Nurse Practitioner-Physician Co-management of Primary Care Patient Panels: Impact, Perspective, and Measurement toward a New Delivery Care Model

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ABSTRACT

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The demands for high quality primary care have become strained by a deficit in the primary care physician supply and the complexity of delivering care to aging populations that are often living with complex co-morbidities. Provider co-management has emerged in practice to help alleviate some of the care delivery demands by having more than primary care provider (PCP) complete care management tasks for the same patient. There is extensive literature investigating two physicians co-managing patient care, and physician-physician assistant co-management, yet limited studies have investigated nurse practitioner (NP)-physician co-management. NPs currently are the fastest growing health care workforce in the United States. Several organizations support the expanded utilization of NPs in primary care. As more U.S. states are granting NPs independent scope of practice, which is free of physician oversight, the potential for NPs to co-manage patients with physicians, and alleviate some of the primary care strain, has increased. However, there are limited to no studies that have investigated NP-physician co-management in primary care. Further, there is a lack of evidence of PCP perspectives about co-managing care, its impact on patient and practice outcomes, or a tool to measure NP-physician co-management in practice or research. More evidence about NP-physician co-management is warranted and will be investigated in this dissertation.

The purpose of this dissertation is to investigate NP-physician co-management in primary care by synthesizing the existing evidence, gathering data from PCPs about NP-physician co-management and to develop a valid and reliable tool to measure it. In Chapter 1, background of
the current demands on primary care is presented and accompanied by a discussion about the need to expand the NP workforce in primary care to help meet the demand. Evidence about the history of provider co-management is presented and gaps in the literature are identified. Specific aims of the dissertation are introduced and tied to existing theoretical underpinnings. In Chapter 2, aim one of the dissertation is addressed by qualitatively obtaining data on the PCP perspective of NP-physician co-management. In Chapter 3, aim two of the dissertation is addressed. A systematic review of the literature was conducted to determine the effects of NP-physician co-management compared to a single physician delivering care. In Chapter 4, aim three is addressed. Based on the collective findings of Aim 1 and Aim 2, a new tool is developed and psychometrically tested to measure NP-physician co-management. Content validity and reliability testing of the tool is conducted. In Chapter 5, the results of the dissertation are synthesized. Practice, policy, and research implications are discussed, and strengths and limitations of the dissertation are presented.
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Chapter 1

Introduction

This chapter of the dissertation presents an overview of the current state of the primary care system in the United States. Next, the chapter introduces a novel type of care delivery, NP-physician co-management that has emerged in practice. A discussion of the conceptual organization and defining elements of NP-physician co-management is provided. Further, the chapter presents identified gaps in the literature and the specific aims of the dissertation.
Problem Statement

The epidemic of chronic diseases, primary care provider shortages, an increase in the number of insured individuals, and rising healthcare costs, continue to pose a strain on the U.S. health care system (Bodenheimer & Pham, 2010; Mitka, 2007). By 2020, an estimated 157 million Americans will be living with a chronic disease who will need timely and high quality primary care to manage their conditions (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; Wu & Green, 2000). The primary care system plays a vital role in our health care continuum as it serves as the first point of contact for patients to access care and focuses on addressing a wide range of patient needs specific to disease prevention, health promotion, and chronic disease management (Halcomb et al., 2005; Starfield, 1998). However, current models for delivering primary care, such as the use of a single provider, are threatened by increased workload, growing complexity of patient visits due to multimorbidity, and an expected deficit of 40,000 primary care physicians by 2020 (Colwill, Cultice, & Kruse, 2008). As a result, it is estimated that individual physicians would require approximately 21 hours per day to complete all recommended care guidelines (Yarnall et al., 2009). Given these challenges, policy makers are calling for ways to alleviate this burden and assure patients have access to high quality primary care through the investigation of various care delivery models.

Growing Nurse Practitioner Workforce

The expansion of the nurse practitioner (NP) workforce has shown promise with alleviating some of the increased demand and complexity in primary care. NPs are registered nurses with additional training and education, often a master’s or doctoral degree (AANP, 2016). NP workforce is predicted to grow the fastest compared to other health care professions with their numbers doubling between 2008-2025 (Auerbach, 2012; Petterson et al., 2012). Further,
eighty-five percent of NPs are trained and prepared to take on primary care roles (AANP, 2016). The expansion of NP workforce in primary care is supported by the National Academy of Medicine, the American College of Physicians (ACP), Federal Trade Commission, and others to promote increased patient access to high quality primary care (National Academy of Medicine, 2016; American College of Physicians, 2009). Thus, optimal utilization of the NP workforce in primary care has been identified as a substantial solution to alleviating some of the demands in patient care management (Everett et al., 2013; Litaker et al., 2003; Poghosyan, Lucero, Rauch, & Berkowitz, 2012).

Evidence has been accumulated demonstrating that NP care yields optimal patient outcomes, such as disease specific measures and increased patient satisfaction, and thus suggests that increased NP utilization may be a key solution to meet the demands of primary care (Horrocks, Anderson, & Salisbury, 2002; Lenz, Mundinger, Kane, Hopkins, & Lin, 2004; Russell et al., 2009). NP scope of practice, however, is variable by state-based legislation and organizational policy. Twenty-two U.S. states, plus the District of Columbia, currently grant NPs independent scope of practice that is free of physician oversight (AANP, 2017). However, other states require mandatory collaboration with, or supervision by, a physician, and thus policies include chart reviews, limitations of NP prescriptive privileges, and requiring a physician to be present on site where the NP is practicing. This variability in scope of practice presents challenges and barriers that inhibit NPs from working to the full extent of their education and training (Poghosyan, Norful, & Martsolf, 2017b). Further, studies have shown that NPs are often underutilized within their primary care practices (Bryant-Lukosius, DiCenso, Browne, & Pinelli, 2004; Poghosyan, Norful, & Martsolf, 2017a; Poghosyan et al., 2017b). For example, although NP and physician scope of practice overlaps, organizational policy has been
found to inhibit NP practice due to a lack of understanding of the role NPs should play in primary care (Poghosyan et al., 2013). Further, a RAND report using Agency for Healthcare Research and Quality (AHRQ) data estimated that the underutilization of NPs has cost the health care system approximately $8 billion per year (RAND Health, 2009). An exploration of primary care delivery designs that utilize NPs is warranted and researchers have highlighted the need for evidence that will help to design evidence-based care delivery and promote full NP utilization needed for high quality care (Bryant-Lukosius et al., 2004).

**Provider Co-management of Patients**

One type of care delivery that has increasingly emerged in practice and research, to alleviate the increased demands for high quality care, includes more than one provider co-managing the same patient panel and sharing the care management responsibilities. One of the first studies to examine co-management in healthcare was a large retrospective cohort study about orthopedic surgery. This study examined the effects of a surgeon and primary care physician co-managing the same patient and found positive associations between co-management and shorter hospital stays and fewer in-patient deaths (Hinami, Feinglass, Ferranti, & Williams, 2011). Co-management has increasingly become a common practice across acute care organizations, and co-management practice agreements have been implemented between specialty providers such as surgeons and primary care providers (PCPs). These agreements clearly lay out responsibilities of each provider, their communication methods and frequency, and also provide specific guidelines on disagreement resolution.(Cheng, 2012)

Studies carried out in outpatient settings are limited and have primarily focused on co-management by specialists and primary care physicians, or pharmacists and physicians (Bowman, Kleiner, & Bolton, 2013; Von Muenster et al., 2008; Weber, Ernst, Sezate, Zheng, &
Carter, 2010). However, as more and more NPs take on PCP roles and responsibilities, and an increasing number of NPs are practicing without physician oversight, there is limited evidence that clearly describes NP-physician co-management and its potential impact in primary care. More research that investigates NP-physician co-management is warranted and will be investigated in this dissertation.

**NP-Physician Co-management: Understanding the Concept**

In order to accurately investigate NP-physician co-management within this dissertation, we first set out to define the concept of NP-physician co-management using existing evidence and concept analysis techniques. We searched nursing, medical, and social literature for all relevant evidence about NP-physician co-management and using guidelines from Walker and Avant’s modified framework we determined the concept’s antecedents, attributes, and consequences (Walker & Avant, 2005). Details of the concept analysis can be found elsewhere and are summarized below (Norful et al., 2017a).

First, we identified the concept’s antecedents, or circumstances that must be in place for NP-physician co-management to exist. This included organizational policies that allow NPs to work to the full extent of their education and training, and to practice free of physician oversight. If NPs are experiencing barriers to practice and cannot perform care management activities, such as seeing new patients, then co-management is inhibited. A second antecedent includes organizational policy that enables NPs to have access to similar care delivery resources as physicians, such as a sufficient number of exam rooms and support staff (e.g. medical assistants). If similar resources are not provided to both the NP and the physician, co-management is hindered.
Next, we examined the attributes that make up the structure of NP-physician co-management and must be in place for NP-physician co-management to exist. The first is effective and timely communication, which may occur in-person, electronically, or via telephone (Lawson, 2002; O’Malley, Draper, Gourevitch, Cross, & Scholle, 2015). Communication needs to be timely and with transparency of each PCP’s care management documentation (Lawson, 2002). The second attribute is a mutual respect and trust. This includes a reciprocal understanding and identification of the value of each other’s educational background, training and expertise. In the event that either the physician or NP lacks trust, co-management is repressed. The third and final attribute that must be in place for co-management to exist is a shared philosophy of care which involves a clinical alignment or mutual plan for the way care is delivered (Way, Jones, & Busing, 2000).

Finally, we extracted evidence of the potential consequences of NP-physician co-management. Literature that examines the impact of NP-physician co-management was found to be limited. Emerging evidence suggests that co-management includes the shared responsibility of patient care needed to meet the demand for high quality and timely access to primary care (San Martín-Rodríguez, Beaulieu, D’Amour, & Ferrada-Videla, 2005; Way et al., 2000). It has the potential to increase provider and patient satisfaction, as well as increased continuity of care as patients are navigated across the health continuum (Roblin, Becker, Adams, Howard, & Roberts, 2004).

Figure 1 presents the conceptual model of NP-physician co-management. For the purpose of this dissertation, we define NP-Physician co-management as two types of primary care providers (NP and physician) sharing care management responsibilities during patient care delivery (Norful et al., 2017a; Way et al., 2000).
Identified Gaps in the Literature

Our prior research and concept analysis illuminated gaps in the literature about NP-physician co-management. First, there is a lack of information about the process of co-management and how it is currently practiced. An understanding of processes, such as allocation of care management responsibilities, will provide evidence for providers and organizations to successfully implement NP-physician co-management. Second, the literature lacks the perspective of NPs and physicians, and whether there is a PCP willingness to practice in this type of care delivery model. We also lack their perspectives about the implications of co-managing patient care. Finally, there are limited empirical studies available that provide evidence of an association between NP-physician co-management and patient and care management outcomes. We attribute this to the lack of instrumentation to measure NP-physician co-management in research or practice. There are currently no tools to measure co-management when NPs and physicians share care management responsibilities.
The purpose of this dissertation is: 1) to qualitatively investigate the perspectives of PCPs about co-management care delivery, including PCP willingness to co-manage; 2) to conduct a systematic review of available literature to determine the effects of NP-physician co-management; and 3) to develop and psychometrically test a novel health services instrument that measures NP-physician co-management. This finding in this dissertation inform providers, policymakers, and researchers with new evidence about NP-physician co-management. Further, health services researchers can use these findings to guide future studies that aim to determine associations between NP-physician co-management and patient or care management outcomes. In addition, this dissertation lays the foundation for PCPs and organizations to understand the structure, process, and outcome of NP-physician co-management needed to determine how to implement practice interventions that improve the quality of care delivery when NPs and physicians are co-managing the same primary care patient panels.

**Aims**

The aims of this dissertation are outlined below:

**Aim 1:** Investigate NP-physician co-management in primary care from the perspectives of NPs and physicians.

**Aim 2:** Synthesize literature examining the effects of NP-physician co-management on patient and care management outcomes compared to a traditional physician-only delivery care model.

**Aim 3:** Develop, pilot, and psychometrically test a new instrument to measure NP-physician co-management in primary care.
Theoretical Framework

Donabedian’s quality of care model (1988) was used as the framework guiding this dissertation. This model helps to understand how to assess quality of care through three linear dimensions including structure, process, and outcome. First, structure, involves the context of the health care environment such as the type of providers, the care delivery model attributes, and the environment in which care is delivered. Next, process, concerns the manner in which care is delivered or what is being done to the patient and by the provider. Finally, outcomes, include all of the effects on patients and care management outcomes, and the impact on quality of care.

In this dissertation, we investigated all three dimensions of Donabedian’s model in order to present evidence about the impact, perspective, and measurement of NP-physician co-management (Figure 2). Our prior research and conceptual analysis helped to first determine the structure of NP-physician co-management, which consists of three attributes: effective communication, mutual respect and trust, and a shared philosophy of care. Next, a qualitative study (Aim1) utilized this conceptual model to inductively and deductively examine PCP perspectives about the structure of NP-physician co-management, its attributes, processes, and outcomes. The second paper in the dissertation, a systematic review (Aim 2), investigated the outcomes of NP-physician co-management care delivery compared to a single physician delivering care. In the final paper of this dissertation, we took the collective findings about structure, process and outcome, and developed, piloted and psychometrically tested a new tool to measure NP-physician co-management (Aim 3). All studies and methodologies are described in Chapters 2 through 4 in this proposal.
Figure 2

**Applied Donabedian Quality of Care Model for NP-Physician Co-Management**

Summary

In summary, while policymakers are calling for new care delivery models to alleviate the primary care strain, evidence is needed to understand effective care delivery models that include the integration of different types of PCPs, including NPs (Bodenheimer & Pham, 2010; Everett et al., 2013; Ganz et al., 2010; Litaker et al., 2003; Offredy & Townsend, 2000; Yarnall et al., 2009). Studies are just beginning to show promise for NP-physician co-management (Ganz et al., 2010; Lenz et al., 2004; Litaker et al., 2003) but more evidence is warranted to determine its impact on patient and/or practice outcomes. This dissertation aims to provide evidence about the effects of NP-physician co-management compared to traditional individual physician-led care
delivery; PCP perspectives of NP-physician co-management; and also to provide instrumentation that allows the measurement of NP-physician co-management in future research.
Chapter 2

The Provider Perspective of Nurse Practitioner-Physician Co-management of Patients in Primary Care (Aim 1)

This chapter addresses aim one of this dissertation. The study provides the first evidence of PCP perspectives about NP-physician co-management. This includes in-depth qualitative data about how PCPs define NP-physician co-management, the necessary attributes for effective co-management, and the implications for care delivery and patient outcomes.

Note 1: The recruitment email can be found in Appendix A
Note 2: The interview guide can be found in Appendix B

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Abstract

**Background:** The current demand for primary care services will soon exceed the capacity of the primary care provider (PCP) workforce. As patient panel sizes increase, it has become increasingly difficult for a single PCP to deliver all recommended care. Expansion of nurse practitioner (NP) use in primary care has been shown to alleviate some of this strain. NP-physician co-management of primary care patient panels has emerged as a care delivery model where PCPs share the responsibility of larger patient panel sizes to meet the demand. However, there is currently no evidence of PCP perspectives of NP-physician co-management or PCP willingness to practice in such a model.

**Objective:** The purpose of this study is to investigate NP and physician perspectives of co-managing primary care patients.

**Design:** Qualitative design

**Participants:** Twenty-six PCPs (14 NPs and 12 physicians)

Approach: Using an interview guide, we conducted in-person interviews of primary care physicians and NPs. The interviews lasted 30-40 minutes, were audio-recorded, and then professionally transcribed. The transcripts were de-identified and checked for accuracy. Two researchers conducted the data analysis using both a deductive and inductive process to identify codes and emerging themes.

**Key Results:** Physicians and NPs perceive that co-management increases adherence to recommended care guidelines, improves quality of care, and increases patient access to care and follow-up. Effective communication, mutual respect and trust, and a shared philosophy of care
enhance co-management. Physicians and NPs report positive relations with each other in primary care settings and are optimistic about co-management care delivery.

**Conclusions:** PCPs report that NP-physician co-management is a promising care delivery model to alleviate primary care delivery strain. Both NPs and physicians report that strong co-management yields optimal patient outcomes. Future research should include empirical studies to determine the association between co-management and patient or organizational outcomes.
Introduction

Primary care providers (PCP) and health care organizations are increasingly strained by the demand to deliver high quality patient care to aging populations that often have chronic disease and require complex care management and follow-up (Bodenheimer & Pham, 2010; Lopez et al., 2006). In addition, the shift to value-based payment models, mandated by the Center for Medicare and Medicaid, has prompted healthcare organizations to reassess their current care delivery models to accommodate increased patient volume and care management complexity by ensuring that workforce resources are allocated effectively (Burwell, 2015). The demands for primary care services, however, are unlikely to be able to be met by primary care physicians alone. In fact, there is currently an estimated deficit upward of 50,000 primary care physicians in the U.S., which yield patient panel sizes far greater than what an individual PCP is recommended to manage (Mitka, 2007; Murray, Davies, & Boushon, 2007). One study estimates that it takes a single physician an unrealistic 21 hours per day to complete all recommended care management tasks and responsibilities (Yarnall et al., 2009). Therefore, policymakers are calling for novel care delivery models to help alleviate some of the PCP strain and ensure effective utilization of all available workforce resources to improve the quality of care.

Organizations such as the American College of Physicians and the National Academy of Medicine have supported the expansion of nurse practitioners (NPs) into primary care to help alleviate the primary care physician shortage and support increased patient access to primary care services (National Academy of Medicine, 2016; American College of Physicians, 2009). NPs are registered nurses with a master’s or doctoral degree. Individual states grant NP licenses that differ in terms of NP scope of practice and what NPs are licensed to assess, diagnose, and
prescribe (AANP, 2016). There are currently 22 states, plus the District of Columbia, that grant NPs independent practice without physician oversight (AANP, 2017). There is increasing evidence of the effectiveness of NP care delivery and some studies have found that clinical outcomes for NP-managed patients are equivalent to those patients managed by their physician colleagues (Lenz et al., 2004; Stanik-Hutt et al., 2013). Nurse practitioners currently make up the fastest growing healthcare workforce in the U.S. with their numbers expected to double in the next five years (Auerbach, 2012). This marks a potential to alleviate some of the PCP deficit. However, given the variability of NP scope of practice and the lack of evidence of how to best utilize NPs and physicians together in primary care management, there remains a gap in the literature of the best way to utilize NPs in different practice models (American College of Physicians, 2009; National Academy of Medicine, 2016; National Governor's Association, 2012). Furthermore, there is limited evidence of how NPs and physicians perceive NP-physician co-management care delivery, its potential benefits and shortcomings, and best approaches for implementation of this model in primary care practices.

One care model that has emerged is NP-physician co-management of the same primary care patient panel. In this model, NPs and physicians have a joint responsibility to complete all recommended care for the same primary care patient panel. A recent systematic review shows that NPs and physicians whom share patient care responsibilities in primary care yield patient outcomes that are the same or superior to a traditional single physician care delivery model (Norful et al., 2017b). In addition, when NPs and physicians co-manage the same patient, guideline recommended care is more likely to be provided. This illuminates the potential for a co-management care model to alleviate organizational and provider strain to deliver optimal patient care. The objective of this study is to explore NP and physician perspectives of co-
management in primary care to inform policymakers, administrators and providers about NP-physician co-management processes, necessary attributes, and potential implications of a co-management model.

**Approach**

The study was approved by the Columbia University Medical Center Institutional Review Board. A qualitative descriptive design guided this study (Bradley, Curry, & Devers, 2007). We used a purposive sampling approach (Sandelowski, 1995b) to recruit NPs and physicians that work in primary care. A flyer, containing the details of the study and contact information for the researchers, was circulated across several primary care practices in New York State through emails and were posted in local primary care practice sites. Interested participants contacted the researchers to set up a face-to-face interview at a convenient time and location to conduct the interview. Written consent was obtained prior to the interview. In addition, participants were asked to refer other PCPs to the researchers for participation in the study (snowball technique) (Biernacki & Waldorf, 1981). PCPs were eligible for participation if: 1) they were currently practicing as a NP or physician and practicing in a primary care outpatient office or clinic; and 2) they were able to speak and understand English.

An interview guide was created based on existing literature and evidence about co-management care delivery (Brault et al., 2014; Norful et al., 2017; Way, Jones, & Busing, 2000). The interviews lasted from 25-45 minutes. An example of questions asked during the interview included: “Can you describe a scenario where another primary care provider has helped supplement your patient care to fulfill recommended care guidelines?” and “What types of barriers to co-management of patient care by NPs and physicians have you experienced?” Prompts were used, such as “tell me more” or “give me an example” to obtain more detailed
information about the participant responses (Jacob & Furgerson, 2012). All interviews were
audiotaped to ensure descriptive validity and were immediately sent to a professional
transcriptionist. Each transcript was imported into NVIVO v11 software for qualitative analysis.
The researchers used an inductive and deductive approach to explore emergent themes about NP-
physician co-management care models. Two researchers performed the data analysis.
Transcripts were analyzed concurrently with the interviews to explore and interpret what codes
were emerging and to allow the researchers to further explore emergent themes in subsequent
interviews (Sandelowski, 1995a). First, the transcripts were read and re-read to obtain a general
sense of the participant responses. Each transcript was coded with unique identifiers and a code
book was created to ensure accuracy of the data extraction. The two researchers met weekly to
discuss patterns and commonalities between participant responses and grouped common codes
into categories, and categories into emerging themes. Three themes emerged from the data and
data rich quotes were extracted to exemplify NP-physician co-management care delivery.
Twenty-six PCPs were interviewed before data saturation was reached—no new information was
emerging from the interviews, thereby concluding the interview process. Each participant
received a $20 gift card incentive for participation.

Key Results

Participants included 26 PCPs (14 NPs and 12 physicians). Table 1 presents the
demographic characteristics of the PCP participants. The mean age of all PCPs was 43 years.
More than half of participants practiced in an urban setting and the majority of PCPs worked in
practices affiliated with hospitals or academic medical centers. There was a mean of 10 years of
practice experience for all PCP participants.
Three themes emerged from the qualitative data: 1) Joint Ownership of Patient Care Management; 2) Attributes needed for effective co-management to exist; and 3) Potential implications of NP-physician co-management. These emergent themes and their subthemes are presented in Table 2 and discussed in detail below.

**Joint Ownership of Patient Care Management**

PCPs described the process of NP-physician co-management as having a joint responsibility to complete all care management responsibilities. Co-management is a process where the workload tasks are described by PCPs as “all pooled together” and “no one has a patient that only he sees or only I see.” For example, one physician working in a suburban practice with two NPs described co-management as, “We divide the work, based on the priority and the need of the patient.” Several PCPs described that although the patient is assigned to a specific PCP by health insurance entities, there is often more than one PCP who is delivering the necessary patient care. PCPs in three different practices reported that co-management allows the PCP to see an increased volume of patients and enables more care management tasks to be completed in one day.

Co-management, in several primary care practices, appears to have occurred naturally, as PCPs have learned to adapt to current demands of increased volumes of patients and increased complexity of care management. Despite that co-management is an increasingly common way to deliver care, it is rare that practices have a written co-management agreement between the two PCPs. A physician working in a large urban community clinic explained, “We've never had a conversation about [co-managing patients]. But it's the only way I ever knew how to work, is that yes, this panel is mine, but we're here together, so it's ours really... if a [patient] comes in and needs something and [the PCP that the patient routinely sees] is not here, it's yours.”
Attributes of Effective Co-management

PCPs explained three key attributes of co-management that need to be present for this type of care delivery to be effective. They include effective communication, shared philosophy of care, and mutual respect and trust.

Effective Communication

Communication emerged as a critical attribute for co-management to take place within primary care practices and is needed to ensure that all PCPs are aware of changes in patient health status or the care management plan. The PCPs described that communication occurs using several channels when co-managing patient care. The most popular modes of communication between PCPs during co-management were face-to-face conversations and telephone calls. In addition, PCPs also communicate through documentation in the electronic health record. A NP working in a private physician office explained, “we’ll just give each other a report on that patient, and discuss the patient, what they might be coming in for or if they have special anxiety issues. After I see the patient, I typically like to give a report back to one of the other providers.”

When PCPs have close proximity to each other during patient visits and more time to interact, effective communication is enhanced and enables PCPs to gain a timely second opinion about diagnoses or treatment plans. A physician co-managing over 5,000 patients with a NP explained, “We share an office...we’re sitting at our computer terminals. And then we rotate through exam rooms depending on who is seeing patients at what time. Everybody walks in and says, ‘I have a question with this patient. What do I do?’...a rash or something that I would just like a second person to eyeball.”

When communication is not possible immediately in-person, some NPs and physicians rely on telephone calls or secure electronic communication. Three PCPs described a designated
meeting time to inform each other of important patient information and also to provide ample time for mutual decision making regarding patient care. A NP who is co-managing patients with the same physician for over 15 years explained, “We try to periodically have [meetings] together and we’ll exchange things. How about this patient, how about that patient? Did you try this? Did you try that? Why? And we go back and forth.”

**Shared Philosophy of Care**

PCPs emphasized the importance of having the same philosophy of care regarding care management goals, as well as aligning their clinical treatment plans when a patient is co-managed. Opposing views on how care should be delivered will often lead to conflict and likely confuse the patient about how to optimally manage care. A NP working in an urban community clinic for 7 years explained, “You can’t have somebody who’s conservative and somebody who’s aggressive co-managing the same patient. Because the patient is going to be in the middle, they're going to be getting conflicting sort of answers from their providers.” She continued with an example, “[A patient] see one provider who will give them an antibiotic, and they'll see another provider who won't. And it just can create a lot of tension. So, you definitely want providers that at least adopt the same philosophy of treatment.”

When PCPs don’t have the same philosophy of care, NP-physician co-management is hindered. A NP working in a private practice explained: “I often butt heads with other providers, providers who want to get a CT scan every time, even though the patient has had five CT scans already... we don't want to go down that route, the risk of exposure to radiation because of CT scans or possible false positives.”

While a shared philosophy of care was identified as important for effective co-management, PCPs do not have to have identical treatment plans but need to exhibit the same
patient care goals. A physician working in a large urban clinic said, “I’m not saying we have to be exactly always on the same page, but I think our general philosophy should be similar.” A physician with almost 20 years of experience explained, “I actually wanted to bring her [NP] on, because she believed in the same philosophy that I believe in. And that makes my life a little bit easier in my head that somebody’s thinking the same way that I am thinking.”

If PCPs have differing opinions regarding the patient’s care plan, some PCPs reported that the patient should ultimately be the one to make care decisions that best suit their needs. A NP in a university-affiliated clinic said, “I let the patient decide...I’ll say the schools of thought, ‘This is his approach, this is my approach. And then you can make the decision.’”

**Mutual Respect & Trust**

PCPs spoke about mutual respect and trust, which includes an appreciation of each other’s expertise and experience that can contribute to the quality of care. A NP practicing for 15 years with the same physician said, “I think you have to both accept that you are competent. I think you have to believe that who you’re working with knows what they’re doing.” When PCPs respect each other, trust is enhanced. A new NP co-managing patients with a physician in a private practice described trust as, “supporting each other and respecting each other … being open to each other, having that dynamic where you're not afraid to say something to someone else.”

Trust between PCPs who co-manage patients develops over time. A NP who recently joined a new physician-owned practice said, “I think trust is always hard. It has to be earned, and I think you do that by showing you're committed to patient care; you're committed to sort of the latest evidence that's out there.” Compared to physicians, NPs predominantly defined respect as the ability of the physician to recognize their NP scope of practice and not hinder their
autonomy. A NP working in a hospital-affiliated clinic with one physician said, “There is a lot of mutual respect, in fact I think that's why she [the physician] doesn't feel that she needs to be hovering over me and reviewing everything because she respects my decisions and my ability to perform, you know. I went to school for this, I have the knowledge. There's no reason why I shouldn’t be able to practice to the full extent of my knowledge.” Another NP working in a large urban clinic said, “If the physician is respectful of the NP … being able to practice independently, as an equal, not as taking orders from the physician, … then [co-management] totally depends on that.”

Physicians, on the other hand, believe it is necessary to have close proximity to a NP to build that trust and respect. Close proximity includes frequent interactions, either in person or via telephone. When NPs and physicians are working at the same time in the same place, physicians believe that trust is built. A physician working in a rural practice said, “I really need to work closely with my Nurse Practitioner to learn her strengths and weaknesses, and to see what she feels comfortable with. And then determine how to allocate the panel.”

Potential Co-management Implications

From the perspective of the PCP participants, two potential implications of NP-physician co-management emerged from the interviews: 1) Improved Quality of Patient Care and 2) Increased Patient Access to Care and Follow up.

*Improved Quality of Patient Care*

Almost all PCPs reported that combining the expertise and experience of co-managing PCPs enhances the quality of patient care. More specifically, two PCPs are able to combine their knowledge and ensure that the patient is getting the most up-to-date and evidence-based care. A physician who is newly co-managing with a NP said, “If [a patient] comes in to my practice and
they have a needle stick and I don’t see needle sticks all the time, I might call [the NP] and ask them, am I ordering the right labs or how often do I have to order these labs? Just to kind of refresh my memory, basically to confirm.”

The ability to gain timely second opinions helps PCPs manage complex patient cases and introduces additional PCP expertise to benefit the patient’s success with targeted goals. It provides reassurance to the PCP that the highest quality of care is being offered to the patient. This, in turn, alleviates PCP strain and prevents PCP burnout. A physician working in a large urban community clinic said, “when I have a patient that I’ve hit a wall with, to have the patient once or twice see another provider, not only would I get a sort of second opinion, which primary care providers don't really get unless they send [the patient] to a specialist, but I could get a break.”

*Increased Access to Care & Follow up*

PCPs recognized that patients benefit when they have two PCPs familiar with them to assure continuity of their care. A NP in a private practice said, “Let's say one provider is out for maternity leave or out for vacation, it would be good [the patient] to see one other central [PCP] instead of just random other physicians where the patient might slip through the crack.”

In addition, when two PCPs are responsible for the care of a particular patient, then the patient is more likely to have timely access to appointments and follow-up. A physician in a private practice said that with co-management, “my work time, in terms of some of the things that I actually do, is actually decreased, which will allow me to do a little bit more in other aspects… doing more, seeing more and taking care of more, the office is able to be run a little bit more efficiently…” Patient follow up also occurs quicker. A physician co-managing in a suburban hospital-affiliated practice explained, “For me to call back twenty patients on that same
day is difficult. If I have shared responsibilities, twenty patients get called back.” A physician with 20 years’ experience in primary care and who recently hired a NP to co-manage patients explained, “I’ll be able to address every single call on that day. The patients won’t have to wait three days for me to put in their medications in the pharmacy. I currently have a seventy-two-hour wait. I needed somebody to help me with that… I don’t let anyone else do it, but the nurse practitioner.”

**Discussion**

This qualitative descriptive study explored PCP perspectives about NP-physician co-management of primary care patients. Both NPs and physicians report that co-management involves a division of care responsibilities and shared workload to ensure that all recommended care guidelines are completed. It is evident that the more opportunity that NPs and physicians have to interact, the stronger the co-management is and thereby yields effective and efficient patient care management. Therefore, we recommend that primary care practices and providers need to make efforts to allocate ample time for PCPs to discuss important patient care information. PCPs also perceive that time well spent together enables the vital attributes of NP-physician co-management (effective communication; mutual respect and trust; and shared philosophy of care).

Given that effective communication is identified as a vital attribute of NP-physician co-management, in-person meetings, as well as transparency in patient documentation, especially in electronic health records, should be encouraged. It is crucial for both PCPs to have access to a patient’s history, laboratory or diagnostic test results, and plans of care, to avoid unnecessary or redundant testing. This will promote continuity of care plans by avoiding a breach in care management. Next, through timely interactions, PCPs are able to remain clinically aligned with
care management goals, which PCPs perceive to build respect, trust, and a shared philosophy of care between co-managing providers. Organizational efforts should be made in co-management care delivery to ensure that PCPs are knowledgeable of each other’s training and areas of expertise that can contribute to the care management plan. Further, PCPs identify that the ability to combine disciplines may improve the quality of care delivered, especially during scenarios in which either provider may lack expertise with a particular patient care need.

There are limitations to this study. We used a purposive convenience sample of NPs and physicians practicing in New York State, and although a typical sample size for qualitative designs, it is possible that other PCPs may have different perspectives about NP-physician co-management. Large scale studies, across a wide geographic location, are recommended.

In summary, the findings in this study demonstrate that NPs and physicians are willing to practice in a co-management care delivery model. Through the perspectives of NPs and physicians, co-management exhibits a promising approach to achieving high quality of primary care delivery and an increased primary care capacity to manage larger patient panel sizes. Given that the volume of NP workforce is increasing, and this study provides evidence of positive PCP perceptions of co-management, further research is now warranted to determine an association between NP-physician co-management and empirical clinical and care management outcomes.

Acknowledgements

Contributors: None

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Prior Presentations: This study was presented as an oral session at the 2017 Eastern Nursing Research Society’s annual research conference; April 2017; Philadelphia, PA.
Table 1

*Qualitative interview participant characteristics*

<table>
<thead>
<tr>
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<th>Participants (N=26)</th>
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<tr>
<td>Occupation N (%)</td>
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<tr>
<td>MD</td>
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<tr>
<td>NP</td>
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<td>Age (years)</td>
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<tr>
<td>Mean (SD)</td>
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<td>Sex N (%)</td>
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<td>Female</td>
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<td>Highest Degree N (%)</td>
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<td>Post-Master’s</td>
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<td>MD</td>
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<tr>
<td>Doctorate (PhD; DNP; PhD/MD)</td>
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<tr>
<td>Years of Experience</td>
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<tr>
<td>Mean (SD)</td>
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<tr>
<td>Main Practice Site N (%)</td>
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<tr>
<td>Private Practice</td>
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<td>University-Affiliated Clinic</td>
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<td>Hospital-Affiliated Clinic</td>
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<td>Government funded Clinic</td>
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<td>Geographic Location N (%)</td>
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<td>Urban</td>
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<td>Suburban</td>
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<td>Rural</td>
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Table 2

*Emergent themes of NP-physician co-management of primary care patients*

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<tr>
<th>Joint Ownership of Patient Care Management</th>
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<tr>
<td>Shared Responsibility</td>
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<td>Pooled Workload</td>
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<th>Attributes for Effective Co-management</th>
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<td>Effective Communication</td>
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<td>Shared Philosophy of Care</td>
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<td>Mutual Respect and Trust</td>
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<th>Co-management Implications</th>
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<tr>
<td>Improved Quality of Patient Care</td>
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<td>Increased Patient Access to Care and Follow-up</td>
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Chapter 3

Nurse practitioner-physician co-management of primary care patients: The promise of a new delivery care model to improve quality of care (Aim 2)

This chapter addresses the second aim of the proposed dissertation. In order to gain an understanding of the potential impact of NP-physician co-management on patient outcomes to support its future investigation, a systematic review was conducted. The manuscript is in press in Health Care Management Review. The citation is as follows:

Nurse practitioner-physician co-management of primary care patients: The promise of a
new delivery care model to improve quality of care

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None declared.

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Abstract

**Background:** The U.S. primary care system is under tremendous strain to deliver care to an increased volume of patients with a concurrent primary care physician shortage. Nurse Practitioner (NP)-physician co-management of primary care patients has been proposed by some policymakers to help alleviate this strain. To date, no collective evidence demonstrates the effects of NP-physician co-management in primary care.

**Purpose:** This is the first review to synthesize all available studies that compare the effects of NP-physician co-management to an individual physician managing primary care.

**Methods:** The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) framework guided the conduct of this systematic review. Five electronic databases were searched. Titles, abstracts, and full texts were reviewed and inclusion/exclusion criteria applied to narrow search results to eligible studies. Quality appraisal was performed using Downs and Black’s quality checklist for randomized and nonrandomized studies.

**Results:** Six studies were identified for synthesis. Three outcome categories emerged: 1) PCP adherence to recommended care guidelines; 2) empirical changes in clinical patient outcomes; and 3) patient/caregiver quality of life. Significantly more recommended care guidelines were completed with NP-physician co-management. There was variability of clinical patient outcomes with some findings favoring the co-management model. Limited differences in patient quality of life were found. Across all studies, the NP-physician co-management care delivery model was determined to produce no detrimental effect on measured outcomes, and in some cases, was more beneficial in reaching practice and clinical targets.

**Practice Implications:** The use of NP-physician co-management of primary care patients is a promising delivery care model to improve the quality of care delivery and alleviate organizational strain given the current demands of increased patient panel sizes and primary care
physician shortages. Future research should focus on NP-physician interactions and processes to isolate the attributes of a successful NP-physician co-management model.

**Keywords:** Teamwork, Primary Care, Nurse Practitioners, Systematic Review, Co-Management
Introduction

Primary care physician shortages, an increase in the number of insured patients, rising healthcare costs, and the epidemic of chronic disease, continue to pose a strain on the United States (US) primary care system (Bodheimer & Pham, 2010; Mitka, 2007). Primary care plays a vital role in our health care system as it serves as the first point of contact for patients to access care services and focuses on addressing a variety of patient needs, particularly to those with chronic conditions (Halcomb et al., 2005; Starfield, Shi, & Macinko, 2005). For example, by 2020, an estimated 157 million Americans will be living with a chronic disease who will need timely and high quality primary care to manage their conditions; yet current care models are threatened by primary care physician shortages that are expected to reach a 40,000 physician deficit over the next five years (Lopez et al., 2006; Wu & Green, 2000).

In traditional care models, a single physician individually manages a primary care patient panel, which is a subgroup of the population assigned to a single primary care provider (PCP) by respective insurance carriers (Murray et al., 2007). However, as patient panel sizes are increasing, it is estimated that it takes an unrealistic 21 hours per day for a single PCP to complete all recommended care guidelines in primary care (Yarnall et al., 2009). Thus, policy makers are calling for ways to alleviate this burden and assure that patients have access to high quality primary care through the investigation of various care delivery models.

The implementation of team-based care models has been proposed by policy makers, researchers, and clinicians, as one option for care delivery in primary care organizations (Bodheimer, Ghorob, Willard-Grace, & Grumbach, 2014). In one type of team, organizations are integrating nurse practitioners (NPs) into care delivery to help alleviate the challenges facing our health care system as NPs are capable of delivering high quality care (Stanik-Hutt et al.,
2013). Individual NP care has been found to provide care equivalent to physicians in terms of achieving the same clinical outcomes and with favorable patient satisfaction (Lenz et al., 2004). However, to date, while many studies have examined the primary care outcomes of an individual physician or an individual NP, this is the first review to examine the potential of NP-physician co-management of primary care patients and its impact on patient outcomes and care delivery.

The NP workforce currently has the fastest growth rate of all health care professions in the U.S. and is projected to continue its growth well over the next decade marking its potential to help alleviate some strain of delivering primary care (Auerbach, 2012). Eighty five percent of currently licensed NPs in the United States (U.S.) are educationally prepared, trained, and certified to work in primary care settings (AANP, 2016). Furthermore, a recent survey shows that 74% of primary care physicians and 88% of primary care NPs would ideally prefer to work in a practice of both NPs and physicians (Buerhaus, Desroches, Dittus, & Donelan, 2015). There is a discrepancy of perspectives, however, regarding NP reimbursement rates, hospital admitting privileges and having a NP lead a medical home (Donelan, Desroches, Dittus, & Buerhaus, 2013). For example, a recent systematic review found potential for cost savings when NPs complement physician-based care (Martin-Misener et al., 2015). Yet, while the American College of Physicians (ACP) (2009) supports the expansion of NP scope of practice to help alleviate the strain in primary care, other medical organizations firmly believe that primary care patients should be strictly physician-managed (American Academy of Family Physicians, 2012). Despite this variability of perceptions of the NP role, the overarching question remains whether the quality of care and clinical outcomes are improved, maintained, or negatively impacted, when a patient is co-managed by a NP and physician, together, sharing the responsibility of patient care for the same primary care patient. In this review, we define co-management as two
types of PCPs jointly sharing the responsibility and workload required for achieving optimal patient care management and outcomes. Co-management can be viewed as a subset of team-based care that is focused on more than one PCP integrated within the team, rather than a single physician, who equally oversee the management of a patient. The purpose of this study is to identify and synthesize all available studies that explore the outcomes of NP-physician co-management compared to a traditional single physician managing care.

**Theory**

The Conceptual Framework for Interprofessional Collaborative Practice (ICP) guided this systematic review (Stutsky & Spence Laschinger, 2014). The ICP framework is centered around four-dimensional constructs that lead to increased collaborative practice between different types of professions: collective ownership of goals; interdependence; knowledge exchange; and understanding of roles. The first dimension, collective ownership, involves active participation of all providers and patients in achieving mutual goals for patient care. The second, knowledge exchange, includes the sharing of information that is vital to the care of the patient and includes a provider’s willingness to do so. The third dimension highlights that an understanding of individual provider roles (e.g. NP versus physician) is vital and includes the identification, appreciation, and subsequent respect of each discipline’s value in patient care. The final dimension, interdependence, includes the reciprocal reliance of provider interaction to reach mutual goals. It also encompasses the need to examine the level of equality of power within the relationship. When all four dimensions are present collectively, provider work behaviors and satisfaction are optimized and as a result, patient safety, patient outcomes, and the quality of care is enhanced.
Upon application of the ICP framework to our research question we decided to focus our PCP co-management type to NPs and physicians. Although other types of PCPs, such as physician assistants, deliver high quality primary care, their scope of practice often involves one of physician oversight of tasks and clinical patient care decisions. NPs, on the other hand, can currently practice independently of physicians in 26 U.S. states (AANP, 2017). Since the ICP framework highlights the importance of equality of provider roles, we deemed it important to examine co-management effects of two types of PCPs that have the most potential in holding equal organizational decision making. Therefore, we focused this review on NP- and physician-PCP disciplines. Using this ICP framework, we hypothesize that NPs and physicians can collaboratively co-manage patients and enhance the quality of care delivered in a primary care setting.

Methods

Search Strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework guided the conduct of this systematic review (Moher, Liberati, Tetzlaff, Altman, & Group, 2009). Comprehensive search strategies were developed and applied during the electronic search of five databases: MEDLINE, PubMed, CINAHL, EMBASE and Cochrane. A search for grey literature was also conducted in an effort to identify unpublished studies and/or conference abstracts. Keywords searched included ‘team,’ ‘teamwork,’ ‘interprofessional,’ ‘nurse practitioner,’ ‘advanced practice nurse,’ ‘primary care,’ and ‘primary healthcare’ and ‘co-management.’

Sample Selection
The initial literature search yielded 572 studies which were imported into reference
management software, Endnote. Forty-seven duplicates were removed, leaving 525 records for
screening. Two investigators reviewed the abstracts and titles of the remaining articles and
applied the following inclusion criteria: 1) The use of a team-based care delivery care model; 2)
The study was conducted in a primary care ambulatory setting; 3) A NP was a member of the
infrastructure of the team; and 4) The study was conducted in the US. Given that NP roles,
responsibilities, and scope of practice often differ across countries, this search was limited to
studies conducted in the US. One hundred sixty-nine studies met eligibility for full text review.
Next, four researchers applied the following exclusion criteria during full text review: 1) No
comparison made between a NP-physician team that co-manages patients and a single physician
delivering patient care (n=79); 2) Unable to extract separate NP and physician assistant outcomes
(n=1); 3) Not an empirical study (e.g. opinion editorials) (n=53); 4) Studies conducted strictly in
the acute care setting (n=13); and 5) Studies conducted more than 20 years ago (n=17). The
studies that were published greater than 20 years ago were deemed by the authors as not relevant
to current NP scope of practice regulations. Six studies remained for final inclusion. Although
some studies included in the final synthesis do not exemplify the highest level of evidence (e.g.
case study), they are the only studies that met the criteria of this review and are the most current
available evidence meeting this study’s purpose. A PRISMA flow diagram of the literature
search strategy is presented in Figure 1. Table 1 outlines the characteristics of each individual
study including the aim, design, sample, study quality, setting, measures, and key findings.

Quality Appraisal

The Downs and Black (1998) checklist for measuring quality of both randomized and
nonrandomized studies was applied to each of the included studies. This tool contains 27 items
with ‘yes,’ ‘no,’ or ‘not applicable’ responses to assess each study’s overall quality (10 items), external validity (3 items), study bias (7 items), confounding and selection bias (6 items), and power of the study (1 items). The creators of the tool designated a predetermined score for each item’s response that yields a potential maximum score of 30. The higher the score, the higher the quality of the study. Two investigators independently appraised each study using the checklist and then compared each item’s score in an attempt to reach a conclusive agreement of the study’s quality. If a consensus was not reached on a particular item of the checklist, a third researcher was asked to determine the final assessment. Study quality was classified as low quality/high risk of bias (score 1-11), medium quality/unclear risk of bias (12-22), and high quality/low risk of bias (23-30).

Results

Six studies were eligible for inclusion in the review and consisted of randomized control trials (n=4), a cross sectional study (n=1), and a case study (n=1). The most common investigated diagnoses in the included studies were Alzheimer’s dementia, diabetes, hyperlipidemia, and hypertension. All studies compared outcomes of co-management by NP-physician teams and individual physician-led care delivery for primary care patients.

Outcome Measures

There were three outcomes that emerged from the studies; 1) PCP adherence to recommended care guidelines; 2) empirical changes in clinical patient outcomes; and 3) self-reported quality of life for the patient and their caregiver. Not every outcome was measured in every study, yet this is the only evidence currently available surrounding NP-physician co-management of primary care patients and the researchers deemed it important to analyze and assess all three outcomes in order to make recommendations for practice implications and future
research. The first category, adherence to recommended care was measured as the percentage of compliance in following recommended practice guidelines that have previously been found to support optimal patient outcomes. For example, the percentage of a patient with diabetes receiving a recommended vaccination or annual ophthalmologic examination. The second category, clinical outcomes, includes changes in diagnosis-specific empirical measurements such as vital signs or laboratory values that are measured during a visit to assess how well a disease is being controlled, such as a change in blood pressure in a patient with hypertension. In patients with Alzheimer’s disease, clinical cognitive changes were assessed using the Cornell Scale for Depression in Dementia to measure changes in mood, behavior, and physical change. Behavior change was also measured using the Neuropsychiatric Inventory (NPI), a widely-used instrument in clinical trials of anti-dementia medications. The third category, self-reported quality of life was measured across the studies using various instruments to scale the level of self-reported quality of life reported by patients when being treated for a particular diagnosis. The quality of life of caregivers was also evaluated. The synthesized results of each category are described below:

Adherence to Recommended Care Guidelines

Four studies evaluated and compared how NP-physician co-management of patient care impact compliance with completing recommended care guidelines (Everett et al., 2013; Ganz et al., 2010; Litaker et al., 2003; Ohman-Strickland et al., 2008; Reuben et al., 2013). In patients with hypertension, elevated cholesterol, and/or diabetes, several diagnosis-specific care guidelines are recommended to improve the quality of care delivered by the PCP in an effort to improve patient outcomes. For example, Reuben et al. (2013) found that 71% of overall recommended guidelines were completed with NP-physician co-management compared to 35% completed by a
single physician ($p<.001$). This study was rated by the researchers as high quality, with limited bias identified. It is important to note that there was variability in the referral of patients to NPs for co-management of patient care, which was described as the result of patient preference or the unwillingness of physicians to make the referral.

Ganz et al. (2010) also found that a higher percentage of completed guidelines favored the NP-physician teams, specifically in patients with dementia ($p<.001$), falls ($p=.00$), incontinence ($p=.01$) and all diagnoses ($p<.001$). This study had a sample size of 200 patients and was conducted using rigorous methodology that scored as low risk of bias during quality appraisal. Litaker et al. (2003) found that recommended influenza and pneumonia vaccinations for patients with chronic disease such as diabetes was more likely to be completed by NP-physician teams ($p<.001$). Also, recommended smoking cessation and foot examinations were more likely to be performed ($p<.001$). There was no difference in the incidence of recommended completion of an annual eye exam by an ophthalmologist ($p=.10$). Patient education was also more likely to be completed such as dietary and activity recommendations that included sodium reduction ($p<.001$), moderation in alcohol consumption ($p<.001$), and weight control or reduction ($p<.001$). While medication side effects were discussed more by NP-physician teams, there was no difference between groups in the occurrence of medication compliance conversations. This study was appraised as high quality by the researchers with a low risk of bias. They demonstrated external validity and a clear effort to reduce bias and confounders. A small sample size ($n=156$) was identified as a threat to generalizability.

Ohman-Strickland et al. (2008) examined the occurrence of recommended chronic disease assessment or monitoring specifically for diabetic patients. This was a large study across 46 practice sites and included 846 patients with diabetes. The researchers reviewed charts to
determine the adherence to American Diabetes Association guidelines, such as measuring
glycosylated hemoglobin (HbA1c) percentages or lipid levels that assess disease control. The
PCPs in the study included NPs, physicians, and physician assistants. For the purpose of this
review, we extracted only data relevant to physicians and NPs. The study found that
significantly more patients were monitored for diabetic control ($p<.001$) and hyperlipidemia
($p=.007$) when co-managed by NPs and physicians compared to a single physician managing
care. No difference was found for blood pressure monitoring ($p=.63$). This study was identified
as medium quality by the researchers. There was limited information about the patients in this
study and therefore it was hard to determine uniformity of the sample at baseline. Also, given
the large amount of practices evaluated, we felt it possibly introduced bias and confounders
surrounding a patient’s exposure to different team members, care processes, and facility
resources. Despite the researcher’s attempt to adjust for potential confounders for organizational
attributes and practices, we felt this variability could introduce influence a provider’s compliance
with recommended care guidelines.

**Empirical Changes in Clinical Outcomes**

Four studies examined clinical outcomes achieved by NP-physician teams compared to a
single physician and were reported as empirical changes in laboratory values or vital signs.
(Callahan et al., 2006; Fortinsky et al., 2014; Litaker et al., 2003; Ohman-Strickland et al., 2008)
Overall, studies presented either an improvement of clinical outcomes with NP-physician co-
management or outcomes equivalent to care managed by a single physician. Two studies
compared the decrease of the patient’s HbA1c percentages, used as an indicator of diabetic
control, with the goal of decreasing the level to a percentage that is a recommended clinical
target. In the first study, Litaker et al. (2003) reported a favorable reduction in the HbA1c level
by 0.63% among patients cared for by NP-physician teams compared to a 0.15% reduction among patients treated solely by a physician (p=.02) (Litaker et al., 2003). Given the narrow window of HbA1c percentage for diabetic control, we felt this was clinically significant. This study was appraised as high quality and used rigorous methods to ensure a low risk of bias especially with attention to selection of patients by assessing their baseline medical complexity and baseline medication use.

In the second study, the attainment of HbA1c targets lacked a significant difference (p=.36) (Ohman-Strickland et al., 2008). As previously mentioned, however, although this second study was much larger, the introduction of potential bias across the 46 practice sites could have potentially influenced the attainment of diabetic targets based on provider resources. In addition, there was no uniformity of patient medications prior to the start of the intervention.

These same two studies measured whether patients with hypertension and hyperlipidemia achieved the intended clinical target for blood pressure (SBP<130 mmHg; DBP<85 mmHg) and lipid levels (LDL-cholesterol ≤ 100 mg/dL) and neither found a significant difference between patients co-managed and patient managed by an individual physician (blood pressure: p=.839, p=.13; lipid: p=.85, p=.78) (Litaker et al., 2003; Ohman-Strickland et al., 2008). Litaker et al. (2003) did however find significantly more patients with a beneficial increase of their high-density lipoproteins (HDL) levels (p=.02).

Clinical outcomes for patients with Alzheimer’s disease were investigated in two studies using the Cornell Scale and NPI that scores cognitive and behavior impairment. The first study, Callahan et al. (2006), was rated as high quality by the researchers with low risk for bias. Their study included blinded randomization of physicians to either managing patient care single handedly or co-managing with a NP. They found no statistically significant cognitive and
behavior changes using the Cornell Scale of Depression for Dementia after 18 months ($p=.94$) or following a telephone interview assessment for cognition ($p=.93$). Using the NPI as the assessment tool, however, they found a significant increase in patient behavior ($p=.01$). Fortinsky et al. (2014) also used the NPI to assess patient behavior and found no statistically significant changes between the patients managed by NP-physician co-management and physicians alone ($p=.18$). During quality appraisal, this study was deemed medium quality with a potential risk for bias. The sample size was extremely small (n=31) questioning generalizability and the possibility that due to the small sample size there was not enough power to detect differences between groups.

**Patient/Caregiver Quality of Life**

Three studies investigated self-reported patient and caregiver quality of life (Callahan et al., 2006; Fortinsky et al., 2014; Litaker et al., 2003). Caregiver quality of life was measured using two tools, NPI and Caregiver Patient Health questionnaire, and administered concurrently at either 6, 12, and/or 18 months. There was no statistical significance between groups for caregiver quality of life at 6 and 12 months, yet an improvement was noted by 18 months ($p=.02$) (Callahan et al., 2006). Similarly, Fortinsky et al. (2014) found no statistical significance at 6 and 12 months yet there was no 18-month follow up assessment for comparison. Again, their small sample size and shorter follow up compared to the other studies may have inhibited finding significance. In the same study, neither care delivery model produced a superior increase in quality of life for patient with dementia ($p=.95$).

A third rigorous study, appraised as high quality by the researchers, found an increase in self-reported quality of life in patients with diabetes, specifically life satisfaction, and favoring those being treated within a co-management model ($p=.04$). All other quality of life measures,
such as diabetes quality of life impact, social worry, or life worry, were found to be not significantly different between types of care delivery (Litaker et al., 2003).

**Discussion**

This systematic review aimed to determine the effects of NP-physician co-management in primary care in comparison to care delivered by an individual physician. Three outcome categories emerged from the studies: PCP adherence to recommended care guidelines; empirical changes in clinical patient outcomes; and patient or caregiver quality of life. It is evident from the literature search that with only six studies available, the investigation of this type of care delivery is still very premature. The findings of this review, however, shed light on the promise of co-management to help organizations meet the demand for care by adhering to recommended care guidelines and maintaining the quality of care. For example, significantly more guidelines were completed for patients with Dementia, Falls, and Incontinence. Further, patients with diabetes were more likely to have their HgbA1c and lipids monitored for changes, as well as receive recommended vaccinations. The application of, and compliance with, these recommended care guidelines is essential for the earlier detection of disease, decreased diagnosis-specific complications, reduced hospitalizations, and reduced health care spending (Penning-van Beest et al., 2007).

Clinically, there was a variability of results for empirical patient outcomes when comparing NP-physician co-management and a single physician managing care. For example, while some patients that were co-managed had a significantly greater reduction in target A1c levels for diabetic patients, other studies found no difference. The improvement may be attributed to the aforementioned increase in PCP adherence to recommended care guidelines given that an increased incidence of diabetic education, such as dietary and nutritional
recommendations, has been found to improve patient outcomes, including HbA1c levels (Padgett, Mumford, Hynes & Carter, 1988). Yet, the lack of consistent findings across studies remains, thus suggesting that there may be differences in NP-physician co-management interactions or processes; something worth investigating and recommended as future research. Further, it is unknown whether the patients in the studies were being treated with the same medications to control total cholesterol levels and blood pressure. Only one study reported an effort to control for baseline medications but only by the number of medications and not by pharmaceutical class or mechanism of action. This lack of knowledge potentiates a variability in treatment modalities that could skew the reduction of empirical clinical changes in patients. A study that controls for baseline blood pressure, cholesterol levels, and medications, is recommended.

The lack of the co-management process or PCP interaction descriptions were evident across all studies and could have potentiated the variability of the included studies’ findings in this review. Most noteworthy, there remains a lack of instruments that assess PCP interactions with each other, and with patients or caregivers, within a co-management model and needed to optimize the care that is delivered. For example, there was limited to no description of how NPs and physicians allocated tasks between each other or what type of ancillary support or resources were available to each PCP. As primary care continues to be delivered in team-based environments, a closer look at PCP relationships and interactions could benefit the implementation and future investigation of co-management care delivery.

In summary, this review demonstrates promising evidence that the integration of NPs and physicians in a co-management care model is as effective as a single physician managing a primary care patient. This finding highlights a potential solution to overcoming some of the
primary care strain of managing larger patient panel sizes while maintaining the quality of care. It is important to note that individual outcome categories were not examined across all studies and were predominantly limited to two to three studies each. This further illuminates that this emerging care model requires additional research to determine its long-term effect on primary care.

**Practice Implications**

The findings of this systematic review suggest significant practice, policy, and research implications. First, in terms of practice, the implementation of a NP-physician co-management care model increases the ability of primary care organizations to adhere to recommended clinical care guidelines. It is unclear whether the increase that is demonstrated in this review is due to an increase in the number of PCPs available to the patient or the combination of individual discipline values (medicine and advanced practice nursing) that contribute to patient care. Regardless, an increase in adherence will improve the quality of patient care delivered, as guidelines are based on the most current evidence-based and cost-effective practice. Completion of care guidelines have been found to decrease the incidence of patient disease complications, thereby alleviating unexpected exacerbations of illness that lead to increased patient visits and hospitalizations.

The process of co-management needs to be carefully examined within individual organizational institutions for successful implementation. Characteristics of effective co-management include effective communication, trust and respect, and a shared philosophy of care to ensure clinical alignment. These characteristics need to be supported by ensuring that both providers have access to each other’s patient care documentation; a mutually agreed up on mode of communication; and strategies to promote alignment of clinical management. Policies and an
organizational culture that recognizes NPs as independent providers will be necessary to allocate equivalent support and resources that are needed to deliver optimal patient care. It has also been noted that over time, trust and respect between providers increases, and moreover, will be strengthened when providers are given enough time and space to co-manage through collaboration. Organizational policy should reflect these efforts and the provision of such resources will promote the success of interprofessional teams when providers from various disciplines co-manage the patient’s plan of care.

It is important to also recognize that NP-physician co-management holds potential in helping organizations adhere to changes in national policy. For example, as the U.S. shifts from volume-based to value-based payment (VBP) infrastructure, the strain to complete all recommended care guidelines is vital for an organization to be reimbursed for its patient care services. The US Centers for Medicare and Medicaid Services (CMS) are increasingly shifting toward reimbursements for patient care that are based on the completion of disease-targeted outcomes and guidelines are required to maintain a high quality of care (Burwell, 2015). As previously mentioned, the ability of a single PCP to complete all recommended guidelines for each patient is often difficult and unrealistic when working as the sole PCP. This review demonstrates early evidence of the potential for NP-physician co-management to help alleviate this organizational strain.

In regards to research implications, a substantial amount of research is warranted to understand more about the NP-physician co-management delivery model. First, the current literature lacks a description of how NP-physician co-management is carried out, such as the delegation of tasks, communication between the NP and physician, or how they interact. It is also unclear if each discipline is willing to work within a co-management care delivery model.
Research that is qualitative in nature is recommended to obtain descriptions of the process of existing NP-physician co-management care delivery, as well as, the PCP and/or patient perspective of this type of care delivery. This should include a closer look at what attributes strengthen or impede a successful co-management relationship between NPs and physicians so that health services researchers can continue to evaluate patient and practice outcomes for this care delivery model. Further, due to some of the identified limitations of the studies included in this review, future research should include studies that control for baseline blood pressure and lab values, as well as medications, thereby eliminating bias and potential confounders when investigating co-management effects. Finally, given that primary care is increasingly being delivered by teams with various types of PCPs, it is also recommended that future studies explore co-management care delivery by other types of PCPs, such as physician assistants.

In summary, as the NP workforce continues to increase and policymakers encourage the expansion of NP scope of practice, such as independent NP practice, the results of this review shed light on the potential benefit of NPs and physicians co-managing primary care patients together. More research is needed to determine the best way for organizations, managers, and researchers to successfully implement such a model. The authors of this review support the movement to continually expand the NP workforce in primary care given the emerging and promising evidence of NP-physician co-management to deliver high quality patient care.
Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram

Initial search (OVID Medline, CINAHL, PubMed, Google Scholar) using keywords (n=572)

Duplicate studies removed (n=47)

Abstract/Title Screen (n=525)

Studies excluded based on title/abstract screen (n=356)

Full text review (n=169)

Studies Excluded (n=163) for the following reasons:

1) No comparison made between NP-physician team co-management and single physician care delivery (n=79)
2) Unable to extract separate NP and physician assistant outcomes (n=1)
3) Not an empirical study (n=53)
4) Study conducted in acute care setting (n=13)
5) Study published greater than 20 years ago and not relevant to current NP scope of practice (n=17)

Studies eligible for final inclusion (n=6)
<table>
<thead>
<tr>
<th>Study</th>
<th>Characteristics &amp; Quality Appraisal</th>
<th>Outcome</th>
<th>Measure</th>
<th>Effect</th>
<th>NP-Physician Co-management</th>
<th>Physician led care</th>
<th>p</th>
</tr>
</thead>
</table>
| Fortinsky et al. (2014) | Design: RCT  
Purpose: To determine the efficacy of a nurse practitioner intervention called “Proactive Primary Dementia Care” on health-related outcomes in patients and family members, as well as the acceptability of the intervention based on satisfaction expressed by physicians, patients and caregivers.  
Sample: 31 patients | Clinical Outcome                          | NPI                               | Median  | Did Not Measure     |                            |                   |    |
<p>|                     | Recommended Guidelines Adherence                                                                  | 6 months                          | 3       | 3                   | .59                        |                   |    |
|                     |                                                                                                   | 12 months                         | 9       | 3.5                 |                            |                   |    |
|                     | Quality of Life                                                                                   | QOL-AD                            | Median  |                     |                            |                   |    |
|                     |                                                                                                   | 6 months                          | 39      | 41                  | .95                        |                   |    |
|                     |                                                                                                   | 12 months                         | 37      | 40                  |                            |                   |    |
|                     |                                                                                                   | CES-D                             | Median  |                     |                            |                   |    |
|                     |                                                                                                   | 6 months                          | 5       | 4.5                 | .80                        |                   |    |
|                     |                                                                                                   | 12 months                         | 6       | 2                   |                            |                   |    |
|                     |                                                                                                   | Symptom Management Self Efficacy  |                     |                     |                            |                   |    |
|                     |                                                                                                   | 6 months                          | 36      | 38                  | .14                        |                   |    |
|                     |                                                                                                   | 12 months                         | 35      | 38                  |                            |                   |    |
|                     |                                                                                                   | Zarit-Burden                      | 6 months | 10                  | 3                          | .60               |    |
|                     |                                                                                                   | 12 months                         | 10      | 3                   |                            |                   |    |</p>
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<tr>
<th>Study</th>
<th>Characteristics &amp; Quality Appraisal</th>
<th>Outcome</th>
<th>Measure</th>
<th>Effect</th>
<th>NP-Physician Co-management</th>
<th>Physician led care</th>
<th>p</th>
<th>Quality of Life of Life</th>
<th>Did Not Measure</th>
<th>Did Not Measure</th>
<th>Quality Appraisal: High (Score: 24)</th>
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<td></td>
<td>Purpose: To determine whether NP-physician co-management improves quality of care</td>
<td></td>
<td>Dementia</td>
<td>51</td>
<td>30</td>
<td>&lt;.001</td>
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<td></td>
<td>Sample: 200 patients</td>
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<td>Depression</td>
<td>51</td>
<td>28</td>
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<td></td>
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<td>Falls</td>
<td>44</td>
<td>17</td>
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<td></td>
<td>(Score: 23)</td>
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<td>Heart Failure</td>
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<td></td>
<td>Incontinence</td>
<td>58</td>
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<td>All diagnoses</td>
<td>54</td>
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<td>&lt;.001</td>
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<td>Reuben et al. (2013)</td>
<td>Design: Case Study</td>
<td></td>
<td>Recommended Care Guidelines Adherence</td>
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<td></td>
<td>Purpose: To determine if community-based NP-physician co-management improves the quality of care for geriatric conditions: falls, urinary incontinence, dementia, and depression.</td>
<td></td>
<td>Overall</td>
<td>71</td>
<td>35</td>
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<td>Sample: 485 patients</td>
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<td>Falls</td>
<td>78</td>
<td>32</td>
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<td>Incontinence</td>
<td>66</td>
<td>20</td>
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<td></td>
<td></td>
<td></td>
<td>Dementia</td>
<td>59</td>
<td>38</td>
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<td></td>
<td></td>
<td></td>
<td>Depression</td>
<td>63</td>
<td>60</td>
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Outcome

Did Not Measure

Quality
of
Life

Did Not Measure
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<tr>
<th>Study &amp; Quality Appraisal</th>
<th>Outcome</th>
<th>Measure</th>
<th>Effect % Met</th>
<th>NP-Physician Co-management</th>
<th>Physician led care</th>
<th>p</th>
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<tr>
<td>Ohman-Strickland et al. (2008)</td>
<td>Design: Cross Sectional Purpose: To assess whether the quality of diabetes care differs among practices employing NPs, PAs, or neither, and which practice attributes contribute to any differences.</td>
<td>Recommended Guidelines</td>
<td>HbA1C</td>
<td>65.5</td>
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<td>Adherence</td>
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<td>Lipids</td>
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<td></td>
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<td>Microalbumin</td>
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<td>65.7</td>
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<td>Microalbumin</td>
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<td>46 Practices Quality Appraisal: Medium (Score: 19)</td>
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<td>Target Attainment</td>
<td>HbA1C</td>
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<td>Quality of Life</td>
<td>Did Not Measure</td>
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<td>Study</td>
<td>Characteristics &amp; Quality Appraisal</td>
<td>Outcome</td>
<td>Measure</td>
<td>Effect</td>
<td>NP-Physician Co-management</td>
<td>Physician led care</td>
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<tr>
<td>Callahan et al.</td>
<td>Design: RCT</td>
<td>Recommended Guidelines</td>
<td>Adherence</td>
<td>Did Not Measure</td>
<td></td>
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<td>(2006)</td>
<td>Purpose: To determine the effectiveness of a collaborative care model with an interdisciplinary team to improve the quality of care for patients with Alzheimer’s Disease in primary care.</td>
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<td>Sample: 154 patients</td>
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<td></td>
<td>Quality Appraisal: High (Score: 25)</td>
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<td>Telephone Cognitive Interview</td>
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<td>Clinical Outcomes</td>
<td>NPI</td>
<td>MD (SD)</td>
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<td></td>
<td>6 months</td>
<td>9.4 (12.9)</td>
<td>11.1 (16.4)</td>
<td>.61</td>
<td></td>
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<tr>
<td></td>
<td>12 months</td>
<td>8.0 (12.0)</td>
<td>16.1 (19.4)</td>
<td>.01</td>
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<td></td>
<td>18 months</td>
<td>8.4 (10.2)</td>
<td>16.2 (18.7)</td>
<td>.01</td>
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<tr>
<td></td>
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<tr>
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<td>Measure</td>
<td>Effect NP-Physician Co-management</td>
<td>Physician led care</td>
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<td>Callahan et al. (2006)</td>
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<td>ADCSG ADLs</td>
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<td>Study</td>
<td>Characteristics &amp; Quality Appraisal</td>
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<tr>
<td>------------------------------</td>
<td>------------------------------------</td>
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<td>Litaker et al. (2003)</td>
<td>Design: RCT</td>
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<tr>
<td></td>
<td>Purpose: To compare a traditional physician-only model of care with a more collaborative, team based approach to chronic disease management (hypertension &amp; diabetes management)</td>
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<td>Sample: 156</td>
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<td>Quality Appraisal: High</td>
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<td>(Score: 25)</td>
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<tr>
<td>Study &amp; Quality Appraisal</td>
<td>Outcome</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------</td>
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<td>Litaker et al. (2003)</td>
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<tr>
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<td>Vital Signs Blood Pressure</td>
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MD: mean difference; AF: absolute frequency; RCT: Randomized Control Trial; pt.: patient; QOL: quality of life; SD: standard deviation; ADLs: Activities of daily living; ADSC: Alzheimer’s disease cooperative study group; NPI: Neuropsychiatric Inventory; CSGC: Cornell Scale for Depression in Dementia
Chapter 4: Development and Psychometric Testing of the Provider Co-Management Index (PCMI): Measuring Nurse Practitioner-Physician Co-management (Aim 3)

This chapter presents a study regarding the instrument development and initial psychometric testing of PCMI that measures NP-physician co-management. In this chapter, aim three of the dissertation is addressed. Tool development steps presented are content validity and reliability testing. This study is important as it demonstrates that the new tool is content-valid, as was determined by six experts, and has a strong internal reliability consistency.

Note 1: The email invitation to participate in content validity testing can be found in Appendix C
Note 2: The email invitation to participate in pilot testing can be found in Appendix D
Note 3: The final PCMI tool can be found in Appendix E
Development and Psychometric Testing of the Provider Co-Management Index (PCMI):

Measuring Nurse Practitioner-Physician Co-management

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Abstract

**Background and Purpose:** Primary care provider (PCP) co-management, which is having more than provider sharing the care management responsibilities for the same patient, has emerged in practice to alleviate the increase in care delivery demands of larger, more complex patient panels. As more nurse practitioners (NPs) are practicing independent of physician oversight, there has been an increase in the number of NPs and physicians co-managing patient care. However, there are currently no tools to measure this unique concept in both practice and research. The purpose of this study is to develop and psychometrically test a new tool that measures NP-physician co-management.

**Methods:** Items and subscales were developed based on three identified theoretically supported dimensions of NP-physician co-management. Six primary care experts participated in face and content validity testing. A convenience sample of 40 PCPs participated in pilot testing and completed an electronic survey. Data analysis included item descriptive statistics, inter-item correlations, corrected item-total correlation, and Cronbach’s alpha.

**Results:** Face and content validity testing of 21 items resulted in one item being removed. Following pilot testing, subscales demonstrated high internal reliability consistency: Effective Communication (r=.811); Mutual Respect and Trust (r=.746); and Shared Philosophy of Care (r=.779). No items were removed following reliability testing. The tool was named the Provider Co-Management Index (PCMI).

**Conclusions:** Initial item analysis and reliability testing reveals strong internal reliability consistency of PCMI. PCMI has potential use in comparative and cost effectiveness studies that examine the impact of NP-physician co-management on patient and practice outcomes. Field testing to determine PCMI factorial structure is recommended prior to wide spread use.
Background and Significance

As the U.S. population continues to age, and more patients are living with complex co-morbidities, there is a strain on providers to complete all recommended primary care management tasks (Mitka, 2007). Further, the demand for primary care services will soon exceed the capacity of physicians available to deliver primary care (Bodenheimer & Pham, 2010; National Academy of Medicine, 2016). Consequently, the number of patients managed by a single primary care provider (PCP) is increasing and placing strain on organizations to ensure that all recommended care is delivered (Altschuler, Margolius, Bodenheimer, & Grumbach, 2012). Policymakers are calling for the investigation of new care delivery models to meet the demand for care given the suboptimal PCP workforce volume (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003). One proposed solution by organizations such as the National Academy of Medicine and the American College of Physicians, is the expanded use of nurse practitioners (NP) in primary care delivery (American College of Physicians, 2009; National Academy of Medicine, 2016).

The NP workforce in the United States (U.S.) currently consists of approximately 250,000 NPs nationwide and 85% of NPs are trained and prepared to work within primary care (AANP, 2016). Further, NP workforce is expected to grow 130% by the year 2025 (Auerbach, 2012). NPs can currently practice independent of physician oversight in 22 states plus the District of Columbia (AANP, 2016). Studies have shown that NPs provide high quality and cost-effective care, and policymakers are optimistic about the NP workforce alleviating some of the PCP deficit (Lenz et al., 2004; Newhouse et al., 2011). However, the demands for care continue to outweigh the time available for a single PCP to complete all recommended care management tasks. One study estimates that it would take an individual PCP approximately 21
hours per day to complete all recommended care guidelines (Yarnall et al., 2009). This poses a threat to our primary care system to ensure that all patients are receiving optimal care.

Provider co-management, which involves more than one provider responsible for completing the care management of the same patient, has emerged in practice to overcome the increased demands of care delivery. The literature demonstrates effective co-management by two physicians, a physician and a pharmacist, and a physician and physician assistant, to improve quality of care and achieve optimal patient outcomes (Hinami et al., 2011; Rappaport et al., 2013; Weber et al., 2010). However, there is a gap in the literature of studies that investigate NP-physician co-management. The primary author of this study recently conducted a systematic review about the effects of NP-physician co-management compared to a single physician delivering patient care. NP-physician co-management showed promise in achieving adherence to recommended care guidelines and improved patient clinical outcomes (Norful, Swords, Marichal, Cho, & Poghosyan, 2017). Furthermore, a concept analysis was performed to identify the conceptual structure of NP-physician co-management and determined that three dimensions make up effective NP-physician co-management: Effective Communication; Mutual Respect and Trust; and Shared Philosophy of Care (Norful, de Jacq, Carlino, & Poghosyan, 2017). Third, a qualitative study that investigated PCP perspectives of NP-physician co-management was conducted and found that PCPs are willing to practice in a NP-physician co-management model; and PCPs perceive that NP-physician co-management can alleviate provider burnout, increase patient access to care, and improve the quality of primary care (Norful, Ye, Van der Biezen, & Poghosyan, 2017). This emerging evidence shows promise for NP-physician co-management to meet the demand for primary care yet there are limited to no studies that empirically measure the association between NP-physician co-management and patient or practice outcomes. This lack
of evidence is attributed to the absence of valid and reliable instruments that measures NP-physician co-management. In order to determine the impact that NP-physician co-management, more empirical studies with a valid and reliable tool needs to be performed. The purpose of this study is to develop and psychometrically pilot test a new tool that measures NP-physician co-management. The tool developed in this study is the first tool that will give researchers, policymakers, and primary care organizations the ability to empirically investigate NP-physician co-management.

Design

An instrument development design was used to generate items for the new tool and to pilot test and revise as needed (Fowler Jr, 2013). The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) framework was used (Eysenbach, 2004). This study was approved by the Columbia University Institutional Review Board.

Item Generation

A pool of items was developed from the content analysis of existing literature, a systematic review, concept analysis, and qualitative data, to ensure the items captured the theoretical foundations of NP-physician co-management (Norful et al., 2017a; Norful et al., 2017b; Norful et al., 2017c). Items were generated to fit subscales that are aligned with three theoretical dimensions of NP-physician co-management: 1) Effective Communication; 2) Mutual Respect and Trust; and 3) Shared Philosophy of Care. Guidelines for item development using technical and grammatical principles were followed to produce clear and concise items that utilize language familiar to PCPs (Hinkin, 1998). Thirty items were generated. A Likert-type scale was chosen as the response type. The 4-point response scale included ratings, strongly agree to strongly disagree, without a neutral midpoint (Johns, 2010). Two researchers reviewed the items and respective subscales for relevance and clarity, and 8 items were removed. Twenty-
one items were subjected for further testing. The tool was named the Provider Co-Management Index (PCMI).

**Face and Content Validity Testing**

Face and content validity testing was performed to determine if PCMI captures NP-physician co-management and if items were relevant to the content being measured (Drost, 2011; Haynes, Richard, & Kubany, 1995). Six primary care experts were purposively recruited to participate in face and content validity. The experts were eligible if: 1) they currently practice as a NP or physician in primary care; and 2) they have over five years of practice experience. Each expert was interviewed individually and asked to review PCMI, its instructions, items, subscales, and response categories. The purpose of these in-person cognitive interviews were to assess face validity through subjective expert judgment on how well PCMI operationalizes NP-physician co-management (Drost, 2011). Next, experts were asked to rate each of the items on a 4-point Likert scale that ranges from ‘highly relevant’ (4) to ‘highly irrelevant’ (1). Experts received a $20 gift card incentive for participating. Expert ratings were entered in SPSS v23 for content validity testing. All items that received a rating of 3 or 4 were kept without modification. Any items with lower scores or lack of clarity as per the experts were reviewed and revised. A content validity index for both individual items (I-CVI) and each subscale (S-CVI) was computed. Items with an I-CVI and S-CVI greater than .8 were eligible for inclusion and further psychometric testing (Lynn, 1986).

Demographics of the six primary care experts can be found in Table 1 and consisted of three physicians and three NPs. Sixty-six percent of the experts practiced in a private physician-owned practice. One third of experts had over 10 years of practice experience. All experts reported that PCMI had face validity. Experts rated 15 items as highly relevant and the
calculated I-CVI was 1.00. The remaining six items were evaluated for revision: 1) Five items were re-worded for clarity and achieved an I-CVI .833; 2) One item, “My co-managing provider and I treat each other as equal colleagues” received poor ratings (I-CVI .667) and was subsequently removed. None of the experts identified additional content to be added. The S-CVI for each subscale was calculated and demonstrated high content validity: Effective Communication (S-CVI .95); Mutual Respect and Trust (S-CVI .94); and Shared Philosophy of Care (S-CVI .90). Twenty items were left for pilot testing.

**Pilot Testing**

The purpose of pilot testing was to conduct item and reliability analysis of PCMI. Twenty items within three subscales was pilot tested.

**Sample and Data Collection**

A convenience sample of primary care NPs and physicians were recruited from primary care practices. Efforts were made to contact practice managers via email with a brief pre-notification of the study to aid in recruitment and increase response rates (Frohlich, 2002). An email invitation was sent to potential participants (NPs and physicians) explaining the study, the survey’s approximate length, its voluntary nature, and contact information for the researchers. The emails also encouraged participants to forward the email to NPs and physicians working in primary care (snowball technique) (Sadler, Lee, Lim, & Fullerton, 2010). After three weeks, a reminder email was sent encouraging participation and requesting help with recruitment (McPeake, Bateson, & O’Neill, 2014).

Qualtrics Research Suite (Qualtrics, 2015), which is a web-based survey software, was utilized for survey distribution and data collection. We uploaded PCMI instructions, the tool’s items, and response categories. The items on the tool were uploaded in no particular order and
not presented within designated subscales. Five to six items were presented on each subsequent screen. Qualtrics generated a web-based survey link for participants to access and complete the survey. This was an open survey and no password was required for access. Participants were able to use the back button to review or change their responses throughout the survey. Cookies were used to assign a unique user identifier to each participant computer, and thus prevented users from completing the survey twice. The suggested minimum recommendation for initial scale development is 30 participants (Johanson & Brooks, 2009). When the desired sample size for pilot testing was reached, the survey link was made inactive and data were extracted. A lottery was conducted and 15 randomly selected participants received a $20 gift card.

**Data Analysis**

All data were exported from Qualtrics to SPSS v23 for psychometric analysis. Data were cleaned and checked for coding accuracy. IP addresses of respondents were checked for duplicate entries. Three surveys were terminated early, missing all responses to items, and therefore removed from the data analysis. Participant and practice characteristics such as mean age, gender, practice type, and practice settings were calculated. Next, descriptive statistics for each tool item, such as range, mean, and standard deviation, were calculated. Items with good variation across participants were retained. Next, inter-item correlations and the coefficient of reliability (Cronbach’s coefficient alpha) for each subscale were calculated. Corrected item-total correlations were calculated to determine how well each item correlated to the whole subscale. Items with a range from .30 to .70 demonstrated sufficient correlation (Nunnally & Bernstein, 1994). Cronbach’s alpha if deleted was also calculated for each item and evaluated closely for potential removal of items (Gliem & Gliem, 2003).

**Results**

66
The final sample consisted of 40 PCPs (21 physicians and 19 NPs). Majority of respondents were female (70%), practiced in an urban geographic location (70%) and had over five years of practice experience (67.5%). The most frequently reported practice types were private physician practices (32.5%) and hospital-affiliated practices (30.0%). Participant demographics are presented in Table 1.

Results of item analysis and reliability testing are presented in Table 2. The first subscale, Effective Communication, had seven items and a Cronbach’s alpha of .811. The mean item response scores (SD) ranged from 1.76 (.830) to 2.35 (.919). Corrected item-total correlations ranged from .288 to .782. The Cronbach’s alpha if deleted was .835 for the item, “My co-managing provider and I communicate needs in a timely manner,” but it was retained for further psychometric testing in larger scale field testing because of its strong theoretical origins. The item, “My co-managing provider and I communicate changes in patient health status” had marginally high correlation to other items (r=.782) but it’s Cronbach’s alpha if deleted (.747) would not improve reliability if removed. Therefore, all seven items were retained for this subscale.

The second subscale, Mutual Respect and Trust, had six items and achieved a Cronbach’s alpha of .746. Item means (SD) ranged from 1.73 (.693) to 2.19 (.701). Corrected item-total correlations ranged from .389 to .674. No items were determined to be highly correlated to each other. Cronbach’s alpha if deleted ranged from .664 to .740 and we determined that removal of any items would not increase reliability. All six items in the subscale were retained.

The third subscale, Shared Philosophy of Care, had seven items and achieved a Cronbach’s alpha of .779. Item means (SD) ranged from 1.78 (.672) to 2.41 (.865). Corrected item-total correlations ranged from .363 to .531. Cronbach’s alpha if deleted ranged from .728
to .787. The removal of the item, “My co-managing provider and I have a mutually agreed upon protocol to resolve disagreement” would increase the subscale reliability from .779 to .787. However, this item was retained for future psychometric field testing to assess its factor loading and at which point, it would be determined if it should be removed or included in another subscale. All seven items were retained in this subscale. At the conclusion of pilot testing, the three-subscale PCMI consists of 20 items. Each individual subscale consists of 6-7 items.

**Discussion**

This study developed a new health services tool, PCMI, to measure NP-physician co-management in primary care. We conducted its psychometric testing through expert assessment of face and content validity, and pilot tested the survey to obtain evidence of reliability. Item and subscale generation was based on the conceptual dimensions and empirical evidence about NP-physician co-management: Effective Communication; Mutual Respect and Trust; Shared Philosophy of Care. Face and content validity was supported by the subjective input of six primary care experts. The final PCMI, following pilot testing, consisted of 20 items, and was determined to have strong internal reliability consistency. PCMI is now ready for further psychometric testing.

Future research should include field testing in a large sample of PCPs to determine PCMI’s factorial structure, assess its dimensionality, and conduct further reliability testing (Nunnally & Bernstein, 1994). Exploratory factor analysis will help to determine if the PCMI subscales emerge as separate factors to assess its dimensionality. Confirmatory factor analysis should next be conducted to provide evidence about the construct validity of the tool (Fowler Jr, 2013). When PCMI is validated for widespread use, future research using the tool may include comparative effectiveness studies that compare NP-physician co-management to other care
delivery models. Also, the tool can be used to investigate an association between NP-physician co-management and empirical patient or organizational outcomes. Practice implications of the PCMI include the ability of organizations to evaluate existing NP-physician co-management care delivery and its subsequent impact on patient outcomes. It can alert PCPs and practice managers to suboptimal NP-physician co-management so that interventions can be implemented to improve the quality of patient care delivery.

There are limitations to this study. The face validity, content validity, and pilot testing, were achieved by a purposive convenience sample. While the sample sizes were adequate the responses of other PCPs may differ. Also, this study did not establish factorial structure and was informed strictly by classical test theory. Further psychometric testing, including factor analyses and field testing, is planned and recommended prior to PCMI wide spread use.

**Conclusion**

This study developed and pilot tested the first tool that measures NP-physician co-management in primary care. Having a psychometrically sound tool to measure NP-physician co-management will allow researchers to evaluate NP-physician co-management during care delivery and help to determine its association with patient and practice outcomes. Further psychometric analysis, including an assessment of PCMI’s factorial structure, is recommended.
Table 1

Participant demographics in content validity and pilot testing

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<tr>
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<td>40-49</td>
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<td>50-59</td>
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<td>&gt;60</td>
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<td>5 (12.5)</td>
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<tr>
<td>&lt;1 year</td>
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<td>1-4 years</td>
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<td>10 (25.0)</td>
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<tr>
<td>5-10 years</td>
<td>4 (66.6)</td>
<td>9 (22.5)</td>
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<td>11-14 years</td>
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<td>&gt;15 years</td>
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### Highest Educational Degree

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<td>Post-Master’s Certificate</td>
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<td>Medical Degree (MD/DO)</td>
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<td>Doctoral Degree (PhD; DNP; PhD/MD)</td>
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<td>7 (17.5)</td>
</tr>
</tbody>
</table>

### Practice Type

<table>
<thead>
<tr>
<th>Practice Type</th>
<th>Count (Percentage)</th>
<th>Total (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private physician practice</td>
<td>3 (50.0)</td>
<td>13 (32.5)</td>
</tr>
<tr>
<td>Nurse managed clinic</td>
<td>-</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Hospital-affiliated practice</td>
<td>2 (33.3)</td>
<td>12 (30.0)</td>
</tr>
<tr>
<td>University-affiliated clinic</td>
<td>-</td>
<td>4 (10.0)</td>
</tr>
<tr>
<td>Community health center</td>
<td>1 (16.7)</td>
<td>10 (25.0)</td>
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</tbody>
</table>

### Practice setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Count (Percentage)</th>
<th>Total (Percentage)</th>
</tr>
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<tbody>
<tr>
<td>Urban</td>
<td>2 (33.3)</td>
<td>28 (70.0)</td>
</tr>
<tr>
<td>Suburban</td>
<td>4 (66.6)</td>
<td>12 (30.0)</td>
</tr>
</tbody>
</table>
Table 2

PCMI psychometric results from pilot testing

<table>
<thead>
<tr>
<th>Subscales with respective items</th>
<th>Mean</th>
<th>SD</th>
<th>Corrected item-total correlation</th>
<th>Cronbach's alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effective Communication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Cronbach's alpha .811)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My co-managing provider and I:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discuss patient care plans</td>
<td>1.92</td>
<td>.640</td>
<td>.710</td>
<td>.767</td>
</tr>
<tr>
<td>Review each other’s patient documentation of care plan</td>
<td>2.22</td>
<td>.672</td>
<td>.454</td>
<td>.785</td>
</tr>
<tr>
<td>Communicate patient needs in a timely manner</td>
<td>2.24</td>
<td>.830</td>
<td>.263</td>
<td>.835</td>
</tr>
<tr>
<td>Have patient documentation that is available to one another</td>
<td>1.76</td>
<td>.830</td>
<td>.545</td>
<td>.766</td>
</tr>
<tr>
<td>Share a mutual medical language necessary to communicate</td>
<td>1.59</td>
<td>.599</td>
<td>.498</td>
<td>.812</td>
</tr>
<tr>
<td>Notify each other about information that was relayed to patient/family</td>
<td>2.35</td>
<td>.919</td>
<td>.632</td>
<td>.779</td>
</tr>
<tr>
<td><strong>Mutual Respect and Trust</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Cronbach's alpha .746)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>My co-managing provider and I:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have knowledge of each other’s training background</td>
<td>2.03</td>
<td>.866</td>
<td>.616</td>
<td>.668</td>
</tr>
<tr>
<td>Respect each other’s decisions about patient care</td>
<td>1.73</td>
<td>.693</td>
<td>.417</td>
<td>.727</td>
</tr>
<tr>
<td>Trust each other’s decisions about patient care</td>
<td>1.92</td>
<td>.759</td>
<td>.458</td>
<td>.716</td>
</tr>
<tr>
<td>Recognize each other’s contributions to patient care</td>
<td>2.19</td>
<td>.908</td>
<td>.399</td>
<td>.740</td>
</tr>
<tr>
<td>Have knowledge of each other’s scope of practice</td>
<td>1.89</td>
<td>.658</td>
<td>.674</td>
<td>.664</td>
</tr>
<tr>
<td>Identify each other’s strengths and limitations to deliver patient care</td>
<td>2.19</td>
<td>.701</td>
<td>.389</td>
<td>.733</td>
</tr>
</tbody>
</table>
**Shared Philosophy of Care**

(Cronbach's alpha .779)

My co-managing provider and I:

<table>
<thead>
<tr>
<th>Item</th>
<th>My</th>
<th>Colleague</th>
<th>Co-investigator</th>
<th>Cronbach's α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share the same values for patient care</td>
<td>1.78</td>
<td>.672</td>
<td>.531</td>
<td>.745</td>
</tr>
<tr>
<td>Practice with the same work ethic (e.g. time; effort)</td>
<td>1.95</td>
<td>.911</td>
<td>.658</td>
<td>.715</td>
</tr>
<tr>
<td>Agree on rationale for diagnostics tests (e.g. labs; CT scan)</td>
<td>2.08</td>
<td>.547</td>
<td>.437</td>
<td>.764</td>
</tr>
<tr>
<td>Agree on rationale for treatments (e.g. medications)</td>
<td>1.92</td>
<td>.493</td>
<td>.611</td>
<td>.741</td>
</tr>
<tr>
<td>Have a mutually agreed upon protocol to resolve conflict</td>
<td>2.41</td>
<td>.865</td>
<td>.363</td>
<td>.787</td>
</tr>
<tr>
<td>Share the same patient goals</td>
<td>1.84</td>
<td>.646</td>
<td>.629</td>
<td>.728</td>
</tr>
<tr>
<td>Share the same philosophy about how care should be delivered</td>
<td>1.89</td>
<td>.737</td>
<td>.417</td>
<td>.768</td>
</tr>
</tbody>
</table>
Chapter 5: Discussion and Policy, Practice, and Research Recommendations

This chapter synthesizes the results from the three studies to present policy, practice, and research recommendations. Strengths and limitations of the dissertation are also discussed.
Discussion of Findings

This dissertation incorporates three studies that examine NP-physician co-management in primary care. Aim one was achieved by conducting a qualitative study to explore the PCP perspectives of NP-physician co-management in primary care. Twenty-six in-person interviews were conducted with PCPs. First, PCPs defined co-management as having a joint responsibility of care management for the same patient. Next, PCPs provided an in-depth, firsthand account of what factors promote effective NP-physician co-management: Effective Communication; Mutual Respect and Trust; and a Shared Philosophy of Care. This study concluded that NPs and physicians are not only willing to co-manage patients but perceive that co-management has a positive effect of increased patient access to care, reduced PCP burnout, and an improvement of the quality of care provided to patients.

Aim two was achieved by conducting a systematic review of evidence to investigate the outcomes of NP-physician co-management. Six studies were identified in the review, from which the data were extracted and synthesized. Key findings revealed that NP-physician co-management increases PCP adherence to recommended care guidelines. In addition, NP-physician co-management improves clinical patient outcomes, such as a patient achieving diabetic control and optimal cholesterol levels. There was no significant difference between quality of life for patients co-managed by NPs and physicians compared to patients under the care of a single physician. Results from this systematic review illuminated early evidence of the benefits of NP-physician co-management. However, within the included studies there was variation of the methodology used to measure co-management, thus identifying a need for a valid and reliable tool for future research.
Aim three of this dissertation was achieved by developing and conducting initial psychometric testing of a new tool, PCMI, to measure NP-physician co-management. Results from the first two aims of this dissertation provided a foundation for the development of the PCMI items and subscales. Six primary care experts individually reviewed the instrument, including its items, subscales, and response categories, and determined it was content valid. Next, the newly developed PCMI was pilot tested in a convenience sample of 40 PCPs to determine internal reliability consistency. The PCMI measures co-management within three subscales: Effective Communication; Mutual Respect and Trust; and Shared Philosophy of Care. The psychometric testing verified that PCMI and its three subscales have high internal reliability consistency and is now ready for further psychometric field testing.

**Strengths and Limitations**

There are several strengths to this dissertation. First, this dissertation provides unique evidence about NP-physician co-management in primary care and contributes new knowledge to impact practice, policy, and research. Second, it provides the first psychometrically reliable and valid instrument to measure NP-physician co-management in both clinical practice and future research. Third, this dissertation used rigorous methodological approaches that were guided by strong evidence of conducting systematic reviews, qualitative studies, and developing and psychometrically testing an instrument. Finally, this research is timely, as providers, primary care practices, and policy makers are calling for primary care redesign and the investigation of care delivery models that achieve optimal patient and care management outcomes.

This dissertation has limitations. First, the qualitative study presents data from a small sample of PCPs, and while an appropriate sample size for qualitative analysis, perspectives of other PCPs may differ. Second, the findings of the systematic review were dependent on a small
number of studies (n=6), and despite a rigorous search strategy, studies may have been missed. Third, reliability and validity results for PCMI are based on pilot testing and prior to widespread use of PCMI, a wider geographic and larger scale psychometric analysis needs to be conducted.

**Implications**

The findings of the studies in this dissertation have several policy, practice, and research implications.

**Policy Implications**

The systematic review sheds light on the effects of NP-physician co-management on care management, clinical patient, and quality of life outcomes. Policy makers can use these findings to evaluate existing care delivery models and consider primary care redesign that includes the integration of NPs into a co-management care delivery model. The qualitative study in this dissertation provided PCP perspective of what attributes need to be present for effective NP-physician co-management. Policymakers now have evidence of these attributes, such as effective communication, the impact of co-management care delivery, and what requires close attention when implementing NP-physician co-management. In addition, policymakers can use the knowledge of NP and physician qualitative perspectives to ensure that NPs are being utilized to the full extent of their training capabilities. In order to initiate NP-physician co-management care delivery, it is imperative to examine policies surrounding NP practice autonomy, resources needed for NPs during care management, and the promotion of optimal co-management delivery with physicians. The implementation of policies that effectively support NP-physician co-management have the potential to improve the quality of patient care, increase patient access to care, and promote optimal NP-physician care delivery.
Practice Implications

This dissertation produced a novel tool, PCMI, to measure NP-physician co-management in the practice setting. PCMI is a tool that providers and practice managers can use to illuminate suboptimal NP-physician co-management and determine the association between specific NPs and physicians co-managing patients and their subsequent patient or quality of care outcomes, thereby providing a method to evaluate quality of care delivery. In addition, practice managers can survey PCPs with PCMI to determine a need for interventions that promote effective co-management care delivery. At this point, there is the ability to determine which PCPs are effectively or ineffectively co-managing patients, in order to appropriately place PCPs together within the practices.

Research Implications

There are also several research implications of this dissertation. The studies in this dissertation provide the first collective evidence of NP-physician co-management outcomes, PCP perspectives of NP-physician co-management, and the first psychometrically tested, valid and reliable tool to measure NP-physician co-management. However, more empirical evidence is needed prior to making the recommendation that this is an optimal care delivery model for primary care settings. First, the qualitative study can guide researchers to further investigate each of the identified factors that make NP-physician co-management effective, such as interventions to improve PCP communication or strategies to build mutual respect and trust. Second, the PCMI is the first tool that provides researchers with a method to measure NP-physician co-management. PCMI can be used in a multitude of comparative effectiveness research and cost analyses such as the clinical impact or cost effectiveness of co-management in various health care settings. Researchers may also investigate if more than two providers co-
managing patients has an impact on primary care efficiency and effectiveness. Moreover, health services researchers can use PCMI to investigate the association between NP-physician co-management and a myriad of patient, care delivery or cost outcomes. If needed, the tool can be further validated in healthcare settings outside of primary care, or with different types of PCPs, such as physician assistants.

**Planned Future Research**

The studies in this dissertation demonstrate that NP-physician co-management shows promise of improving quality of care management, increased patient access to care, and improved patient clinical outcomes. In addition, it provides a new tool that enables researchers, providers, and organizations to measure NP-physician co-management in practice and future research to determine the impacts on patient and care delivery outcomes. However, before its widespread use, the PCMI must undergo additional psychometric testing to determine its factorial structure and produce evidence of its construct validity. Therefore, PCMI will undergo field testing in a large sample (n=400) of PCPs nationwide. An exploratory, and then confirmatory, factor analysis will be used to determine the factorial structure. Following the field testing of PCMI, additional studies are planned and will use PCMI to determine an association between NP-physician co-management and care management outcomes (e.g. care management guideline adherence); and NP-physician co-management and empirical clinical patient outcomes (e.g. blood pressure control).

**Conclusion**

This dissertation consists of three unique studies that produce novel evidence about the impact, PCP perspective, and measurement of NP-physician co-management. The dissertation lays the foundation for providers, policymakers, and researchers to further investigate the
associations between NP-physician co-management and patient or practice outcomes and can be used to inform the implementation of high quality care delivery interventions. While the systematic review in this dissertation demonstrates the potential benefit of NP-physician co-management to achieve improved patient and practice outcomes, the qualitative study reveals that there are several underlying factors that determines the success of co-management. Close attention to the conceptual attributes of NP-physician co-management (e.g. Effective Communication; Mutual Respect and Trust; and Shared Philosophy of Care) is warranted to promote co-management success. Further, the need for a tool to measure NP-physician co-management in practice and future research was apparent. This dissertation provides a content valid and internally reliable pilot-tested PCMI which researchers can use to further investigate evidence about NP-physician co-management. Future research is recommended to make recommendations about NP-physician co-management in primary care redesign.
References


doi:http://dx.doi.org/10.1097/MLR.0b013e318249d6e7


81


Gerontological Nursing, 7(3), 126-137. doi:http://dx.doi.org/10.3928/19404921-20140113-01


doi:http://dx.doi.org/10.1016/j.jclinepi.2009.06.005


Appendices

Appendix A: Recruitment Flyer for Qualitative PCP Interviews

Appendix B: Qualitative Interview Guide

Appendix C: Email Invitation to Participate in Content Validity Testing

Appendix D: Email Invitation to Participate in Pilot Testing

Appendix E: Provider Co-management Index (PCMI)
Appendix A: Recruitment Flyer for Qualitative PCP Interviews

Columbia University School of Nursing is conducting a research study: “Errors of Care Omission: Implications for Primary Care”. The study will develop new survey tools, that will be used to evaluate care omission errors in primary care settings and obtain the perspectives of primary care providers on nurse practitioner-physician co-management of patients to alleviate care omission.

The research team is looking for primary care providers (Nurse practitioners and physicians) to help build this tool and provide their perspective of NP-physician co-management of primary care patient to reduce care omissions.

The research team is looking for primary care providers (physicians and nurse practitioners) to help develop the tools.

As a participant in this study, you would be asked to participate in one individual interview to review ECOS and provide feedback. The interview will take about 30-45 minutes. You will choose the date and time. The researcher will meet you in a convenient location for you. **You will receive a $20 gift certificate.**

For more information about this study, or to volunteer for this study, please contact:

Lusine Poghosyan, lp2475@columbia.edu, phone: 212-305-7081;

Allison Norful, aan2139@cumc.columbia.edu
Appendix B: Qualitative Interview Guide

A. Introduction and Consent

B. General Opening Questions

1. Describe your usual day’s work. Probe. What are your major responsibilities? What do you do all day? What are the major parts of your job? Probe: Administration/patient care/follow-up/teaching?
   - Probe – types of visits, patients, age group?

2. Tell me about the practice you work in. What types of services are provided by your practice?
   - Probe--number of providers and types, funding, staffing, for profit or non-profit, part of a bigger organization, etc.

3. Describe your role as a primary care provider? How is this defined in your organization? How would you distinguish your primary care provider role from other primary care providers (e.g., physicians, NPs, PAs) that work in the practice?
   - Probe—do you follow patients exclusively or do you share patient care?

C. NP-Physician Co-management

1. Can you describe a scenario where another provider has helped supplement care to fulfill recommended care guidelines?
   - Probe: patient follow-up? Lab test results? Patient education?

2. Describe the work relationship between nurse practitioners and physicians in your environment?
   - Probe: roles and responsibilities? Communication type? Work flow?

3. How can NPs and physicians work best together to improve quality of primary care delivery?

4. What types of barriers to co-management of patient care by NPs and physicians have you experienced?
   - Probe: time and space? Communication? Scope of practice regulations?

D. Care Omission

1. Describe the care you usually deliver when you have adequate time.

2. If there are times you don’t deliver that care, what types of care are omitted? Probe: What clinical care is regularly missed? Why is that clinical care omitted?

3. What care gets omitted when you are pressed for time? Probes: inadequate staffing? cannot collaborate with colleagues? poor communication among staff?

Thank you for taking time to talk with me about these questions. What questions do you have?
Appendix C: Email Invitation to Participate in Content Validity Testing

The following is the email invitation requesting experts to participation in an in-person interview to assess face and content validity.

IRB # AAAQ5708

Dear PCP Colleague:

You have been purposively selected as an expert in your field to participate in an important research study being conducted at the Columbia University School of Nursing.

The purpose of the study is to develop two new tools that assess primary care environments, including provider co-management patients, and omission of care. The study is being conducted by Lusine Poghosyan, PhD, MPH, RN, FAAN, Assistant Professor, and Allison Norful, MSN, MPhil, RN, ANP-BC, Doctoral Candidate.

You are being asked to participate in the validation of the Error of Care Omission Survey (ECOS) and Provider Co-Management Index (PCMI) tools. Your participation would involve your rating the relevance and clarity of items on the tools, and providing feedback that will either improve item relevance or remove items that are not relevant.

Should you agree to participate, one researcher will meet you in-person at a mutually agreeable date, time and private location. Validation of ECOS and PCMI is expected to take 45-60 minutes. Response burden could occur related to the expected duration of participation. Compensation will be provided in the form of a $20 gift card. Participation in this research is completely voluntary, and you are free to withdraw at any time without penalty. No personally identifiable information will be collected. All collected data will be securely housed on a password-protected research computer with limited access by only the researchers and authorities from Columbia University Institutional Review Board (IRB).

Please respond to this email with your intent to participate in this important research or if you have further questions.

Thank you for your time and consideration,

Lusine Poghosyan, PhD, MPH, RN

Allison A. Norful, MSN, RN, ANP-BC
Appendix D: Email Invitation to Participate in Pilot Testing

IRB # AAAQ5708

Dear PCP Colleague:

You are receiving this email because you are an expert in primary care. We would like to ask you to participate in an important research study being conducted at the Columbia University School of Nursing.

The purpose of the study is to develop two new tools to assess provider co-management patients in primary care and omission of care. The study is being conducted by Lusine Poghosyan, PhD, MPH, RN, FAAN, Assistant Professor, and Allison Norful, MSN, MPhil, RN, ANP-BC, Doctoral Candidate.

You are being asked to participate in the pilot testing of the Error of Care Omission Survey (ECOS) and Provider Co-Management Index (PCMI) tools.

The survey will take approximately 10-15 minutes. Participation in this research is voluntary, and you are free to withdraw at any time without penalty. No personally identifiable information will be collected. All collected data will be securely housed on a password-protected research computer with limited access by only the researchers and authorities from Columbia University Institutional Review Board (IRB).

Should you consent to participate, you can begin the survey by clicking on the following link or copy and pasting the link into your browser:

https://cumc.co1.qualtrics.com/SE/?SID=SV_cvDvlhdTQY3Fztb

Upon completion of the survey, you may voluntarily provide your email for a chance to win one of fifteen $20 Amazon gift cards.

If you have any questions about your rights in this research, you may contact the Institutional Review Board at Columbia University, 154 Haven Avenue, 1st Floor, New York, NY 10032. Phone: 212-305-5883

We invite you to share this link with your PCP colleagues.

Thank you for your time and consideration,

Lusine Poghosyan, PhD, MPH, RN, FAAN
lp2475@columbia.edu

Allison A. Norful, MSN, RN, ANP-BC
aan2139@cumc.columbia.edu
Appendix E: Provider Co-Management Index (PCMI)

**Provider Co-Management Index (PCMI)**

**Instructions:** Think about your practice when co-managing patient care with one other primary care provider. This may be within a single patient visit or over an extended period of time in which you both share responsibility for the same patient’s care. (Select your response)

<table>
<thead>
<tr>
<th>My co-managing provider and I:</th>
<th>Strongly Agree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effective Communication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. discuss patient care plans</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. review each other’s patient care documentation</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. communicate patient needs in a timely manner</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. communicate changes in patient health status</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. have patient documentation that is available to one another</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. share a mutual medical language necessary to communicate</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. notify each other about information that was relayed to the patient/family</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Mutual Respect &amp; Trust</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. have knowledge of each other’s education and training background</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. respect each other’s decisions about patient care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. trust each other’s decisions about patient care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. recognize each other’s contributions to patient care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. have knowledge of each other’s scope of practice</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. identify each other’s strengths and limitations to deliver patient care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Shared Philosophy of Care</td>
<td>Strongly Agree</td>
<td>Agree</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>----------------</td>
<td>-------</td>
</tr>
<tr>
<td>1. share the same values for patient care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. practice with the same work ethic (e.g. time, effort)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. agree on rationale for diagnostic tests (e.g. labs, CT scan)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. agree on rationale for treatments (e.g. medications)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. have a mutually agreed upon protocol to resolve conflict</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. share the same goals for patient care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. share the same philosophy about how care should be delivered</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>