. Future research could explore practice partner needs for completing PBRN work.

Collaborative relationships spanning host organizations, practice partners, and other external stakeholders are important to success of practice-based research networks (Goode, Mott, & Charter, 2008). These relationships help foster a community-building function of some PBRNs and can empower community participants to help shape their PBRNs vision through contribution of voice (Green et al., 2005; Anderko, Bartz, & Lundeen, 2005; Westfall, VanVorst, Main, & Herbert, 2006; Williams, Shelley, & Sussman, 2009). Shared decision making with community leaders and practice partners within PBRNs can fuel social change in the local delivery of health care Westfall et al., 2009). These partnerships are also desirable by funding agencies seeking to increase patient and community voice when conducting meaningful research.

Time and funding were two scarce resources that were reported often by study participants as barriers to completing PBRN activities. This study echoes the abundance of literature purporting these two problems (Green, 2000; Green et al., 2005; Green & Dovey, 2001; Nutting, 1996). But it also extends previous work by identifying just how limited time and funding can disrupt processes of decision making and communication within PBRNs. Time and funding reportedly affected the ability of central staff to communicate with practice

partners and community members. Reportedly, this is brought on through limitations of face-to-face meetings and fewer communication vehicles being used less frequently. Time and funding reportedly also affected project specific decisions causing prioritization and consideration of trade-offs to determine which strategy to implement projects was most practical. Time and funding limitations also affected data collection tools used by study PBRNs. Electronic medical record collection is desirable for real-time convenience and assistance that it can provide clinicians and administrators when providing and documenting care. However, electronic medical records are a costly tool. Time also serves as a motivational barrier to clinician member participation. But, study participants reported that burdens of time were not as large as initially thought. As study participants were highly motivated members of PBRNs, they may have different time expectations than other less motivated members. Educational support to potential practice partners informing them clearly with expectations of effort may lessen the impact of time barriers they face in deciding to participate in PBRN work (Bakken et al., 2009; Solberg, 2006).

This study also found that many study PBRNs made acquiring of funding a division of labor activity spread across positions throughout their PBRNs, including use of clinician members to increase funding. Clinician member participation on advisory boards helped garner funds, especially from Federal sources, reportedly. Clinician member participation on advisory boards helps enrich the perspective of PBRN leaders, practice partners, and other stakeholders through active dialogue and other PBRN processes (Green et al., 2005). Reportedly, through advisory group efforts, projects are vetted and strategic directions are discussed that enable PBRNs to stay on the cutting edge of community needs and funding opportunities.

Communication reportedly fueled much of the action in PBRNs, as far as developing and completing projects, building the network, and disseminating findings. This communication was deeply embedded in the fostering of collaborations, creating an identity in which practice partners, central staff, and other PBRN participants and stakeholders came together to create new practice knowledge (Koschmann, 2008; Koschmann, 2012). As such, all positions within the PBRN were expected to engage in active communication. Although, this communication was not always synchronous. Asynchronous and synchronous communications were used to enable collaboration and information sharing (Green et al., 2005). Communications were tailored depending on its purpose, and these purposes included education, networking, and negotiation. This implied some degree of give and take amongst collaborators and this tension may help sustain the collaboration, likely through better productivity (Kramer & Crespy, 2011). PBRN leaders, practice partners, and other stakeholders networked through annual face-to-face meetings, dialogue using asynchronous listserv communications, and meetings outside of the PBRN. Education about PBRN activities and the purposes and mission of the PBRN came through emails and newsletter communication modes. These communications reportedly occurred more frequently than others, and were project-specific. Negotiations about study roles and PBRN involvement were more personal and often occurred over the phone as projects were being carried out. A range of communication frequencies were reported. Difficulties sustaining perpetual communication with all members of PBRN participants, due to time and funding barriers, may hinder PBRN performance. More research is needed to frame the communication channels and their role in enabling PBRN effectiveness.

In addition to systematic aspects of collaborative leadership identified in the creation of decision making advisory groups and communication channels,

there were desired intrinsic characteristics and behaviors expected of PBRN directors. This matches the concept of first-person (intrinsic attributes) and second-person (interactive behaviors) identified by Armistead, Pettigrew, and Aves (2007) in their study of multi-sector partnerships. Traits do play a limited role in leadership effectiveness (Stodgill, 1948). Despite the notion that leadership is to be shared or distributed throughout an organization, positional leaders still have authority, albeit a less powerful authority in setting agenda for the collaborative and in crafting decisions as they relate to a collaborative's vision (Huxham & Vangen, 2000). As reported by PBRN directors in this study, they walk a fine line in providing oversight and support for PBRN collaborative processes. The grounding of leadership behaviors into tangible tasks, such as negotiating with practice partners, host organizations, and external funding bodies, delegating assignments amongst staff and active practice partners, and leading meetings, helps extend nebulous literature on specific PBRN director actions (Green et al., 2005). This study also helped frame these actions as enablers of collaboration through communicative and decision making processes.

This study also helped clarify network coordinators' roles and expectations. Network coordinators often take on leadership roles in their own right. In this way they act as "collateral leaders" responsible for conveying enthusiasm and support to practice partners and other central staff (Alexander, Comfort, Weiner, & Bogue, 2001). Additionally, network coordinators that have a diverse skill set and are adaptable were valuable to a PBRNs success. As network coordinators are responsible for ensuring day-to-day activities of PBRNs run smoothly, flexibility is important (Green et al., 2005). The motivators and demotivators of network coordinators reported were different from other positions in the PBRN, and focused on having more available support staff and

less travel stress. More research should be conducted to examine job satisfaction of PBRN central staff, as these aspects of PBRN work remain unaddressed.

This study adds the perspective of the principal/co-investigator to the PBRN literature. Individuals in these positions were reportedly expected to be inclusive of the PBRN and their practice partners throughout the research process. Yet, they were also encouraged to be independent. This paradox in expectation is interesting and warrants further investigation. One could easily believe a more independent principal/co-investigator could be more successful in obtaining external funding, but this could also stymie collaboration with other members of a PBRN. Striking the right balance between collaborative and independence of principal investigators working in PBRN contexts may be an important factor to integrating this position with in the PBRN. The biggest barrier to participation in PBRNs for principal/co-investigators was a lack of awareness and experience with PBRN work. Some PBRNs attempted to bring investigators into the fold early through completion of smaller projects. This seems like a useful strategy that may help build trust and commitment, two ingredients that foster collaborative partnership synergy (Goode, Mott, & Chater, 2008; Lasker, Weiss, & Miller, 2001).

Much has been reported on clinician member motivations and demotivators to participating in PBRN projects. This study validates previous findings that reported improving patient care and professional self-actualization as incentives for clinician members (Bakken et al., 2009; Gibson et al., 2010; Yawn et al., 2010). This study found that financial incentives were primarily used as a means to buy off practice staff time for their involvement in projects. Two unique findings to this study were how clinician members' "What's in it for me" attitudes and interpretations of PBRN projects as poor science could demotivate them from participating. Having a "What's in it for me?" attitude is antithetical

to collaboration and it may strike the ears of PBRN leaders trying to recruit practice partners as a turnoff. Also, being able to critically evaluate clinical literature is a clinician member's job. Thus, it seems logically that clinician members of PBRNs would evaluate study designs of proposed PBRN projects and their background/theoretical foundations to determine if the science is good enough for them to participate.

Aim 3

As understanding the theoretical basis of leadership in PBRNs is necessary (Thomas et al., 2001), this study made important contributions to the literature by empirically testing the role of PBRN director leadership directiveness and participativeness in relationship to clinician member performance within PBRNs. Based on the regression analyses, this study provides little support for the framing of leadership behaviors of PBRN directors as participative or directive. This contradicts findings from management literature showing strong positive relationships with directive and participative behaviors on performance, but these studies were not conducted in inter-organizational contexts (Somech, 2006; Somech & Wenderow, 2006). Use of leadership constructs rooted in hierarchical organizations appears to be less effective predictors of performance when used in collaborative organizations, such as PBRNs (Huxham & Vangen, 2000). That is, tests of leadership-performance relationships that implicitly assume a leader and follower hierarchical dyad may not fit collaborative organizations. Empirically, this is bolstered by evidence from the qualitative interviews that overwhelmingly identified collaboration and collaborative leadership behaviors influencing PBRN activities and clinician member performance.

Alternatively, the definitions and operationalization of leader directiveness and participativeness may not have been well suited for use in

PBRN contexts (Northouse, 2007). The leader directiveness and participativeness scales did reliably measure leadership behaviors in a manner similar to previous research (Cassar, 1999; Sagie et al., 2002; Somech, 2005; Somech, 2006; Somech & Wenderow, 2006). It could be argued that there was not enough variation in leadership behavior scores to be useful in estimating the leadership performance relationships using a regression technique. Future research could solicit directive and participative behaviors of PBRN leaders using qualitative data collection techniques and incorporate those findings into context-specific quantitative measures, as done with clinician member performance in this study. However, those run the risk of being less useful and valid in more generalizable leadership research.

The regression analyses did shed light on two interesting findings that did significantly associate with performance. First, the ownership performance scale was significantly and positively associated with a clinician member's tenure in their current PBRN. One explanation of such a relationship could be explained through a process of informal or incidental learning one would have in completing PBRN activities over time that help build a clinician member's self-efficacy and raw ability in completing PBRN work (Tannenbaum, Beard, McNall, & Salas, 2010). As familiarity with PBRN work increases, the ability to offer suggestions for research proposals and help motivate others to complete PBRN activities with them at their practice sites may become more natural. Another explanation for this tenure-performance finding is that those clinician members who are motivated by research and are well integrated into PBRN efforts retain membership the longest. Efforts by PBRN directors to retain active members and help develop them their research efficacies, skills, and knowledge, may be useful for increasing clinician member performance.

The other second key finding of regression analysis was that physician status was associated with less engagement performance. This may not be surprising given the case-loads of many physicians these days. However, it could also reflect the intrinsic desire for physicians to take on more of a leadership role in tasks they perform. As demonstrating follow-through or commitment to someone else's project may be less desirable to a physician, being able to steer and follow-through on projects of their own creation may increase their engagement. This notion has some empirical support in this study. Most PBRNs in this study operated on a top-down basis and made most decisions using a top-down approach, implying that physicians were likely less active in deciding what and how PBRN work was done. Additionally, interviews of physicians indicated that they would compare their own interests with the aims of a proposed project to decide whether or not to participate. Increasing collaboration with physicians may be especially crucial for improving their performance in PBRNs, beyond mere participation. However, this may only be valid for physician clinician members desiring more active involvement in PBRN work.

One potentially useful way for stratifying clinician members within a PBRN based on their actual or desired activity level is through the use of Dr. Hahn's single-item activity level scale. Based on observation and experience, Dr. Hahn conceptualized different activity levels of clinician members in PBRNs (Hahn, 1999). This study was the first to operationalize, measure, and provide some evidence of its validity. Significant and positive bivariate correlations with other activity level measures including hours per week spent on PBRN activities and percent time of job spent on PBRN activities provide empirical support for this measure's construct validity. Furthermore, it separated across the study participants as predicted, with a majority of participants being passive or active members, a lesser number being fully active, and an even lesser number being

hyperactive. PBRN directors could include this very brief, single-item measure on recruitment materials or on annual membership data collection forms to identify PBRN members desired activity level and help them to provide direct collaboration to those desiring more active levels of participation. It is important to note that actual activity level and desired activity level may be different. As compared to previous work, when we asked clinician members how much time they had participated in PBRN activities versus previous studies that asked how much time they intended to participate, the intended level of effort was more than actual levels (Carr, Divine, Hanna, Freeman, & Blumenschein, 2011). The samples were different; but, this study provided support that a social desirability bias might influence clinician members when asked about their PBRN effort intentions.

In the factor analysis of performance items, only two factors emerged, as opposed to the four identified in Phase I. However, these demarcations did fall along the conceptual lines identified in the first phase. That is, one factor (*ownership*) included the awareness or buy-in measures along with the leadership role. The other factor (*engagement*) included the follow-through or commitment items along with communication. These two factors seemed to correspond to aspects of ownership and engagement of clinician members, ideas discussed by study participants in Phase I. These measures were very reliable, albeit skewed. This implies that a very high performing sample of clinician members were included in the study. This makes sense, as PBRN directors were likely eager to recruit clinician members that would complete surveys. This also limits the interpretation of the factors to clinician members who are most active and high performing. Empirical support for the distinction between participation and performance is found in the bivariate correlations across performance and

activity level variables. There were some small, positive correlations across these variables; however, not all variation was shared.

The most interesting findings from the bivariate analysis were the relationships across decision making orientation variables (i.e. top-down and percent decisions made using top-down approach) with membership, grant funding, and productivity. Significant and negative associations were found between these variables and top-down decision making orientation. These findings could be explained due to top-down decision making being antithetical to collaboration; and thus, members are less motivated to actively participate. Having less members could explain the difficulty these PBRNs face in obtaining funding and being productive. An alternative explanation, is that younger PBRNs are more top-down oriented because their central staff members have more experience in making practice-based research decisions than clinician members. Younger PBRNs are usually smaller, less successful in grant funding, and less productive than more seasoned PBRNs. Additionally, PBRNs with more limited research foci, based upon a single or limited set of grant funding, might make more top-down decisions. All explanations are plausible and future research and data collection by AHRQ could help explore this decision making orientation-organizational effectiveness relationship.

Qualitative data gathered in Phase I of the analysis provides support for a younger PBRN hypothesis, as PBRN directors of younger PBRNs insinuated that leadership style would change once their PBRNs grew in experience and size. Qualitative data from Phase I also supported the motivational hypothesis, as study participants described that less collaborative PBRNs were less fun to work in, did smaller research projects, and were unattractive to funding agencies. In some cases top-down decision making may be preferred for making quick decisions while bottom-up approaches may be preferential when new ideas and

clinician member buy-in are needed (Thomas, Griffiths, Kai, & O'Dwyer, 2001). Furthermore, crosstab comparisons provided some, albeit statistically insignificant support for both alternative hypotheses. Younger PBRNs and PBRNs with smaller research foci did descriptively appear to make more top-down decisions. It appears that minimizing top-down decisions to only quick decisions where a decision needs no collaboration may be a useful strategy for PBRN directors wishing to maximize effectiveness of their organizations, while also supporting the inculcation of their collaborative culture. However, further research is necessary to fully describe the top-down and bottom-up phenomena in PBRNs.

Theoretical Implications

While this study may not have demonstrated significant quantitative support for the loose-tight theory of leadership as currently conceptualized, the mixing of findings across qualitative and quantitative phases from this study have implications for broadening the conceptualization of the loose-tight leadership phenomena. There does appear to be support for a flexibility of leadership approaches necessary to successfully provide leadership within a PBRN. However, this leadership flexibility is likely not rooted in concepts of directive or participative leader behaviors, as seen in more hierarchical organizational contexts. With the voluntary, networked structure of a PBRN organization, leadership seems to ebb and flow between the states of distributed decision making and centralized decision making, or a mixture of top-down and bottom-up decision making. While some decisions, like which funding opportunities to pursue and how to organize network decision making bodies are largely made by a central support staff led by a PBRN director, many decisions, such as "What research questions are interesting?" and "How will the study be communicated and conducted within a practice site?" are determined

by clinician members. By expanding the construct of loose-tight leadership to include collaborative and non-collaborative leadership behaviors, the boundaries of the loose-tight theory could be expanded to non-hierarchical organizations.

However, this would call into question the unit of analysis. As most studies (Sagie,1997a; Somech, 2005; Somech, 2006; Somech, & Wenderow, 2006) including this one, have focused on dyadic relationships between leaders and their followers, a more collaborative type of leadership may best be captured at the organization or team-level, where diffused leadership across all participants is quantifiable. In these cases, certain leadership actions would still be attributable to those with legitimate authority to influence group or organizational behavior, such as a PBRN director. However, non-directors would also influence team and organizational behavior through the wielding of power earned in their own right. More research is necessary to elucidate key distinctions and relationships amongst leadership flexibility, authority, and power in collaborative, non-hierarchal organizations.

Methodology Implications

Results and experiences from this study can inform mixed methods research design. While taxonomies are nice for helping scientists quickly describe a range of suitable approaches for conducting research, they may not reflect realities of the method actually employed. In the case of this study, there were some sequential and concurrent elements of data collection. Collecting and analyzing clinician member performance data occurred prior to quantitative data collection, thus meeting the expectation of a sequentially-phased, exploratory mixed method study design. However, a full thematic analysis of qualitative data collected in Phase I occurred concurrently with quantitative data collection of Phase II. Information gleaned about the leadership behaviors and styles of PBRN directors, as well as the importance of communication and decision

making in accomplishing PBRN activities during the initial qualitative phase of the study failed to help design the quantitative data collection tools in the second phase of the study. While the blending of sequential and concurrent timing helped quickly moved the project forward, additional insights about leadership-performance relationships collected in Phase I could have improved the modeling of the leadership-performance relationship in Phase II. However, the theoretical underpinning of Phase II presented at the time of initial study approval was rooted in extant literature and framed testable hypotheses.

This brings to light two important considerations for mixed methodologist. First, should researchers design sequential mixed methods studies in manner that ensures adequate time is allowed for full data collection and analysis? That is, do sequential studies need to be fully sequential? Second, how do researchers adequately present a sequential mixed methods proposal to funding agencies or dissertation committees that is both true to study design, while allowing for the flexibility of making significant revisions to the second phase of inquiry? As mixed methods research is a relatively young field, more discussion and explication of these issues remain critical to advancing mixed methods research methodology (Tashakkori & Creswell, 2007).

In terms of this study, the creation of the performance measure and its subsequent testing appeared to perform well. While not entirely validated, the measure did have reliable measurement and seemed to deconstruct along empirically identified constructs across phases of the study and across methods of inquiry. That is, the sequential component of the study worked as planned. The least sequential aspects of this study were the use of leadership measures extracted from extant literature in the second phase of the study, without utilizing any information identified in the first phase of the study. This appeared to work less effectively, as the expected relationships between leadership and

performance were not identified in this study. However, those measures did have good reliability. It could just be a case of a poorly specified model, which could have also benefited from information gathered in the first phase of the analysis. Or more likely, based on emergent principles of the qualitative interviews, these leadership measures were not well suited for the context in which they were used. Does this imply that no information was learned by testing this poorly fit model? Some could argue that this test was necessary and it adds to knowledge through rejection of leadership theories based in hierarchical contexts if used in collaborative contexts (Huxham & Vangen, 2000). Others could argue, that this blending was inefficient and a more fully informed second phase, while different from the initial study proposal, would have produced better information. This study presents evidence that should encourage and inform further deliberations to advance mixed methods research.

Practical Implications

This study has practical implications for PBRN members and stakeholders wishing to improve PBRN effectiveness. PBRN directors could focus efforts on increasing collaboration throughout their PBRNs. Collaborative efforts can be strengthened through the use of additional central staff, like practice facilitators and community liaisons (Nagykaldi, Mold, Robinson, Niebauer, & Ford, 2006). Additionally, providing quality improvement activities for practice partners can strengthen relationships and help develop practice sites (Mold & Peterson, 2005). Based on study participant perspectives, collaborative leadership behaviors seem to have been important for how some PBRNs increased membership, obtained external funding, and nurtured successful reputations.

The decision making strategy used in PBRNs ranges from bottom-up to top-down and anywhere in-between (Thomas, Giffiths, Kai, & O'Dwyer, 2001). This study provided some evidence that top-down decision making is associated

with less funding, fewer members, and less productivity. While it is not possible, or even recommended that PBRNs make all decisions using a bottom-up approach, it is the responsibility of the PBRN director to carefully consider which decisions are most appropriate for top-down decision making. Furthermore, PBRN directors may consider minimizing the amount of decisions using a top-down approach. By encouraging collaboration through creation of external advisory boards or project workgroups encouraging participation of clinicians and community members within PBRN decision making, this could foster a systematic approach to gathering bottom-up input (Green et al., 2005).

Beyond orientation of their PBRNs decision making style, PBRN directors may use behaviors or strategies to ensure collaboration is inculcated throughout their PBRN. One protective strategy used by directors in this study was enforcing collaborative behaviors of potential principal/co-investigators that planned on conducting research within PBRNs. Making sure that these investigators incorporated the PBRN wholeheartedly in everything from study design to dissemination reportedly helped encourage active participation from members and leads to more successful projects. Additional strategies include developing a cadre of communication vehicles that allow for 1-way and 2-way communication (Green et al., 2005). Through synchronous and asynchronous communication channels, information about projects and activities occurring in the PBRN can be relayed to potential participants. These also can serve as reward mechanisms if PBRN directors choose to highlight significant contributions of practice partners or central staff members. Finally, the chief responsibility of the PBRN director is ensuring attainment of adequate resources that enable collaborative effort. As collaboration produces better results and better results improve likelihood of funding, creating a culture of collaboration first may actually help garner more resources. This is further evidenced by agencies, such

as AHRQ, increasing funding opportunities for PBRNs to come together through their "Centers for Primary Care Practice-Based Research and Learning."

Clinician members desiring to increase their performance within PBRNs, and potentially increase the effectiveness of their PBRN, should consider taking more ownership in research projects and staying engaged, even in between projects. Clinician members could inquire about PBRNs utilization of practice facilitators or community liaisons, as these may help them stay engaged. Most PBRN leaders try to minimize clinician efforts on projects. While this may help increase participation for clinician members looking to serve in a passive capacity within the PBRN, more active clinician members should be brought in and empowered to contribute in more active ways. This requires both PBRN leaders and clinician members step-up when forming collaborative relationships. Collaborative working relationships are built on trust and commitment (Doucette & McDonough, 2001). Initially doing small scale projects in a PBRN may help develop these relational attributes (Good, Mott, & Charter, 2008).

The AHRQ should continue to foster training and development of PBRN participants. Providing more funding is essential, as a lack of funding hampers PBRN leaders' abilities to create infrastructure that fosters collaboration and decision making, which may ultimately influence their effectiveness. Additionally, AHRQ may benefit from taking a more focused look at the structure and process of positional performance within PBRNs as identified in this study. By accurately measuring PBRNs in their utilization of different personnel configurations, and their abilities to interact with practice partners, AHRQ could gain deeper insights on why certain PBRNs were successful and why others were not (Griffiths, Wild, Harvey, & Fenton, 2000).

Limitations

This study has limitations worth noting. As different data collection methods and samples were utilized in each phase of this study, the discussion of limitations is broken down by phases.

Phase I

First, data collected in the first phase of the study are reflective of the participants included in the sample. These study participants tended to be well-experienced, highly motivated, and relatively successful in performing PBRN work. While some study participants were from PBRNs in a developing stage of their life-cycle, those directors and non-directors still had a good amount of experience in conducting practice-based research. It was difficult for study participants to think about negative critical incidents, but there were a few mentioned. However, these few examples study participants described were full of clarifications and attempts to portray the negative incidents in a manner that minimized the negative performance of PBRN members involved. Additionally, study participants reported that the lowest performing clinician members or staff members often leave PBRNs before becoming problematic. This suggests that perspectives from low performing individuals would not be captured. It could be useful to identify former PBRN participants in non-director and director positions, to allow their perspectives to be heard and included in development of leadership and performance measures, similar to participation research methods used by Green, Niebauer, Miller, and Lutz (1991).

Second, the sampling strategy in the first phase worked well for identifying PBRNs and their members across different geographic distributions and this may have corresponded well to inclusion of PBRNs of different sizes and with different configurations of governance. However, distributions of PBRNs employing different research methodologies and different levels of

success were harder to identify, as data surrounding these constructs are not necessarily identifiable, even if they are publically available. Thus, the data collected here cannot be used to establish correlations with success or to define the entire set of PBRN activities, decision making, leadership, and performance. The data gathered here does provide a good starting point for an organization like AHRQ to consider using language identified in this study to capture additional information in their annual PBRN Registry Survey. Data collection across the entire PBRN population would provide deeper insight into infrastructures PBRNs need to be successful and could help identify ways to enhance existing infrastructures.

Finally, interviews with study participants in the first phase of data collection were very brief. This limited the amount of information collected. While significant effort was taken to limit the topics discussed during the interviews, there always seemed as if there could have been even deeper insights revealed if interviews would have lasted longer. This observation is the researcher's and not necessarily shared by study participants. It is important to note just how busy people involved in practice-based research are, as most study participants were serving in positions where PBRN activity was just a portion of their overall job responsibilities, and in the case of clinician members, may have been outside of their job requirements. With as challenging as it was to identify 32 study participants willing to complete interviews, it should be interpreted that the study participants had something to say about the topics addressed and were passionate about PBRN research. Again, this sampling strategy limited the perspectives that were included in the data analysis and care should be made when thinking about how information gathered in this study may or may not be applicable to all AHRQ-registered PBRNs.

Phase II

First, while attempts were made to select a random sample of PBRNs to participate, inevitably, every PBRN director was solicited. Only those who self-selected were included in the study. Furthermore, the population of clinician members working within PBRNs is unknown. This is problematic because the sample of clinician members included likely differs from the population as a whole. Comparisons were made between the sample of PBRNs who participated and the population of AHRQ-registered PBRNs, based on measured, publicly available, and identifiable data. PBRNs in our sample tended to be more geographically dispersed than other PBRNs in the population and were less varied in their practitioner mix. PBRNs in the study sample were mostly family medicine PBRNs. Nationally, practitioner mix tends to have higher levels of PBRNs with mixed clinician member backgrounds. PBRNs in the study sample tended to complete more studies in the previous year than the documented national average for PBRNs; but, the median study count was roughly the same. Clinician members in the study sample tended to be physicians with a fair degree of experience in their PBRNs and a little bit more experienced overall in practice-based research. Generalizations made from this study should be taken with caution. PBRNs and PBRN clinician members should carefully consider their own characteristics in regard to sample characteristics before applying information gleaned from this study to their PBRNs.

Second, the sample size was small for data measured at the individual level and even smaller for data gathered at the PBRN level. This is problematic for quantitative analysis. First, this problem restricts the range of measured items. As seen in this data, there were examples of skewed distributions for performance, leadership behavior, and participative decision making. Second, this problem restricts the variation used in correlation and regression analysis.

Any true and significant finding thus becomes more difficult to identify, as available variance to demonstrate sharedness amongst variables is absent. Third, it makes accurate estimation of relationships amongst variables difficult. Ideally, for this study a multi-level analysis would be conducted with all available data included in the final model, accounting for both levels of data. As adequate sample size for that type of estimation was not achieved, alternative approaches were used to model the data. No PBRN-level variables were included in the initial regression estimation. An additional, regression equation with a single PBRN-level construct included was conducted to inspect the consistency of our initial estimates across levels of data. A thoughtful set of analyses were also conducted in the factor estimation procedure, including increasing the conservativeness of factor loadings required to be significant, and running the model oblique and orthogonal. And yet, it remains that estimations of relationships using a larger sample size could differ from the ones created in this study.

Finally, this study was conducted in a cross-sectional manner. This makes it difficult to accurately estimate the effect of leadership flexibility theorized in the Loose-tight Theory of Leadership. It is only through the addition of qualitative findings that this study was able to shed light on the relatively few examples of leadership flexibility. A more carefully specified operationalization of leadership flexibility is warranted, and a more rigorous approach to elucidation in qualitative data and measurement in quantitative data is necessary. Furthermore, the generalization of performance as stable across time within individuals is questionable.

Conclusion

Clinician member performance within PBRNs is a multidimensional construct distinct from participation that is comprised of ownership and

engagement aspects, although there is some evidence of a further division into leadership, awareness, follow-through, and communication factors. Collaborative leadership was reported as being distributed to all roles in the PBRN, but is primarily inculcated by a collaborative PBRN director. Time and funding were reported as important resources necessary for the completion of PBRN activities, and are increasingly becoming more limited in their availability. PBRNs engage in a variety of projects and other activities carried out and monitored through ongoing collaborative communication and consensus-based decision making efforts. Top-down decision making patterns by PBRNs have negative relationships with measures of productivity. Directive and participative leadership behaviors do not appear to have direct relationship with clinician member performance, but years of involvement in current PBRN does have a positive association. However, further investigation is necessary to replicate these findings in larger samples. Also, aiding busy clinicians with engagement through use of central staff may be beneficial. PBRN directors should focus on strengthening collaborative culture of their PBRN and minimizing barriers to effective communication and decision making.

APPENDIX A: IRB DOCUMENTS PHASE I

Exempt Information Sheet

FOR IRB USE ONLY
APPROVED BY: IRB-01
IRB ID #: 201212712
APPROVAL DATE: 01/11/13
EXPIRATION DATE: N/A

We invite you to participate in a research study being conducted by investigators from The University of Iowa. The purpose of this study is to describe leadership behaviors of PBRN directors and conceptualize PBRN member performance.

If you agree to participate, we would like you to participate in a 30 minute interview. Additionally, a month after the interview, you will be asked to rank items of a list that will take no more than 10 minutes to complete. You are free to skip any questions that you prefer not to answer. A $50 Amazon gift card will be provided to participants completing the interview.

We will not use your name when presenting results of the study. These interviews will be audio recorded and used to create verbatim transcripts. The recordings will be destroyed after the transcripts are made. No identifying information will be recorded in the transcripts.

Taking part in this research study is completely voluntary. A reminder telephone call will be made a week after receipt of this letter. If you do not wish to participate in this study or receive reminder contacts, you may respond to this email requesting no further contact.

If you have questions about the rights of research subjects, please contact the Human Subjects Office, 105 Hardin Library for the Health Sciences, 600 Newton Rd, The University of Iowa, Iowa City, IA 52242-1098, (319) 335-6564, or e-mail irb@uiowa.edu.

Thank you very much for your consideration of this research study.

Recruitment Email

[DATE]

[Recipient Name]
[Title]
[School Name]
[Street Address]
[City, ST ZIP Code]

Dear [Recipient Name]:

Attached is an information sheet that conveys information about a research study aimed to describe leadership behaviors of PBRN directors and conceptualize PBRN member performance. Your involvement in such an endeavor to advance our knowledge of leadership-performance relationships within PBRNs that could ultimately lead to increased performance across PBRNs would be greatly appreciated.

Your name has been identified via the Agency for Healthcare Research and Quality (AHRQ) PBRN registry or as supplied by your PBRN director. Participation is voluntary in this study. Participation requires a 30 minute interview and a 10 minute ranking of items on a list. A $50 Amazon gift card will be provided to those who participate. We will need to collect your Social Security Number (SSN) in order to pay you. You can participate without compensation, if you prefer not to provide the SSN.

If you are have any questions regarding this study or wish to schedule your interview, please email the study PI, Brandon Patterson, at Brandon-patterson@uiowa.edu.

Thank you for your time and interest. I look forward to hearing from you.

Sincerely,

Brandon J. Patterson, PharmD, PhD candidate
UI Presidential Fellow
AFPE Fellow
Pharmaceutical Socioeconomics
University of Iowa College of Pharmacy

Study Advisors:

Barry L. Carter, PharmD (NIPC-PBRN director)
Barcey T. Levy, MD, PhD (IRENE director)
William R. Doucette, PhD
Julie Urmie, PhD
Mary Schroeder, PhD

APPENDIX B: QUALITATIVE DATA ANALYSIS CODEBOOK

Table B1. Qualitative Codes Used in Aim 2 Analysis

Codes
Leadership Approach
Leadership Approach: Team/Collaboration
Leadership Approach: Transformational
Leadership Behaviors
Leadership Behavior: Delegation
Leadership Behavior: Acquire Resources
Leadership Behavior: Allocate Resources
Leadership Behavior: Ensuring accountability
Leadership Behavior: Negotiation
Leadership Behavior: Lead Meetings
Loose-tight leadership: Direct
Loose-Tight Leadership: Flexibility
Loose-Tight Leadership: Participative
Leadership Characteristic
Leadership Characteristic: Accessible
Leadership Characteristic: Admit Mistakes
Leadership Characteristic: Approachable
Leadership Characteristic: Confident
Leadership Characteristic: Consistent
Leadership Characteristic: Engaging
Leadership Characteristic: Fair
Leadership Characteristic: Intelligent
Leadership Characteristic: Organizationally Aware
Leadership Characteristic: Organized
Leadership Characteristic: Experienced with Practice
Leadership Characteristic: Experienced with Research
Leadership Characteristic: Respectful
Leadership Characteristic: Supportive
PBRN Director Leadership Role
Leadership Role: Cheerleader
Leadership Role: Communicator
Leadership Role: Visionary
Leadership Role: Inculcator
Leadership Role: External Face [Move outreach here]

Table B1. Continued

Codes
Leadership Role: Facilitator
Leadership Role: Manager
Leadership Role: Problem Solver
Leadership Role: Protector
Leadership Role: Writer
Communication Frequency
Communication Frequency: Every Other Month
Communication Frequency: Semiannual/ Annual
Communication Frequency: Project-Based
Communication Frequency: Infrequent (More Than One Year)
Communication Frequency: Weekly
Communication Frequency: Twice Per Month
Communication Frequency: Network Based
Communication Frequency: Three Times Annually
Communication Frequency: Quarterly
Communication Frequency: Monthly
Communication Mode
Communication Mode: Project-Based
Communication Mode: Face to Face
Communication Mode: Email
Communication Mode: Telephone
Communication Mode: Letter
Communication Mode: Newsletter
Communication Processes
Communication Processes: Education
Communication Processes: Reward
Communication Processes: Feedback
Communication Processes: Networking
Communication Processes: Recruitment
Communication Outcomes
Communication Outcomes: Poor Communication
Communication Outcomes: Effective Communication
Barriers To Communication
Barriers To Communication: Time
Barriers To Communication: Funding
Barriers To Communication: Workload
Barriers to Communication: Changes in Workflow
Decisions
Decisions: Feedback
Decisions: Vetting Projects

Table B1. Continued

Codes
Decisions: Collaboration
Decisions: Delegation of Tasks
Decisions: Future Planning
Decisions: Study Design
Decisions: Improvement of PBRN
Decisions: Pursuit of Funding
Decision Makers
Decision Makers: Internal Advisory Board: Non-executive
Decision Makers: Internal Advisory Board: Non-executive and Executive
Decision Makers: Internal Advisory Board: Executive
Decision Makers: External Advisory Board
Decision Makers: Principal Investigator
Decision Makers: Director
Decision Makers: Project Dependent
Barriers to Decision Making
Barriers to Decision Making: Funding
Barriers to Decision Making: Time Constraints
Barriers to Decision Making: Lack of Qualified Individuals
Barriers to Decision Making: Lack of Organization
Barriers to Decision Making: Poor Communication
Barriers to Decision Making: Lack of Correct Data
Barriers to Decision Making: Capacity
Clinician Member Demotivators
Clinician Member Demotivator: Lack of Resources
Clinician Member Demotivator: No Follow-up
Clinician Member Demotivator: Oppressive Study Requirements
Clinician Member Demotivator: Poor Science
Clinician Member Demotivator: Time
Clinician Member Demotivator: WIIFM Attitude
Clinician Member Motivators
Clinician Member Motivator: Affiliation
Clinician Member Motivator: Economic/money
Clinician Member Motivator: Improving Patient Care
Clinician Member Motivator: Publications
Clinician Member Motivator: Resource Access
Clinician Member Motivator: Self-Actualization
Clinician Member Motivator: Support/Encouragement
Clinician Member Motivator: Minimize Physician Effort
PI/Co-investigator Roles
PIC Roles: Study Oversight

Table B1. Continued

Codes
PIC Roles: Collaborator
PIC Roles: Solicit Funding
PIC Roles: Problem Solver
PIC Roles: Communicator
PI/Co-investigator Performance Outcome
PIC Performance Outcome: Positive Performance
PIC Performance Outcome: Negative Performance
PIC Performance Outcome: Productivity
PI/Co-investigator Characteristics
PIC Performance Characteristics: Inclusive
PIC Performance Characteristics: Supportive
PIC Performance Characteristics: Independent
PI/Co-investigator Demotivator
PIC Demotivator: Lack of Experience
PIC Demotivator : Work Overload
PIC Demotivator : Lack of Awareness
PIC Demotivator : Lack of Interest
PIC Demotivator : Lack of Appropriate Request
PIC Demotivator : Indecisiveness
PIC Demotivator : Lack of Funding
PIC Demotivator : Poor Communication
PIC Demotivator: Poor Fit
PI/Co-investigator Motivator
PIC Motivator: Lack of Choice
PIC Motivator: Interest in Project
PIC Motivator: Ambition
PIC Motivator: Receiving Assistance
Coordinator Role
Coordinator Role: Day to Day Operations
Coordinator Role: Research Coordination
Coordinator Role: Acquire Resources
Coordinator Role: Research Dissemination
Coordinator Role: Practice Site Development
Coordinator Role: External Face
Coordinator Role: Problem Solver
Coordinator Role: Communicator
Coordinator Role: Leader
Coordinator Role: Goal Setting
Coordinator Motivators/Demotivators
Coordinator Motivators/Demotivators: Time Constraints

Table B1. Continued

Codes
Coordinator Motivators/Demotivators: Travel Stressors
Coordinator Motivators/Demotivators: Available Support Staff
Coordinator Characteristics
Coordinator Characteristics: Accountable
Coordinator Characteristics: Committed
Coordinator Characteristics: Adaptable
Coordinator Characteristics: Education
Coordinator Characteristic: Involved
Coordinator Characteristics : Diverse Skill Set
Coordinator Performance Level
Coordinator Performance Level: Standard
Coordinator Performance Level: Exemplary
Demographics: Experience
Demographics: Time in Role
Demographics: Time in Practice-based Research
Prior Experience
Prior Experience: PBRNs
Prior Experience: Non-PBRN Research
Degree
Degree: MD/DO
Degree: MS
Degree: PharmD
Degree: PhD
Degree: DDS
Degree: RN
Degree: Athletic Training
Degree: MPH
Non-degree: Postdoctoral Fellowship
Timeline
PBRN Size
PBRN Size: Number of Sites
PBRN Size: Numbers of Individuals
PBRN AHRQ: Affiliate
PBRN Activity Level/Involvement
Sponsoring Organization
Sponsor Organization: Non-profit
Sponsor Organization: Education
Sponsor Organization: CTSA
Governance
Governance: External Advisory

Table B1. Continued

Codes
Governance: Internal Advisory
Governance: Board of Directors
Governance: Meetings
External Funding
External funding difficult to obtain
PBRN Participants
PBRN Central Support Staff: Researchers
PBRN Central Support Staff: Practice facilitators
PBRN Central Support Staff: Research Coordinators
PBRN Central Support Staff: Clinical Directors
PBRN Central Support Staff: Medical Assistants
PBRN Central Support Staff: Study Coordinators
PBRN Central Support Staff: Community Liaisons
PBRN Central Support Staff: Postdoctoral Fellow
PBRN Central Support Staff: Administrative Assistants
Clinician Member: Less Involved Than Leaders
Clinician Member: Contributing Through Participation at Chosen Level
Clinician Member: Collect Data
Clinician Member: Extra Role: Coordinate IRB for others
Clinician Member: Practice Site Champion
Clinician member: Determine Appropriateness of Research for Practice Site
Residents: No Use
Residents: Use
Research Associate Practice Facilitator: Communication
Research Associate/Practice Facilitator: Site Development
Research Associate/Practice Facilitator: Relationship Development
Research Associate/Practice Facilitator: Collaborate
Research Associate/Practice Facilitator: Study Design
Research Associate/Practice Facilitator: Research Dissemination
Research Associate/Practice Facilitator: Data Collection
Research Associate/Practice Facilitator: Soliciting Funding
External Stakeholders
External Stakeholders: Parochial
External Stakeholders: Community Health Centers
Productivity
Productivity: Manuscripts
Productivity: QI/Best Practices
Productivity: Presentations
Productivity: Projects
Project Topic

Table B1. Continued

Codes
Project Topic: Medication Error Prevention
Project Topic: Clinical Decision Making
Project Topic: Diabetes
Project Topic: Alzheimer's
Project Topic: Asthma
Project Topic: Depression Management
Project Topic: Hypertension
Project Topic: Obesity
Project Topic: SSRIs
Project Topic: Polypharmacy
Project Topic: Provider Sanitary Practices
Project Topic: Difficult Patients
Project Topic: Clinical Pharmacist Activities
Project Topic: Patient Community Connectedness
Project Topic: Bisphosphonate-associated Jaw Necrosis
Project Topic: Dental Blood Glucose Monitoring
Project Topic: Drug Shortages
Project Topic: Sports Related Injuries
Collect Data
Collect Data: Patient Reported
Collect Data: Longitudinal
Collect Data: Provider Reported
Collect Data: Surveys
Collect Data: Cards
Collect Data: Focus Groups
Collect Data: Clinical
Collect Data: Observation
Collect Data: Patient Specimens
Ongoing Activities
IRB Issues
Obtain Letters of Support
Support Research Culture
Project Gaps
Patient Recruitment
PBRN Building/Development
PBRN Building: Recruit Staff
PBRN Building: Recruit Clinicians
PBRN Building: Develop Advisory Boards
PBRN Building: Initial Project
PBRN Building: Determine Goals

Table B1. Continued

Codes
PBRN Building: Develop Relationships
PBRN Building: Develop Policies and Procedures

APPENDIX C: IRB DOCUMENTS PHASE II

PBRN Director Exempt Information Sheet

FOR IRB USE ONLY
APPROVED BY: IRB-01
IRB ID #: 201303816
APPROVAL DATE: 08/05/13
EXPIRATION DATE: N/A

We invite you to participate in a research study being conducted by investigators from The University of Iowa. The purpose of this study is to identify significant relationships across leadership behaviors within a practice-based research network (PBRN) and PBRN participant performance. Your response will help inform us about leadership actions and their effects in PBRN settings.

If you agree to participate, we would like you to do three tasks. First, you will be asked to supply the names and email addresses of clinician members of your PBRN. These members may be asked to complete a short survey about leadership behaviors within the PBRN. Second, you will be asked to complete a brief demographic survey that will ask you about productivity of your PBRN. Third, you will be asked to provide information on selected clinicians' performance using a short survey. The surveys should not take more than 10 minutes each to complete. Survey links will be sent to you via email for you to complete at your convenience. Each survey link will come with more detailed instructions. Attached are questions asked in the surveys for your reference before agreeing to participate in the study. You are free to skip any questions that you prefer not to answer. A $50 Amazon gift card will be provided for completing the survey and associated tasks. Additionally, for PBRNs who have more than 15 clinician members participating in this study, aggregated information of participant surveys on activity level and perceptions of directive and participative leadership behaviors within their PBRN will be provided.

We will not use your name when presenting results of the study. Only a numeric study id will be kept with electronic survey data to match up data collected from you and the clinicians form your PBRN.

Taking part in this research study is completely voluntary. A reminder telephone call will be made a week after receipt of this letter. If you do not wish to participate in this study or receive reminder contacts, you may respond to this email requesting no further contact.

If you have questions about the rights of research subjects, please contact the Human Subjects Office, 105 Hardin Library for the Health Sciences, 600 Newton Rd, The University of Iowa, Iowa City, IA 52242-1098, (319) 335-6564, or e-mail irb@uiowa.edu.

Thank you very much for your consideration of this research study.

PBRN Clinician Member Exempt Information Sheet

FOR IRB USE ONLY
APPROVED BY: IRB-01
IRB ID #: 201303816
APPROVAL DATE: 04/23/13
EXPIRATION DATE: N/A

We invite you to participate in a research study being conducted by investigators from The University of Iowa. The purpose of this study is to identify significant relationships across leadership behaviors within a practice-based research network (PBRN) and PBRN participant performance. Your response will help inform us about leadership actions and their effects in PBRN settings.

If you agree to participate, we would like you to complete a survey on leadership behaviors within your PBRN. An email link will be sent with further instructions, so that you may complete the survey online at your convenience. The survey should not take more than 7 minutes to complete. You are free to skip any questions that you prefer not to answer. A $10 Amazon gift card will be provided to participants completing the survey and associated tasks.

We will not use your name when presenting results of the study. Only a numeric study id will be kept with electronic survey data.

Taking part in this research study is completely voluntary. A reminder telephone call will be made a week after receipt of this letter. If you do not wish to participate in this study or receive reminder contacts, you may respond to this email requesting no further contact.

If you have questions about the rights of research subjects, please contact the Human Subjects Office, 105 Hardin Library for the Health Sciences, 600 Newton Rd, The University of Iowa, Iowa City, IA 52242-1098, (319) 335-6564, or e-mail irb@uiowa.edu.

Thank you very much for your consideration of this research study.

PBRN Director Recruitment Email

[DATE]

[Recipient Name]
[Title]
[School Name]
[Street Address]
[City, ST ZIP Code]

Dear [Recipient Name]:

Attached is an information sheet that conveys information about a research study aimed to identify significant relationships across leadership and performance of Practice-based Research Networks (PBRNs). Your involvement in such an endeavor to advance our knowledge of leadership-performance relationships within PBRNs that could ultimately lead to increased performance across PBRNs would be greatly appreciated.

Your name has been identified via the Agency for Healthcare Research and Quality (AHRQ) PBRN registry. Participation requires three activities. First, you will be asked to supply the names and email addresses of clinician members of your PBRN. These members may be asked to complete a short survey about leadership behaviors within the PBRN. Second, you will be asked to complete a brief demographic survey that will ask you about productivity of your PBRN. Third, you will be asked to provide information on selected clinicians' performance using a short survey. Survey links will be sent to you via email for you to complete at your convenience. Each survey link will come with more detailed instructions. Attached are questions asked in the surveys for your reference before agreeing to participate in the study. For your efforts a $50 Amazon gift card will be provided to those who participate. We will need to collect your Social Security Number (SSN) in order to pay you. You can participate without compensation, if you prefer not to provide the SSN.

If you are have any questions regarding this study or wish to schedule your interview, please email the study PI, Brandon Patterson, at Brandon-patterson@uiowa.edu.

Thank you for your time and interest. I look forward to hearing from you.

Sincerely,

Brandon J. Patterson, PharmD, PhD candidate
UI Presidential Fellow
Pharmaceutical Socioeconomics
University of Iowa College of Pharmacy

Study Advisors: Barry L. Carter, PharmD (NIPC-PBRN director)
William R. Doucette, PhD
Barcey T. Levy, MD, PhD (IRENE director)
Julie Urmie, PhD
Mary Schroeder, PhD

PBRN Clinician Member Recruitment Email

[DATE]

[Recipient Name]
[Title]
[School Name]
[Street Address]
[City, ST ZIP Code]

Dear [Recipient Name]:

Attached is an information sheet that conveys information about a research study aimed to identify significant relationships across leadership and performance of Practice-based Research Networks (PBRN). Your involvement in such an endeavor to advance our knowledge of leadership-performance relationships within PBRNs that could ultimately lead to increased performance across PBRNs would be greatly appreciated.

Your name has been identified by your PBRN Director. Participation in this study involves completion of a brief survey that will ask you about leadership behaviors within your PBRN. An email link will be sent with further instructions, so that you may complete the survey online at your convenience. For your efforts a $10 Amazon gift card will be provided to those who participate.

If you are have any questions regarding this study or wish to schedule your interview, please email the study PI, Brandon Patterson, at Brandon-patterson@uiowa.edu.

Thank you for your time and interest. I look forward to hearing from you.

Sincerely,

Brandon J. Patterson, PharmD, PhD candidate
UI Presidential Fellow
Pharmaceutical Socioeconomics
University of Iowa College of Pharmacy

Study Advisors:
Barry L. Carter, PharmD (NIPC-PBRN director)
Barcey T. Levy, MD, PhD (IRENE director)
William R. Doucette, PhD
Julie Urmie, PhD
Mary Schroeder, PhD

APPENDIX D: QUANTITATIVE DATA ANALYSIS CODEBOOK

Table D1. Quantitative Data Analysis Codebook

Variable	Label	Values
PTCP_ID	Participant Identification Number	
PBRN_ID	PBRN Identification Number	
CM_ED_MDDO	Clinician Member Physician	0 = Not Physician; 1 = Physician
CM_ED_DENT	Clinician Member Dentist	0 = Not Dentist; 1 = Physician
CM_ED_NURS	Clinician Member Nurse	0 = Not Nurse; 1 = Physician
CM_ED_AT	Clinician Member Athletic Trainer	0 = Not Athletic Trainer; 1 = Physician
CM_ED_PHARM	Clinician Member Pharmacist	0 = Not Pharmacist; 1 = Physician
CM_ED_MPH	Clinician Member MPH	0 = Not MPH; 1 = MPH
CM_ED_MSMA	Clinician Member Masters	0 = Not Masters; 1 = Masters
CM_ED_PHD	Clinician Member PhD	0 = Not PhD; 1 = PhD
CM_ED_OTH	Clinician Member Other	0 = Not Other; 1 = Other
CM_ED_TXT	Clinician Member Training Text	
CM_PBRNYR	Clinician Member Year Started with PBRN	
CM_STARTYR	Clinician Member Year Started with Practice-based Research	
FUTRESIDEAS_TXT	Future Research Ideas Text	
AL_SCALE	Activity Level Scale	0 = Inactive; 1 = Passive; 2 = Active; 3 = Fully Active; 4 = Hyperactive
AL_HPW	Activity Level Hours Per Week	
AL_PCTTIME	Activity Level Percent Time	

Table D1. Continued

Variable	Label	Values
AL_PROJCOUNT	Activity Level Project Number	
LDR_ROLE_DIR	Leader Identified Director Status	0 = Non-director; 1 = Director
LDRBEH_1_RAW	Directive Leadership Behavior Q1	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_2_RAW	Participative Leadership Behavior Q1	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_3_RAW	Participative Leadership Behavior Q2	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_4_RAW	Directive Leadership Behavior Q2	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_5_RAW	Participative Leadership Behavior Q3 [REVERSE NEEDED]	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_6_RAW	Directive Leadership Behavior Q3	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_7_RAW	Participative Leadership Behavior Q4	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_8_RAW	Directive Leadership Behavior Q4	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_9_RAW	Participative Leadership Behavior Q5	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
LDRBEH_10_RAW	Directive Leadership Behavior Q5 [REVERSE NEEDED]	0 = Never; 1 = Hardly Ever; 2 = Seldom; 3 = Occasionally; 4 = Often; 5 = Usually; 6 = Always
PDM_1_RAW	Participative Decision Making Q1	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always

Table D1. Continued

Variable	Label	Values
PDM_2_RAW	Participative Decision Making Q2	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PDM_3_RAW	Participative Decision Making Q3	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PDM_4_RAW	Participative Decision Making Q4	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PDM_5_RAW	Participative Decision Making Q5	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_1_RAW	Communication Performance Domain Q1 [REVERSE NEEDED]	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_2_RAW	Awareness Buy-in Performance Domain Q1	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_3_RAW	Awareness Buy-in Performance Domain Q2	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_4_RAW	Leadership Role Q1	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_5_RAW	Follow-through Commitment Q1 [REVERSE NEEDED]	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_6_RAW	Follow-through Commitment Q2	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_7_RAW	Leadership Role Q2	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_8_RAW	Communication Performance Domain Q2	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always

Table D1. Continued

Variable	Label	Values
PER_9_RAW	Communication Performance Domain Q3	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_10_RAW	Follow-through Commitment Q3	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_11_RAW	Follow-through Commitment Q4	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_12_RAW	Awareness Buy-in Performance Domain Q3	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_13_RAW	Leadership Role Q3	0 = Never; 1 = Rarely; 2 = Sometimes; 3 = Most of the Time; 4 = Always
PER_GLOBAL	Global Performance	0 = Poor; 1 = Fair; 2 = Good; 3 = Very Good; 4 = Excellent
DIR_ED_MDDO	Director Physician	0 = Not Physician; 1 = Physician
DIR_ED_DENT	Director Dentist	0 = Not Dentist; 1 = Physician
DIR_ED_NURS	Director Nurse	0 = Not Nurse; 1 = Physician
DIR_ED_AT	Director Athletic Trainer	0 = Not Athletic Trainer; 1 = Physician
DIR_ED_PHARM	Director Pharmacist	0 = Not Pharmacist; 1 = Physician
DIR_ED_MPH	Director MPH	0 = Not MPH; 1 = MPH
DIR_ED_MSMA	Director Masters	0 = Not Masters; 1 = Masters
DIR_ED_PHD	Director PhD	0 = Not PhD; 1 = PhD
DIR_ED_OTH	Director Other	0 = Not Other; 1 = Other
DIR_ED_TXT	Director Training Text	
DIR_PBRNYR	Director Year Started with PBRN	
DIR_STARTYR	Director Year Started with Practice-based Research	
MEMDEF_TXT	Membership Definition	
MEMCOUNT	Member Number	

Table D1. Continued

Variable	Label	Values
ACTIVEPCT	Members Active Percentage Past 12 Months	
GRANT_APPS	Grants Applied Past 12 Months	
GRANT_AWARD	Grants Awarded Past 12 Months	
GRANT_ACTIVE	Grants Actively Funding PBRN Activity Past 12 Months	
GRANT_FED	Grants Federal	0 = No Federal Grants; 1 = Yes Federal Grants
GRANT_STATE	Grants State	0 = No State Grants; 1 = Yes State Grants
GRANT_PROF	Grants Professional Association	0 = No Professional Association Grants; 1 = Yes Professional Association Grants
GRANT_INDUST	Grants Industry	0 = No Industry Grants; 1 = Yes Industry Grants
GRANT_INTERNAL	Grants Internal	0 = No Internal Grants; 1 = Yes Internal Grants
STUDYCOUNT	Studies Conducted Past 12 Month	
MANUCOUNT	Manuscripts Submitted Past 12 Months	
QI	QI Activities	0 = No QI; 1 = Yes QI
QI_TXT	QI Activity Text	
TPDOWN_PCT	Top-down Decisions Percentage	
TPDOWN	Top-down PBRN	0 = Bottom-up; 1 = Top-down
PBRNTY_PED	PBRN Type Pediatric	0 = Not Pediatric; 1 = Pediatric
PBRNTY_FAM	PBRN Type Family Medicine	0 = Not Family Medicine; 1 = Family Medicine
PBRNTY_INT	PBRN Type Internal Medicine	0 = Not Internal Medicine; 1 = Internal Medicine
PBRNTY_DENT	PBRN Type Dentistry	0 = Not Dentistry; 1 = Dentistry

Table D1. Continued

Variable	Label	Values
PBRNTY_MTLHLT	PBRN Type Mental Health	0 = Not Mental Health; 1 = Mental Health
PBRNTY_MIXED	PBRN Type Mixed	0 = Not Mixed; 1 = Mixed
PBRNTY_PHARM	PBRN Type Pharmacy	0 = Not Pharmacy; 1 = Pharmacy
PBRNTY_PUBHLT	PBRN Type Public Health	0 = Not Public Health; 1 = Public Health
PBRNTY_NUR	PBRN Type Nursing	0 = Not Nursing; 1 = Nursing
PBRNTY_OTH	PBRN Type Other	0 = Not Other; 1 = Other
PBRNGEO_LOC	PBRN Geographic Dispersion Local	0 = Not Local; 1 = Local
PBRNGEO_STATE	PBRN Geographic Dispersion State	0 = Not State; 1 = State
PBRNGEO_REG	PBRN Geographic Dispersion Regional	0 = Not Regional; 1 = Regional
PBRNGEO_NAT	PBRN Geographic Dispersion National	0 = Not National; 1 = National
SCALE_PDM	Participative Decision Making Scale	
CALC_CM_PBRNYR	Calculated PBRN Time Clinician Member	
CALC_CM_STARTYR	Calculated Practice-based Research Time Clinician Member	
CALC_DIR_PBRNYR	Calculated PBRN Time Director	
CALC_DIR_STARTYR	Calculated Practice-based Research Time Director	
RC_LDRBEH_5	Participative Leadership Behavior Q3 REVERSED	6 = Never; 5 = Hardly Ever; 4 = Seldom; 3 = Occasionally; 2 = Often; 1 = Usually; 0 = Always
RC_LDRBEH_10	Directive Leadership Behavior Q5 REVERSED	6 = Never; 5 = Hardly Ever; 4 = Seldom; 3 = Occasionally; 2 = Often; 1 = Usually; 0 = Always

Table D1. Continued

Variable	Label	Values
RC_PER_1	Communication Performance Domain Q1 REVERSED	4 = Never; 3 = Rarely; 2 = Sometimes; 1 = Most of the Time; 0 = Always
RC_PER_5	Follow-through Commitment Q1 REVERSED	4 = Never; 3 = Rarely; 2 = Sometimes; 1 = Most of the Time; 0 = Always
SCALE_ABILR	Awareness/Buy-in/Leadership Role Performance Scale	
SCALE_FTCOMM	Follow-through/Communication Performance Scale	
SCALE_LDRDIR	Leadership Directive Behavior Scale	
SCALE_LDRPAR	Leadership Participative Behavior Scale	
SCALE_PERTOT	Performance Total Scale	
RC_AL_DICHOT	Dichotomized Activity Level Scale	0 = Passive; 1 = Active, Fully Active, Hyperactive

APPENDIX E: BIVARIATE CORRELATION TABLES

Table E1. Bivariate Correlation Matrix for Individual Level Variables

Variable	1	2	3	4	5	6	7
1. CM_ED_MDDO	1.00						
2. CM_ED_NURS	-0.34**	1.00					
3. CM_ED_AT	-0.46**	-0.06	1.00				
4. CM_ED_PHARM	-0.55**	-0.08	-0.11	1.00			
5. CM_ED_MPH	0.11	-0.04	-0.05	-0.07	1.00		
6. CM_ED_MSMS	-0.19	-0.06	0.23*	-0.11	-0.05	1.00	
7. CM_ED_PHD	-0.17	-0.02	0.37**	-0.04	-0.02	0.37**	1.00
8. CM_ED_OTH	-0.34**	-0.04	0.34**	-0.08	-0.04	0.14	-0.02
9. CALC_CM_PBRNYR	0.36**	0.02	-0.33**	-0.16	0.01	0.04	-0.10
10. CALC_CM_STARTYR	0.36**	-0.03	-0.29**	-0.15	0.24*	0.05	-0.12
11. AL_SCALE	0.13	0.08	-0.06	-0.12	0.13	-0.06	0.05
12. AL_HPW	-0.07	-0.04	0.21	0.06	0.06	-0.04	0.02
13. AL_PCTTIME	-0.04	-0.14	0.33**	0.02	0.01	0.11	0.10
14. AL_PROJCOUNT	0.42**	0.09	-0.31**	-0.38**	-0.01	-0.02	-0.06
15. SCALE_ABILR	0.02	0.18	-0.40**	0.12	0.22	-0.03	-0.15
16. SCALE_FTCOMM	-0.26*	0.23*	-0.10	0.26*	0.18	-0.02	-0.02
17. SCALE_PERTOT	-0.04	0.23	-0.33**	0.13	0.24*	-0.04	-0.11
18. PER_GLOBAL	-0.04	0.16	-0.16	0.02	0.05	0.03	-0.04
19. SCALE_LDRDIR	-0.06	0.08	-0.09	0.03	0.07	-0.10	0.13
20. SCALE_LDRPAR	0.18	0.02	-0.18	-0.18	-0.03	-0.14	0.00
21. SCALE_PDM	0.10	0.20	-0.11	-0.09	-0.09	-0.12	-0.02

Table E1. Continued

Variable	8	9	10	11	12	13	14
1. CM_ED_MDDO							
2. CM_ED_NURS							
3. CM_ED_AT							
4. CM_ED_PHARM							
5. CM_ED_MPH							
6. CM_ED_MSMS							
7. CM_ED_PHD							
8. CM_ED_OTH	1.00						
9. CALC_CM_PBRNYR	-0.21*	1.00					
10. CALC_CM_STARTYR	-0.27*	0.64**	1.00				
11. AL_SCALE	0.02	0.17	0.13	1.00			
12. AL_HPW	0.13	0.13	0.07	0.31**	1.00		
13. AL_PCTTIME	0.03	0.21	0.10	0.24*	0.86**	1.00	
14. AL_PROJCOUNT	-0.22*	0.31**	0.13	0.18	0.25*	0.32**	1.00
15. SCALE_ABILR	-0.25*	0.39**	0.36**	0.17	-0.02	0.09	0.28*
16. SCALE_FTCOMM	-0.18	-0.08	-0.06	0.10	0.08	0.13	0.04
17. SCALE_PERTOT	-0.24*	0.21	0.22	0.08	-0.04	0.08	0.18
18. PER_GLOBAL	-0.09	0.05	-0.08	0.24*	0.15	0.12	0.27*
19. SCALE_LDRDIR	-0.03	-0.17	-0.14	-0.04	0.18	0.08	-0.15
20. SCALE_LDRPAR	-0.03	0.01	-0.04	0.10	0.17	0.12	0.07
21. SCALE_PDM	-0.05	0.08	-0.04	0.08	0.21	0.17	-0.08

Table E1. Continued

Variable	15	16	17	18	19	20	21
1. CM_ED_MDDO							
2. CM_ED_NURS							
3. CM_ED_AT							
4. CM_ED_PHARM							
5. CM_ED_MPH							
6. CM_ED_MSMS							
7. CM_ED_PHD							
8. CM_ED_OTH							
9. CALC_CM_PBRNYR							
10. CALC_CM_STARTYR							
11. AL_SCALE							
12. AL_HPW							
13. AL_PCTTIME							
14. AL_PROJCOUNT							
15. SCALE_ABILR	1.00						
16. SCALE_FTCOMM	0.66**	1.00					
17. SCALE_PERTOT	0.92**	0.91**	1.00				
18. PER_GLOBAL	0.75**	0.68**	0.74**	1.00			
19. SCALE_LDRDIR	-0.07	-0.03	-0.06	0.01	1.00		
20. SCALE_LDRPAR	0.03	-0.02	0.01	0.10	0.63**	1.00	
21. SCALE_PDM	-0.08	-0.07	-0.08	0.04	0.25*	0.47**	1.00

Note: Variable descriptions and scales can be found in Appendix D.

n ranges from 67 to 94.

For dichotomous variable pairs, Phi correlation is reported.

For dichotomous and continuous variable pairs, Point-biserial correlation is reported.

For continuous variable pairs, Pearson's product-moment is reported.

* - significant at the $\alpha = 0.05$ level and ** - significant at the $\alpha = 0.01$ level.

INC - Incalculable.

Table E2. Bivariate Correlation Matrix for PBRN Level Variables

Variable	1	2	3	4	5	6	7
1. DIR_ED_MDDO	1.00						
2. DIR_ED_NURS	-0.28	1.00					
3. DIR_ED_AT	-0.28	-0.08	1.00				
4. DIR_ED_PHARM	-0.28	-0.08	-0.08	1.00			
5. DIR_ED_MPH	0.28	-0.08	-0.08	-0.08	1.00		
6. DIR_ED_PHD	-0.45	-0.21	0.37	-0.21	-0.21	1.00	
7. DIR_ED_OTH	-0.52	0.53	0.53	-0.15	-0.15	-0.03	1.00
8. CALC_DIR_PBRNYR	0.66*	-0.13	-0.19	-0.13	0.49	-0.48	-0.25
9. CALC_DIR_STARTYR	0.25	-0.31	-0.31	0.51	0.16	-0.30	-0.53
10. MEMCOUNT	-0.11	0.17	-0.23	-0.28	0.28	0.42	-0.23
11. ACTIVEPCT	-0.33	0.37	-0.35	0.22	0.18	-0.30	0.25
12. GRANT_APPS	-0.02	INC	-0.07	-0.31	0.08	0.19	-0.22
13. GRANT_AWARD	0.31	INC	-0.20	-0.32	0.17	0.06	-0.29
14. GRANT_ACTIVE	0.21	INC	-0.21	-0.26	0.00	0.02	-0.20
15. GRANT_FED	0.30	0.09	INC	0.09	0.09	-0.43	-0.52
16. GRANT_STATE	0.35	0.21	-0.43	-0.43	0.21	0.13	-0.41
17. GRANT_PROF	0.17	-0.26	0.36	-0.26	-0.26	0.12	-0.10
18. GRANT_INDUST	0.33	-0.30	-0.30	-0.30	-0.30	0.00	-0.19
19. GRANT_INTERN	-0.17	0.26	0.26	-0.36	0.26	0.24	0.10
20. STUDYCOUNT	-0.29	0.93**	-0.13	-0.16	-0.05	-0.01	0.44
21. MANUCOUNT	-0.22	0.43	-0.25	-0.12	0.00	0.13	0.04
22. QI	0.52	-0.53	-0.53	0.15	0.15	-0.34	-0.58*
23. TPDWN_PCT	0.02	INC	0.28	0.39	-0.15	-0.08	0.28
24. TPDOWN	0.00	0.18	0.18	0.18	-0.44	-0.19	0.33

Table E2. Continued

Variable	8	9	10	11	12	13	14
1. DIR_ED_MDDO							
2. DIR_ED_NURS							
3. DIR_ED_AT							
4. DIR_ED_PHARM							
5. DIR_ED_MPH							
6. DIR_ED_PHD							
7. DIR_ED_OTH							
8. CALC_DIR_PBRNYR	1.00						
9. CALC_DIR_STARTYR	0.33	1.00					
10. MEMCOUNT	0.21	0.16	1.00				
11. ACTIVEPCT	-0.03	0.22	0.00	1.00			
12. GRANT_APPS	0.20	0.26	0.73**	-0.17	1.00		
13. GRANT_AWARD	0.42	0.44	0.67*	-0.12	0.72**	1.00	
14. GRANT_ACTIVE	0.23	0.56*	0.53	0.01	0.57*	0.81**	1.00
15. GRANT_FED	0.25	0.40	0.28	0.44	0.16	0.29	0.31
16. GRANT_STATE	-0.02	0.10	0.56	-0.09	0.60	0.70*	0.62*
17. GRANT_PROF	-0.08	0.21	-0.08	-0.43	0.44	0.53	0.48
18. GRANT_INDUST	0.19	0.28	-0.01	0.20	-0.13	0.36	0.51
19. GRANT_INTERN	-0.30	0.06	0.36	0.10	0.46	0.28	0.44
20. STUDYCOUNT	-0.13	-0.22	0.44	0.36	0.63*	0.77**	0.54
21. MANUCOUNT	0.12	0.13	0.81**	0.10	0.88**	0.71**	0.53
22. QI	0.39	0.60*	0.08	-0.09	0.28	0.38	0.39
23. TPDWN_PCT	-0.24	-0.42	-0.73*	-0.11	-0.70*	-0.72*	-0.81**
24. TPDOWN	-0.15	-0.46	-0.71**	0.03	-0.65*	-0.53	-0.68*

Table E2. Continued

Variable	15	16	17	18	19	20	21
1. DIR_ED_MDDO							
2. DIR_ED_NURS							
3. DIR_ED_AT							
4. DIR_ED_PHARM							
5. DIR_ED_MPH							
6. DIR_ED_PHD							
7. DIR_ED_OTH							
8. CALC_DIR_PBRNYR							
9. CALC_DIR_STARTYR							
10. MEMCOUNT							
11. ACTIVEPCT							
12. GRANT_APPS							
13. GRANT_AWARD							
14. GRANT_ACTIVE							
15. GRANT_FED	1.00						
16. GRANT_STATE	0.43	1.00					
17. GRANT_PROF	-0.36	0.24	1.00				
18. GRANT_INDUST	0.30	0.00	0.17	1.00			
19. GRANT_INTERN	-0.26	0.48	0.37	-0.17	1.00		
20. STUDYCOUNT	0.17	0.40	-0.19	-0.20	0.30	1.00	
21. MANUCOUNT	0.37	0.52	-0.04	-0.16	0.21	0.66**	1.00
22. QI	0.67*	0.16	-0.08	0.45	-0.38	-0.41	0.12
23. TPDWN_PCT	-0.33	-0.58	-0.34	-0.44	-0.62	-0.51	-0.62*
24. TPDOWN	-0.21	-0.50	-0.12	0.00	-0.60*	0.00	-0.46

Table E2. Continued

Variable	22	23	24
1. DIR_ED_MDDO			
2. DIR_ED_NURS			
3. DIR_ED_AT			
4. DIR_ED_PHARM			
5. DIR_ED_MPH			
6. DIR_ED_PHD			
7. DIR_ED_OTH			
8. CALC_DIR_PBRNYR			
9. CALC_DIR_STARTYR			
10. MEMCOUNT			
11. ACTIVEPCT			
12. GRANT_APPS			
13. GRANT_AWARD			
14. GRANT_ACTIVE			
15. GRANT_FED			
16. GRANT_STATE			
17. GRANT_PROF			
18. GRANT_INDUST			
19. GRANT_INTERN			
20. STUDYCOUNT			
21. MANUCOUNT			
22. QI	1.00		
23. TPDWN_PCT	-0.30	1.00	
24. TPDOWN	-0.33	0.86**	1.00

Note: Variable descriptions and scales can be found in Appendix D.

n ranges from 11 to 14.

For dichotomous variable pairs, Phi correlation is reported.

For dichotomous and continuous variable pairs, Point-biserial correlation is reported.

For continuous variable pairs, Pearson's product-moment is reported.

* - significant at the $\alpha = 0.05$ level and ** - significant at the $\alpha = 0.01$ level.

INC - Incalculable.

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