PILOTTING A MEDICAID POPULATION HEALTH MANAGEMENT INTERVENTION IN COMMUNITY PHARMACIES: AN IMPLEMENTATION STUDY

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A dissertation submitted to the faculty at the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Health Policy and Management in the Gillings School of Global Public Health.

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ABSTRACT

Kea L. Turner: Piloting a Medicaid Population Health Management Intervention in Community Pharmacies: An Implementation Study
(Under the direction of Christopher M. Shea)

The overall objectives of this research were to: (1) examine the determinants of implementation effectiveness of a community pharmacy population health management intervention and (2) compare the implementation process of high- and low-performing community pharmacies participating in a population health management intervention.

We used a sequential mixed-methods research design to examine implementation of the Community Pharmacy Enhanced Services Network (CPESN™) in North Carolina. Data sources included qualitative interviews and survey data linked with program administrative data from 2016. The first study used a hurdle regression to examine the impact of organizational determinants on implementation effectiveness (e.g., implementation activity and program reach) (n=191). Community pharmacy’s implementation climate (AME = 2.65, p = 0.000) and innovation-values fit (AME = 2.17, p = 0.037) was significantly associated with implementation activity (e.g., implementation versus non-implementation). Similarly, pharmacy’s implementation climate (AME = 5.05, p = 0.001) and innovation-values fit (AME = 11.79, p = 0.000) was significantly associated with program reach (e.g., amount of intervention delivered to target population).

The second study identified the role of network ties to support implementation of NC-CPESN and compared network ties among high- and low-performing pharmacies using thematic analysis of qualitative interviews (n=40). The study found that high-performing pharmacies had
a greater diversity of network ties (e.g., relationships with healthcare providers, care managers, and public health agencies) and were able to use those ties to support implementation of NC-CPESN.

The third study compared the implementation process of high- and low-performing NC-CPESN community pharmacies using thematic analysis of qualitative interviews (n=40). Community pharmacies employed implementation strategies such as redefining job responsibilities to ensure pharmacists and pharmacy technicians are working at the top of their license. Findings also revealed differences in the implementation process among high- and low-performing pharmacies, such as low-performing pharmacies omitting strategies used by high-performers.

In sum, organizational- and environmental-level determinants and differences in the implementation process affected implementation effectiveness of a community pharmacy population health management intervention. Payers supporting community pharmacy integration into population health management models should consider these factors affect implementation and develop implementation strategies accordingly.
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<td>AME</td>
<td>average marginal effect</td>
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<tr>
<td>CCNC</td>
<td>Community Care of North Carolina</td>
<td></td>
</tr>
<tr>
<td>CFIR</td>
<td>consolidated framework for implementation research</td>
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<tr>
<td>CI</td>
<td>confidence interval</td>
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<tr>
<td>CMR</td>
<td>comprehensive medication review</td>
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<tr>
<td>CPESN\textsuperscript{SM}</td>
<td>Community Pharmacy Enhanced Services Network</td>
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<td>EHR</td>
<td>electronic health records</td>
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<tr>
<td>EV</td>
<td>eigenvalue</td>
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<tr>
<td>FTE</td>
<td>full-time equivalent</td>
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<td>HIE</td>
<td>health information exchange</td>
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<td>HPM</td>
<td>Health Policy and Management</td>
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<td>HNHC</td>
<td>high-need, high-cost</td>
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<tr>
<td>KMO</td>
<td>Kaiser-Meyer-Olkin</td>
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<td>LDL</td>
<td>low-density lipoprotein</td>
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<td>MCC</td>
<td>multiple chronic conditions</td>
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<td>MN</td>
<td>Minnesota</td>
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<tr>
<td>MTM</td>
<td>medication therapy management</td>
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<tr>
<td>NB2</td>
<td>negative binomial model type 2</td>
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<tr>
<td>NC</td>
<td>North Carolina</td>
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<tr>
<td>NC-CPESN</td>
<td>North Carolina CPESN</td>
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<tr>
<td>PCPs</td>
<td>primary care providers</td>
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<td>RUCA</td>
<td>rural-urban commuting area</td>
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<tr>
<td>SD</td>
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<td>WI</td>
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CHAPTER 1. INTRODUCTION

The Affordable Care Act has changed the organization, financing, and delivery of healthcare\(^1\) by implementing new payment models and financial incentives to encourage healthcare providers to accept and manage healthcare for a defined patient population.\(^2\) To this end, population health management programs have arisen that have common features such as identifying high-need, high-cost (HNHC) patients; tailoring care delivery to patients’ risk level; and coordinating care across a diverse team of healthcare and social service providers.\(^3\) One of the most challenging aspects of population health management is improving health outcomes for HNHC patients\(^4\) who often have complex health and social needs that can interfere with disease management.\(^5\)–\(^7\) Pharmacists could play a critical role in population health management programs by delivering medication management services to HNHC patients. However, pharmacists have been underutilized in population health management models such as Accountable Care Organizations.\(^8\)

Community Care of North Carolina (CCNC)—North Carolina’s primary case management program for Medicaid beneficiaries—is currently piloting Community Pharmacy Enhanced Services Network (CPESN\(^{SM}\)), a population health management intervention designed to both improve the quality and outcomes of healthcare and reduce healthcare costs for HNHC patients.\(^9\) Pharmacies participating in CPESN deliver intensive, one-on-one services to patients, often requiring pharmacy staff to work together in teams to effectively deliver services. Program participants include community pharmacies that are locally-owned, part of a chain, or outpatient pharmacies that are part of a health system.\(^10\) The evaluation of the CPESN pilot that is
underway does not assess its implementation effectiveness (the quality and consistency of implementation\textsuperscript{11,12}), which is critical for decision-makers in North Carolina who seek to spread CPESN, as well stakeholders in other states that are considering similar programs.

We used a sequential mixed-methods research design\textsuperscript{25} to examine implementation of the CPESN program in North Carolina. Using the organizational theory of implementation effectiveness\textsuperscript{11,12}, the first study of this dissertation quantitatively examined the role of implementation climate, as well as the overall fit between CPESN and pharmacy’s mission and values, on implementation effectiveness in community pharmacies.\textsuperscript{13} This first study also examined the impact of other organizational determinants of implementation effectiveness that are identified by the consolidated framework for implementation research including patient needs and resources, available resources, access to information and knowledge, and structural characteristics.\textsuperscript{14}

The second study of this dissertation identified and compared the use of network ties to support implementation among high- and low-performing community pharmacies using qualitative methods. The second study also explored how network ties are formed and maintained to support implementation of CPESN. The third study compared the implementation strategies used at different stages of the innovation process among high- and low-performing community pharmacies. The implementation process unfolds in key phases, from agenda setting when an organization identifies a need for an innovation, through routinization when the innovation is no longer viewed as separate from day-to-day activities of the organization.\textsuperscript{15} Within each of these phases, pharmacies use key implementation strategies to support the implementation process, such as planning, education, restructuring, quality-management, and finance strategies.\textsuperscript{16,17}
The central hypothesis of this research was that key organizational and environmental determinants and the implementation process influence which pharmacies are more effective at implementing CPESN. The long-term goal of this research is to increase successful implementation of population health management interventions in community pharmacies in the US. To test the central hypothesis, this dissertation examined implementation effectiveness of CPESN in approximately 255 community pharmacies in NC by pursuing the following Specific Aims:

Aim 1: To examine the association between organizational determinants and implementation effectiveness of a population health management intervention in community pharmacies.

Aim 2: To identify and compare the network ties used to support implementation of a population health management intervention among high- and low-performing community pharmacies.

Aim 3: To identify and compare the implementation strategies of high- and low-performing community pharmacies at different stages of the innovation implementation process.

This dissertation used a sequential mixed-methods research design to examine implementation of the Community Pharmacy Enhanced Services Network (CPESN\textsuperscript{SM}) in North Carolina. Data sources included qualitative interviews and survey data linked with program administrative data from 2016. The first study used a hurdle regression model to examine the impact of organizational determinants on implementation effectiveness (e.g., implementation activity and program reach). The second study used a thematic analysis of qualitative interviews to identify and compare the network ties used to support implementation of a population health
management intervention among high- and low-performing community pharmacies. Similarly, the third study used a thematic analysis of qualitative interviews to identify and compare the implementation strategies of high- and low-performing community pharmacies at different stages of the innovation implementation process.

The aims from this dissertation were anticipated to produce the following outcomes: 1) contribute to understanding of the environmental and organizational determinants of implementation effectiveness of a population health management in community pharmacy, and 2) Provide guidance to community pharmacy practitioners and policymakers on how to implement population health management interventions in community pharmacy settings. The results from this dissertation will be important for scaling up interventions like CPESN that seek to integrate community pharmacists into population health management models.

The sections of this dissertation are organized as follows. Chapter 2 summarizes the current literature regarding population health management in community pharmacy. This chapter concludes with a statement regarding the significance and innovation of this research. Chapter 3 provides an overview of the methods used in this dissertation including the conceptual framework, study design and rationale, study setting and sample, intervention description, data sources, and analytic approaches. Chapters 4-6 are manuscripts for Aims 1-3, respectively, and are intended for submission for peer-reviewed publication. Chapter 7 summarizes the findings of this dissertation and provides implications for policy, practice, and research.
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CHAPTER 2. LITERATURE REVIEW

High-Need, High-Cost Patients

Nearly half of total healthcare expenditures are concentrated among five percent of the U.S adult population (12 million people).\textsuperscript{1,2} This small subset of the population is commonly referred to as high-need, high-cost (HNHC).\textsuperscript{3-5} HNHC patients have been defined in multiple ways; however, the most commonly used definition is patients with three or more chronic conditions and a functional limitation (e.g., cognitive, physical, or psychological).\textsuperscript{3-5} Studies have found that HNHC patients have higher annual expenditures on healthcare services and prescriptions and higher rates of preventable hospitalizations and emergency department use than the general population.\textsuperscript{3,4,6-8} Additionally, HNHC patients are more likely than the general population to report having unmet medical needs, lower satisfaction with patient-provider communication, and experiences of social isolation and loneliness.\textsuperscript{6,9} Several patient demographics are positively associated with HNHC status including age greater than 65, female gender, non-Hispanic ethnicity, White race, public insurance, lower educational attainment, and lower income.\textsuperscript{3,6,9}

Within the Medicaid program, HNHC patients account for a large proportion of spending; five percent of Medicaid beneficiaries account for almost half of Medicaid expenditures.\textsuperscript{10} HNHC Medicaid patients are disproportionately impacted by costly chronic conditions, such as asthma and diabetes, and the co-occurrence of difficult-to-treat conditions, including mental health and substance use conditions.\textsuperscript{10} Medicaid HNHC patients more frequently report experiences of social isolation and loneliness and homelessness and housing
instability than other Medicaid beneficiaries.\textsuperscript{11} Several patient demographics are positively associated with HNHC status for Medicaid beneficiaries including older age, female gender, non-Hispanic ethnicity, and White race.\textsuperscript{12,13}

**Pharmacist-led Medication Management Programs**

To improve care for HNHC patients, Medicaid and other payers have started shifting from fee-for-service to alternative payment models, which offer incentives for healthcare organizations to implement population health management strategies to increase the value, effectiveness, and efficiency of care.\textsuperscript{14,15} Population health management programs emphasize tailored interventions for HNHC patients who are at greater risk than the general population for medication errors\textsuperscript{16} and adverse drug events\textsuperscript{17,18}, which, in turn, increase hospitalization risk.\textsuperscript{19} Since pharmacists are highly trained in medication management, some population health management programs have included pharmacist-led medication management programs.\textsuperscript{20}

Pharmacist-led medication management programs have demonstrated success in changing patients’ medication behaviors and therapeutic outcomes while reducing healthcare costs.\textsuperscript{21-28} For example, pharmacist-led medication management programs have demonstrated success in identifying drug-related therapy problems\textsuperscript{29}, improving disease management and medication adherence\textsuperscript{30,31,44}, and reducing inappropriate medication use.\textsuperscript{32} Additionally, community pharmacist-led medication management programs have positively affected patient outcomes including patients’ ability to manage their blood glucose, blood pressure, and LDL cholesterol.\textsuperscript{30,33,34} Studies have also reported that pharmacist-led medication management programs have reduced hospital length of stay and pharmacy and total cost of care compared to usual care.\textsuperscript{35-37}
Implementation of Medication Management Programs

Researchers have tried to determine which medication management program features are associated with changes in patient outcomes but have had difficulty finding a connection due to variation in program design.\textsuperscript{21,38} In the Medicare Part D Medication Therapy Management (MTM) program, for example, researchers have noted that medication services are delivered in a variety of settings (e.g., call centers, outpatient care) and formats (e.g., in-person vs. phone).\textsuperscript{21} Similar challenges exist in Medicaid medication management programs—programs vary in patient eligibility criteria, the services provided, and the setting of service delivery.\textsuperscript{38} Some Medicaid pharmacist-led medication management programs, for example, involve having a pharmacist deliver medication management services in a primary care setting whereas other programs offer medication management services in community pharmacy settings.\textsuperscript{38}

In addition to program design variability, there are a limited number of studies examining implementation of medication management programs, making it difficult to assess why program outcomes might vary across organizations. Organizational context is important for understanding why implementation effectiveness may vary across settings and for identifying common factors across diverse settings that contribute to effective implementation. Many of the studies that have examined determinants of implementation effectiveness have been qualitative, limiting their generalizability, or have not been guided by a theory, making it difficult to interpret the findings. Past studies have identified factors, such as organizational structure (e.g., staff size), leadership support, and financial resource availability\textsuperscript{39-43}, but not applied theory to demonstrate how these factors work in concert to produce effective implementation.

The majority of studies that have examined implementation of pharmacist-led medication management services have not been conducted in community pharmacy settings. Several state Medicaid programs (NC, MN, WI) have launched medication management services in
community pharmacy settings\textsuperscript{38} but there are only two studies assessing implementation.\textsuperscript{44,45} One study focuses on factors associated with documentation of medication management services, rather than overall program implementation.\textsuperscript{44} The other study explores organizational factors associated with program implementation using bivariate analysis, making it difficult to assess which factors are associated with effective implementation holding other factors constant.\textsuperscript{45} This dissertation will address this research gap by using multivariate analysis to examine overall program implementation of the Community Pharmacy Enhanced Services Program--a Medicaid medication management program in a community pharmacy setting.

**Community Pharmacy Enhanced Services Program**

Community Care of North Carolina (CCNC)—North Carolina’s primary case management program for Medicaid beneficiaries—is currently piloting Community Pharmacy Enhanced Services Network (CPESN), a population health management intervention designed to both improve the quality and outcomes of healthcare and reduce healthcare costs for HNHC patients.\textsuperscript{46} Pharmacies participating in CPESN deliver intensive, one-on-one services to patients, often requiring pharmacy staff to work together in teams to effectively deliver services. Program participants include community pharmacies that are locally-owned, part of a chain, and or outpatient pharmacies that are part of a health system.\textsuperscript{47} The evaluation of the CPESN pilot that is underway does not assess its implementation effectiveness (the quality and consistency of implementation\textsuperscript{48,49}), which is critical for decision-makers in North Carolina who seek to spread CPESN, as well stakeholders in other states that are considering similar programs.

**Significance and Innovation**

There is limited implementation research about medication management programs and more specifically, programs in community pharmacy settings.\textsuperscript{21,38,50} Having limited evidence about implementation makes it difficult for policymakers and practitioners to provide
implementation guidance or offer technical assistance to community pharmacies implementing medication management programs. Additionally, the lack of implementation research makes it impossible to spread and scale up effective practices or discontinue ineffective practices. This dissertation is significant for its potential to close this implementation gap by examining three key determinants of implementation effectiveness: organizational determinants (aim 1), environmental determinants (e.g., network ties) (aim 2), and the implementation process (aim 3).

This study is innovative because it uses a theory-based approach to examine implementation effectiveness of a medication management program in a community pharmacy setting. Prior studies of medication management programs have not used a theory-based approach, making it difficult to assess how a combination of factors interacts to produce effective implementation. Additionally, this study quantitatively tests the organizational theory of innovation implementation\textsuperscript{48,49,51}, which has only been quantitatively tested in a few studies\textsuperscript{48,52}, and has never been tested in a community pharmacy setting. Therefore, the findings from this dissertation will contribute to implementation theory by determining whether the constructs of this theory are relevant in the community pharmacy context.
REFERENCES


CHAPTER 3. STUDY DESIGN AND METHODS

Overview and Rationale

This dissertation employed a sequential mixed-methods research design\(^1\) to understand implementation effectiveness of a community pharmacist-led medication management program for Medicaid beneficiaries. The purpose of the mixed-methods design was to use the qualitative findings from aims 2 and 3 to help explain the findings of the quantitative analysis of aim 1 (i.e., expansion).\(^1\) Aim 1 used a hurdle regression to examine the organizational determinants associated with implementation effectiveness (e.g., implementation activity and program reach). In Aim 2, a thematic analysis was conducted to identify and compare use of network ties to support implementation among high- and low-performing community pharmacies. Similarly, aim 3 used a thematic analysis to identify and compare the implementation strategies used by high- and low-performing community pharmacies at each stage of the innovation process.

Specific Aims and Hypotheses

Aim 1: To examine the association between organizational determinants and implementation effectiveness of a population health management intervention in community pharmacies.

Hypothesis 1a: Positive perceptions about implementation climate will be positively associated with implementation effectiveness.

Hypothesis 1b: Positive perceptions about innovation-values fit will be positively associated with implementation effectiveness.
Hypothesis 1c: The impact of implementation climate on implementation effectiveness will be amplified by positive, and weakened by negative, perceptions about innovation-values fit (moderation).

Hypothesis 1d: Four contextual factors (e.g., patient needs and resources, available resources, access to knowledge, and structural characteristics, will affect implementation effectiveness.

Aim 2: To identify and compare the use of network ties to support implementation of a population health management intervention in community pharmacies among high- and low-performing pharmacies.

Aim 3: To identify and compare the implementation strategies of high- and low-performing community pharmacies at different stages of the innovation implementation process.

Conceptual Framework

Implementation theories have been developed to identify the organizational factors and underlying relationships that are hypothesized to influence effective implementation (i.e., the quality and consistency of implementation).\textsuperscript{2,3} The organizational theory of innovation implementation effectiveness was designed for complex innovations like medication management programs, which often require coordinated use by multiple individuals to be effective.\textsuperscript{3-5} This theory posits that effective implementation is driven by an organization’s implementation climate and the fit between the innovation and organization values (Figure 3.1).\textsuperscript{3-5} For example, a community pharmacy might develop formal policies or strategies to support implementation of medication management programs such as employee training, reward and recognition systems, or job reassignment. The collective influence of the pharmacy’s implementation policies, in turn, affects employees’ shared perceptions about the extent to which the medication management program is rewarded, supported, and expected (implementation
Positive perceptions about implementation climate are likely to increase employees’ acceptance of medication management programs, increasingly the likelihood that pharmacy staff will appropriately implement medication management programs (i.e., as the pharmacy intended for it to be implemented) and ultimately increase implementation effectiveness.

The organizational theory of innovation implementation effectiveness maintains that innovation-values fit also affects implementation effectiveness. Specifically, pharmacy employees’ perceptions about how well medication management programs align with the values of the pharmacy and the pharmacy profession affect implementation effectiveness both directly and indirectly. If pharmacy employees perceive that medication management programs do not align with the pharmacy’s values, the employee may be less committed to implementation and exert less effort towards ensuring effective implementation. Innovation-values fit is also likely to impact the relationship between implementation climate and implementation effectiveness. Since innovation-values fit affects commitment, the impact of implementation climate on implementation effectiveness will be amplified by positive, and weakened by negative, perceptions about innovation-values fit.

Implementation effectiveness is also likely to be affected by broader environmental and organizational factors (e.g., organizational context). Based on the consolidated framework for implementation research, we hypothesize four factors influence implementation effectiveness: patient needs and resources, available resources, access to knowledge and information, and structural characteristics. For example, community pharmacies that serve a higher proportion of high-need, high-cost patients may be better at implementing innovations for high-need, high-cost populations. Additionally, pharmacies in rural locations may be better at implementing innovations for high-need, high-cost populations since residents in rural areas have higher rates
of chronic illness.\textsuperscript{7} Implementation effectiveness is also likely to be positively influenced by a pharmacy’s available resources, such as amount of staff and training of staff, and access to knowledge and information about medication management programs (e.g., experience implementing similar interventions). Conversely, certain structural characteristics may negatively affect implementation effectiveness. For example, pharmacies that have opened recently may not have as strong of ties with patients as pharmacies that have been in operation for many years (e.g., the liability of newness hypothesis).\textsuperscript{8} Similarly, larger pharmacies may be impeded by a more formal organizational structure, which can negatively impact innovation implementation.\textsuperscript{9} For instance, managers of independently owned pharmacies may have greater decisional autonomy because there is less formalization in the organization and as a result, be better able to support implementation of medication management programs.
Figure 3.1. The impact of implementation climate and innovation-values fit on implementation effectiveness

- **Innovation-values fit**
  - (Perception of how well the innovation fits with mission of the organization and profession)

- **Implementation climate**
  - (Perception of the extent to which the innovation is supported, rewarded, and expected)

- **Implementation Policies and Practices**
  - (Formal policies and practices to support and reward innovation use)

- **Implementation effectiveness**
  - (The quality and consistency of implementation)

- **Organizational context**
  - (Broader environmental and organizational factors including patient needs and resources, available resources, access to knowledge and information, and structural characteristics)
Study Setting and Sample

The study was conducted with approximately 255 community pharmacies that participated in CPESN over the three-year program period (September 2014- August 2017). The community pharmacies were located throughout the state of NC in both rural and urban areas. The participating pharmacies served Medicaid, Medicare, dually eligible, and NC Health Choice Beneficiaries. Participating community pharmacies were located in various settings such as grocery stores and federally qualified health centers and included a mix of approximately locally owned and non-locally owned pharmacies such as chain pharmacies and outpatient pharmacies. The sample included 123 community pharmacies that enrolled in year 1 of the program, 107 community pharmacies that enrolled in year 2 of the program, and 25 community pharmacies that enrolled in year 3 of the program. Within each pharmacy, staff that participated in implementing CPESN were surveyed including pharmacy owners or managers, the lead pharmacists, other pharmacists, pharmacy technicians, data entry specialists, and delivery drivers. Pharmacies varied in their staffing models to support CPESN. As an example, some pharmacies had only one staff member responsible for CPESN implementation, such as the owner, whereas other pharmacies had several pharmacists and technicians that supported CPESN.

Intervention Description

This dissertation examined the implementation of CPESN in North Carolina. CPESN is an open network of community pharmacies (meaning anyone that meets the requirements can participate) that have agreed to offer enhanced medication management services, document those services in PHARMACeHOME, and receive payment for those services based on performance. The medication management services are based on a population health management approach. CCNC identifies HNHC patients using their proprietary risk score based on chronic conditions.
and disease severity; then, participating pharmacies deliver medication management services to those patients and coordinate that service with other providers in CCNC’s statewide patient-centered medical home network. The specific enhanced medication management services that are offered are divided into required and optional services. One of the key services required for reimbursement is a comprehensive medication review (CMR) to identify opportunities for improving medication management and reduce risk of medication problems. CPESN is funded by a 3-year pilot grant from the Center for Medicare and Medicaid Innovation.

Data Sources

The three aims explored in this dissertation relied on both qualitative and quantitative data sources. Qualitative data were collected through in-depth, semi-structured interviews with community pharmacy representatives who were responsible for overseeing CPESN implementation. There were three sources of quantitative data including survey data, program administrative data, and county health ranking data.

In fall 2016, we administered a paper-based survey to community pharmacies that participated in either the first or second year of the NC-CPESN program. The survey assessed pharmacies’ organizational characteristics, experience with NC-CPESN, and perceptions about implementation (e.g., implementation climate, innovation-values fit). A committee of researchers and community pharmacy practitioners reviewed the survey items’ content, readability, and formatting. The survey questions were also piloted in a small group of community pharmacists (n=5). The survey was mailed to participating pharmacies along with other NC-CPESN program materials to increase the response rate. Pharmacies also received three email reminders at ~2, 4, and 8 weeks after the survey was mailed. Within the pharmacy, employees that were intended users of NC-CPESN (e.g., pharmacists, pharmacy technicians, and administrative staff) completed the survey. We received surveys from 191 of 268 pharmacies (71.3% response rate).
In addition, we used 2016 NC-CPESN program administrative data and 2016 county health ranking data. Program administrative data provided information on the number of high-risk patients attributed to each pharmacy, patient demographics, and the amount of the intervention that was delivered. County health ranking data included county-level measures of clinical (e.g., healthcare access) and social (e.g., insurance status) factors that might affect the pharmacy’s implementation of NC-CPESN. The operationalization of these measures is described below.

**Variables and Measurement**

**Aim 1 Measures**

*Implementation of a CMR for high-risk patients.* Based upon whether a pharmacy implemented a CMR on any attributed high-risk patient, we divided the sample into implementers (e.g., \( \geq 1 \) CMR for an attributed high-risk patient) and non-implementers (e.g., no CMR for any attributed high-risk patients) between Nov 2016 and Jan 2017. We chose this quarter because there were no changes to the intervention (e.g., intervention requirements or payment model) during this or the previous quarter. We measured implementation effectiveness over a quarter to correspond with CCNC’s performance measures. High risk was defined as having a care triage score \( \geq 75 \). Care triage score is a proprietary measure used by CCNC to estimate a patient’s risk for hospitalization. Patients with triage scores \( \geq 75 \) are considered a priority population for CCNC. Patients are defined as attributed to a pharmacy if they filled at least one chronic medication within the last 90 days or \( \geq 80\% \) of their medications for at least two of three months within the quarter.
Propportion of high-risk patients receiving a CMR. Second, we measured implementation effectiveness to assess the reach of the intervention among attributed high-risk patients. We calculated the number of attributed high-risk patients receiving a CMR divided by the number of high-risk, attributed patients per pharmacy during a program quarter.

Independent Variables

Implementation climate. Implementation climate was defined using four survey items assessing the extent to which NC-CPESN was supported, rewarded, and expected within the pharmacy (e.g., “Our pharmacy allocates sufficient time to delivering enhanced pharmacy services” and “Our pharmacy devotes adequate resources to implementing enhanced pharmacy services”). The questions included group rather than individual referents, which is recommended when assessing organizational-level outcomes such as implementation climate. Each item was measured on 5-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). The survey items were summed for individual staff members, and the mean of all individuals in the pharmacy was calculated to produce a pharmacy-level measure. Higher values of the score corresponded with positive perceptions of implementation climate.

Innovation-values fit. Innovation-values fit was defined using four survey items assessing staff perceptions about the extent to which NC-CPESN fit with the values of the pharmacy (e.g., “Delivering enhanced pharmacy services is consistent with providing the best care possible for our patients”) and of the pharmacy profession (“Delivering enhanced pharmacy services is important for advancing the field of pharmacy”). As with implementation climate, the innovation-values fit questions were group-referenced, measured on the same 5-point Likert scale, aggregated from individual responses to produce a pharmacy-level mean, and ordered so that higher scores corresponded to positive perceptions.
Other independent variables. Patients’ needs and resources were measured by rural location, clinical factors, social factors, 340B participation, and proportion of high-risk patients. Rural location was defined as a binary variable (e.g., urban, rural) using a zip code approximation of the rural-urban commuting area (RUCA) codes. Clinical factors were defined using a pre-existing, county-level composite measure of access to care items (e.g., primary care provider ratio, uninsured rate) and quality of care items (e.g., preventable hospital stays, diabetes monitoring) ranging from 0-100.10 Social factors were defined using a pre-existing, county-level composite measure of items such as education, employment, uninsured, and income ranging from 0-100.10 The clinical and social factor scales were recoded so that higher values on the scale were associated with better patient outcomes. Participation in 340B Drug Pricing Program was measured as a binary variable. Proportion of high-risk patients was defined as the number of attributed high-risk patients divided by the number of attributed patients per pharmacy over a program quarter.

Available resources were measured by three variables: the presence of a clinical pharmacist (binary), total number of full- and part-time staff (e.g., pharmacists, pharmacy technicians, administrative staff), and the presence of pharmacy students or residents in the past month (binary).

Access to knowledge and information about the intervention was measured in three ways: (1) experience with NC-CPESN, defined as the number of months the pharmacy was enrolled in NC-CPESN; (2) past performance with NC-CPESN, measured using a lagged dependent variable (e.g., proportion of CMRs completed per high-risk patients) for the previous program quarter (Aug – Oct 2016); and (3) participation in Medicare Part D MTM (binary).
Structural characteristics were assessed by three variables. First, independent ownership was a binary variable: single and multiple independent pharmacies versus chain, outpatient, and federally qualified health center pharmacies. We used a binary variable due to small sample sizes within the chain and outpatient pharmacy categories. Second, prescription volume was dichotomized as low (< 2000 prescriptions/week) versus high (≥2000 prescriptions/week). Third, established pharmacies were those that had been in operation for more than 20 years.

Aim 2 and Aim 3 Measures

A semi-structured interview guide was developed to explore environmental determinants of implementation effectiveness (e.g., network ties) (aim 2) and the stages of the innovation process from Rogers’ stages of the innovation process in organizations (aim 3).6,12 During the first half of the interview, participants were asked to describe the strategies the pharmacy used to implement CPESN at various stages of implementation (e.g., pre-implementation, implementation, and sustainment).12 During the first half of the interview, participants were asked to describe their pharmacy’s relationships with external organizations (e.g., healthcare providers, care managers) and relationships with patients.

Data Analysis by Aim

Aim 1

Descriptive statistics. Frequencies and percentages were used to describe the study population. We conducted bivariate analyses to compare the sample characteristics between implementers (completed ≥ 1 CMR during the program quarter) and non-implementers (no completed CMR during the program quarter).

Exploratory factor analyses. To determine if survey items could be adequately summarized using implementation climate and innovation-values fit scales, we first assessed whether the correlation matrix was factorable by examining the pairwise correlations among the
items and conducting a Barlett’s test of sphericity and a Kaiser-Meyer-Olkin (KMO) test. Second, we defined the number of initial factors using principal component analysis using orthogonal varimax rotation to improve interpretability. Finally, we confirmed the number of extracted factors using two decision rules: 1) eigenvalue >1 and 2) the number of eigenvalues from the factor analysis that are larger than the eigenvalues from randomly generated data (e.g., parallel analysis test). We assessed the reliability of the two scales using Cronbach’s alpha. To ensure the results were not sensitive to the method of factor extraction, we ran a common factor analysis using principal axis factoring and did not find differences in the results. Since the measures of implementation climate and innovation-values fit were aggregated from multiple staff roles within the pharmacy (e.g., pharmacists, pharmacy technicians, and administrative staff), we compared the results of the exploratory factor analyses by these sub-groups and did not find differences in the results. Since all of the implementation climate and innovation-values fit items were measured using similar Likert scales of measurement, we did not standardize the scores (e.g., z scores) prior to conducting the exploratory factor analysis.

Hurdle regression model. Hurdle regression is a two-equation model for count data: one equation determines the likelihood of an outcome (e.g., whether a pharmacy implemented a CMR) and the other examines the positive outcomes (e.g., how many CMRs were delivered to high-risk patients). We used a hurdle regression to model both of these processes and to account for an excess of zeroes in the dependent variable (40.8% of the sample had zero implementation in the program quarter). For the first stage, we used a logistic regression to determine the probability of a pharmacy implementing a CMR for a high-risk patient (e.g., implementer versus non-implementer). For the second stage, we used a zero-truncated negative binomial model to determine how many CMRs were delivered to high-risk patients (e.g.,
program reach). A negative binomial model was selected over a Poisson model to account for overdispersion in the data (i.e., the variance was larger than the mean). For the negative binomial model, we treated the denominator (i.e., number of high-risk patients) as the exposure to adjust for differences in the opportunity available to deliver the intervention and assumed the unobserved heterogeneity was gamma distributed (i.e., NB2 model). We compared this model with a zero-inflated negative binomial, which is another two-equation model for count data; we did not find differences in the results. Therefore, we used the hurdle regression.

In the hurdle regression, we included the key variables of interest (e.g., implementation climate, innovation-values fit, and an interaction of the two) and control variables selected a priori (e.g., patient needs and resources, available resources). We assessed the goodness of fit for the interaction term in both stages of the model since interpretation of marginal effects on interaction terms can be complicated in non-linear models. Since the interaction term improved fit in both stages, we included the term. One control variable, past performance with NC-CPESN, was a lagged dependent variable, which can caused biased coefficients if the data generating process is non-stationary. Using the Harris-Tzavalis test, which can be used when the number of time periods is small relative to the number of panels, we rejected the null hypothesis that the data generating process is non-stationary. Therefore, we included the lagged dependent variable in the model. We used cluster-robust standard errors to account for clustering that might occur at the network level. NC-CPESN pharmacies are grouped into regional networks by CCNC and may receive different levels and quality of implementation support across networks. Because the amount of missing data in both equations of the model was less than 10% (8.0% and 5.8% respectively), we addressed missingness using complete case analysis. To test whether missingness might be correlated with the dependent variable, we compared the
proportion of implementers and non-implementers between survey respondents and non-respondents and did not find significant differences ($\chi^2 = 2.27$, $p = 0.132$). We conducted the analyses using Stata version 13.0 (College Station, TX).

**Aim 2 and Aim 3**

For Aims 2 and 3, thematic analysis was conducted using Dedoose (version 7.0) to analyze the qualitative data. First, a set of structural codes were developed based on Roger’s theory$^{12,18}$ and the CFIR.$^6$ Two members of the research team coded five transcripts to: determine how similarly codes were being applied; develop a set of emergent codes$^{18}$; and reach consensus on code definitions. One author coded the remaining transcripts. After transcripts were coded, a summary was sent to three of the interview participants to confirm the findings; this member-checking process helps ensure that the interpretation is consistent with the experiences of study participants.$^{19}$ Interview participants who were consulted agreed with the interpretation of the findings and did not suggest any modifications.
REFERENCES


CHAPTER 4. ORGANIZATIONAL DETERMINANTS THAT INFLUENCE IMPLEMENTATION EFFECTIVENESS IN A COMMUNITY PHARMACY MEDICAID MEDICATION MANAGEMENT PROGRAM

Introduction

Many state Medicaid programs have expanded enrollment eligibility under the Affordable Care Act, making Medicaid the largest health insurance program in the U.S.\textsuperscript{1,2} Medicaid spending is largely driven by a small subset of high-risk patients; five percent of Medicaid beneficiaries account for almost half of Medicaid expenditures.\textsuperscript{3} This small subset of beneficiaries is disproportionately impacted by chronic conditions, such as diabetes and asthma, and the co-occurrence of difficult-to-treat conditions (e.g., substance use and mental health conditions).\textsuperscript{3} To improve chronic disease management, several Medicaid programs have implemented medication management programs in partnership with pharmacists.\textsuperscript{4-6}

Pharmacist-led medication management programs have improved patients’ medication adherence and therapeutic outcomes (e.g., blood pressure, hemoglobin A1C) while reducing healthcare costs.\textsuperscript{7-10} However, researchers have had difficulty attributing changes in patient outcomes to specific program features due to the wide variability in medication management programs.\textsuperscript{4,11} In the Medicare Part D Medication Therapy Management (MTM) program, for example, researchers have noted that medication services are delivered in a variety of settings (e.g., call centers, outpatient care) and formats (e.g., in-person vs. phone).\textsuperscript{11} Similar challenges exist in Medicaid medication management programs—programs vary in patient eligibility criteria, the services provided, and the setting of service delivery.\textsuperscript{4}
In addition to program design variability, there are a limited number of studies examining implementation of pharmacist-led medication management programs, making it difficult to assess why program outcomes might vary across organizations. Many of the studies that have examined organizational determinants of implementation effectiveness in pharmacist-led medication management programs have been qualitative, limiting their generalizability, or have not been guided by a theory, making it difficult to interpret the findings. Past studies have identified factors, such as organizational structure (e.g., staff size), leadership support, and financial resource availability\textsuperscript{12-16}, but not applied theory to demonstrate how these factors work in concert to produce effective implementation. Thus, this study will test the applicability of the organizational theory of innovation implementation effectiveness to examine implementation of a community pharmacy Medicaid medication management program.

**Conceptual Framework**

Implementation theories have been developed to identify the organizational factors and underlying relationships that are hypothesized to influence effective implementation (i.e., the quality and consistency of implementation).\textsuperscript{17,18} The organizational theory of innovation implementation effectiveness was designed for complex innovations like medication management programs, which often require coordinated use by multiple individuals to be effective.\textsuperscript{18-20} This theory posits that effective implementation is driven by an organization’s implementation climate and the fit between the innovation and organization values (Figure 4.1).\textsuperscript{18-20} For example, a community pharmacy might develop formal policies or strategies to support implementation of medication management program such as employee training, reward and recognition systems, or job reassignment. The collective influence of the pharmacy’s implementation policies, in turn, affects employees’ shared perceptions about the extent to which the medication management program is rewarded, supported, and expected (implementation
Positive perceptions about implementation climate are likely to increase employees’ acceptance of medication management programs, increasingly the likelihood that pharmacy staff will appropriately implement medication management programs (i.e., as the pharmacy intended for it to be implemented) and ultimately increase implementation effectiveness. Therefore, we hypothesize that positive perceptions about implementation climate will be positively associated with implementation effectiveness (H1).

The organizational theory of innovation implementation effectiveness maintains that innovation-values fit also affects implementation effectiveness. Specifically, pharmacy employees’ perceptions about how well medication management programs align with the values of the pharmacy and the pharmacy profession affect implementation effectiveness both directly and indirectly. If pharmacy employees perceive that medication management programs do not align with the pharmacy’s values, the employee may be less committed to implementation and exert less effort towards ensuring effective implementation. Innovation-values fit is also likely to impact the relationship between implementation climate and implementation effectiveness. Since innovation-values fit affects commitment, the impact of implementation climate on implementation effectiveness will be amplified by positive, and weakened by negative, perceptions about innovation-values fit. Thus, we hypothesize that positive perceptions about innovation-values fit will directly and positively affect implementation effectiveness (H2) and moderate the relationship between implementation climate and implementation effectiveness (H3).

Implementation effectiveness is also likely to be affected by broader environmental and organizational factors (e.g., organizational context). Based on the consolidated framework for implementation research (CFIR), we hypothesize four factors influence implementation
effectiveness: patient needs and resources, available resources, access to knowledge and information, and structural characteristics.\textsuperscript{21} For example, community pharmacies that serve a higher proportion of high-risk patients may be better at implementing innovations for high-risk populations. Additionally, pharmacies in rural locations may be better at implementing innovations for high-risk populations since residents in rural areas have higher rates of chronic illness.\textsuperscript{22} Implementation effectiveness is also likely to be positively influenced by a pharmacy’s available resources, such as amount of staff and training of staff, and access to knowledge and information about medication management programs (e.g., experience implementing similar interventions). Conversely, certain structural characteristics may negatively affect implementation effectiveness. For example, pharmacies that have opened recently may not have as strong of ties with patients as pharmacies that have been in operation for many years (e.g., the liability of newness hypothesis).\textsuperscript{23} Similarly, larger pharmacies may be impeded by a more formal organizational structure, which can negatively impact innovation implementation.\textsuperscript{24} For instance, managers of independently owned pharmacies may have greater decisional autonomy because there is less formalization in the organization and as a result, be better able to support implementation of medication management programs. Therefore, we hypothesize that four contextual factors, patient needs and resources, available resources, access to knowledge, and structural characteristics, will affect implementation effectiveness (H4).

**Methods**

**Study Design**

We used a cross-sectional design examining implementation of a community pharmacy Medicaid medication management program during the program year of 2016. The unit of analysis was at the pharmacy level.
**Intervention Description**

The community pharmacy enhanced services network (CPESN\textsuperscript{SM}) is a national network of community pharmacies that offer medication management services.\textsuperscript{25} This study examines the North Carolina CPESN (NC-CPESN), the pioneer site for CPESN.\textsuperscript{6} NC-CPESN was launched in 2014 by the Community Care of North Carolina (CCNC)—the primary case management provider for NC Medicaid beneficiaries.\textsuperscript{6,26} NC-CPESN requires community pharmacies to: (1) provide certain medication management services; (2) be pharmacies responsible for the outcomes of a defined patient population through value-based payment; and (3) tailor services based on patients’ risk score. One of the key services required for reimbursement is a comprehensive medication review (CMR) to identify opportunities for improving medication management and reduce risk of medication problems. Patients include Medicaid, Medicare, and NC Health Choice beneficiaries, as well as dual-eligible patients.

**Study Population**

The study population included community pharmacies that participated in either the first year or the second year of the 3-year NC-CPESN program (September 2014-August 2017); pharmacies that joined in the third year were excluded from the analysis because they had little-to-no experience with implementation at the time of the survey (described below). We excluded results of surveys completed in August 2017 because the intervention (e.g., requirements for delivering a CMR) and payment model (e.g., amount of payment per CMR) changed and we did not think implementation measures would be comparable at the two time points.

**Data Sources**

In fall 2016, we administered a paper-based survey to community pharmacies that participated in either the first or second year of the NC-CPESN program. The survey assessed pharmacies’ organizational characteristics, experience with NC-CPESN, and perceptions about
implementation (e.g., implementation climate, innovation-values fit). A committee of researchers and community pharmacy practitioners reviewed the survey items’ content, readability, and formatting. The survey questions were also piloted in a small group of community pharmacists (n=5). The survey was mailed to participating pharmacies along with other NC-CPESN program materials to increase the response rate. Pharmacies also received three email reminders at ~2, 4, and 8 weeks after the survey was mailed. Within the pharmacy, employees that were intended users of NC-CPESN (e.g., pharmacists, pharmacy technicians, and administrative staff) completed the survey. We did not include supporters of NC-CPESN (e.g., pharmacy owners) since their actions indirectly rather than directly affect implementation, a decision that is consistent with other implementation studies.\textsuperscript{19,27} We often had more than one respondent per pharmacy; therefore, the responses were aggregated to the pharmacy-level (description below).

We received surveys from 191 of 268 pharmacies (71.3\% response rate).

In addition, we used 2016 NC-CPESN program administrative data and 2016 county health ranking data.\textsuperscript{28} Program administrative data provided information on the number of high-risk patients attributed to each pharmacy, patient demographics, and the amount of the intervention that was delivered. County health ranking data included county-level measures of clinical (e.g., healthcare access) and social (e.g., insurance status) factors that might affect the pharmacy’s implementation of NC-CPESN.\textsuperscript{28} The operationalization of these measures is described below.

**Dependent Variables**

*Implementation of a CMR for high-risk patients.* Based upon whether a pharmacy implemented a CMR on any attributed high-risk patient, we divided the sample into implementers (e.g., \( \geq 1 \) CMR for an attributed high-risk patient) and non-implementers (e.g., no CMR for any attributed high-risk patients) between Nov 2016 and Jan 2017. We chose this
quarter because there were no changes to the intervention (e.g., intervention requirements or payment model) during this or the previous quarter. We measured implementation effectiveness over a quarter to correspond with CCNC’s performance measures. High risk was defined as having a care triage score $\geq 75$. Care triage score is a proprietary measure used by CCNC to estimate a patient’s risk for hospitalization. Patients with care triage scores $\geq 75$ are considered a priority population for CCNC. Patients are defined as attributed to a pharmacy if they filled at least one chronic medication within the last 90 days or $\geq 80\%$ of their medications for at least two of three months within the quarter.

Proportion of high-risk patients receiving a CMR. Second, we measured implementation effectiveness to assess the reach of the intervention among attributed high-risk patients. We calculated the number of attributed high-risk patients receiving a CMR divided by the number of high-risk, attributed patients per pharmacy during a program quarter.

Independent Variables

Implementation climate. Implementation climate was defined using four survey items assessing the extent to which NC-CPESN was supported, rewarded, and expected within the pharmacy (e.g., “Our pharmacy allocates sufficient time to delivering enhanced pharmacy services” and “Our pharmacy devotes adequate resources to implementing enhanced pharmacy services”). The survey items were adapted for a pharmacy setting from a scale validated in an oncology setting. The questions included group rather than individual referents, which is recommended when assessing organizational-level outcomes such as implementation climate. Each item was measured on 5-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). The survey items were summed for individual staff members, and the mean of all individuals in the pharmacy was calculated to produce a pharmacy-level measure. Higher values of the score corresponded with positive perceptions of implementation climate.
Innovation-values fit. Innovation-values fit was defined using four survey items assessing staff perceptions about the extent to which NC-CPESN fit with the values of the pharmacy (e.g., “Delivering enhanced pharmacy services is consistent with providing the best care possible for our patients”) and of the pharmacy profession (“Delivering enhanced pharmacy services is important for advancing the field of pharmacy”). As with implementation climate, the innovation-values fit questions were group-referenced, measured on the same 5-point Likert scale, aggregated from individual responses to produce a pharmacy-level mean, and ordered so that higher scores corresponded to positive perceptions.

Other independent variables. Patients’ needs and resources were measured by rural location, clinical factors, social factors, 340B participation, and proportion of high-risk patients. Rural location was defined as a binary variable (e.g., urban, rural) using a zip code approximation of the rural-urban commuting area (RUCA) codes. Clinical factors were defined using a pre-existing, county-level composite measure of access to care items (e.g., primary care provider ratio, uninsured rate) and quality of care items (e.g., preventable hospital stays, diabetes monitoring) ranging from 0-100. Social factors were defined using a pre-existing, county-level composite measure of items such as education, employment, uninsured, and income ranging from 0-100. The clinical and social factor scales were recoded so that higher values on the scale were associated with better patient outcomes. Participation in 340B Drug Pricing Program was measured as a binary variable. Proportion of high-risk patients was defined as the number of attributed high-risk patients divided by the number of attributed patients per pharmacy over a program quarter.

Available resources were measured by three variables: the presence of a clinical pharmacist (binary), total number of full- and part-time staff (e.g., pharmacists, pharmacy
technicians, administrative staff), and the presence of pharmacy students or residents in the past month (binary).

Access to knowledge and information about the intervention was measured in three ways: (1) experience with NC-CPESN, defined as the number of months the pharmacy was enrolled in NC-CPESN; (2) past performance with NC-CPESN, measured using a lagged dependent variable (e.g., proportion of CMRs completed per high-risk patients) for the previous program quarter (Aug – Oct 2016); and (3) participation in Medicare Part D MTM (binary).

Structural characteristics were assessed by three variables. First, independent ownership was a binary variable: single and multiple independent pharmacies versus chain, outpatient, and federally qualified health center pharmacies. We used a binary variable due to small sample sizes within the chain and outpatient pharmacy categories. Second, prescription volume was dichotomized as low (< 2000 prescriptions/week) versus high (≥2000 prescriptions/week). Third, established pharmacies were those that had been in operation for more than 20 years.

Statistical Analysis

Descriptive statistics. Frequencies and percentages were used to describe the study population. We conducted bivariate analyses to compare the sample characteristics between implementers (completed ≥ 1 CMR during the program quarter) and non-implementers (no completed CMR during the program quarter).

Exploratory factor analyses. To determine if implementation climate and innovation-values survey items could be used as distinct variables, we conducted three analyses. First, we examined pairwise correlations among the items and conducted a Barlett’s test of sphericity and a Kaiser-Meyer-Olkin (KMO) test. Second, we defined the number of initial factors using principal component analysis and rotated the factors using orthogonal varimax rotation to improve interpretability. Finally, we confirmed the number of extracted factors using two
decision rules: 1) the number of eigenvalues >1.0; and 2) the number of eigenvalues from the factor analysis that were larger than the eigenvalues from randomly generated data (e.g., parallel analysis test). We also assessed the internal consistency of the two scales using Cronbach’s coefficient alpha. To ensure the results were not overly sensitive to the method of factor extraction, we conducted a sensitivity analysis by running a common factor analysis using principal axis factoring and did not find differences in the results. We also compared the results of the exploratory factor analyses by staff roles within pharmacies (e.g., pharmacists, pharmacy technicians, and administrative staff) to determine if results from different staff types could be aggregated to the pharmacy level. Factor analyses did not differ by subgroup, suggesting that aggregating subgroups was appropriate.

Hurdle regression model. Hurdle regression is a two-equation model for count data: one equation determines the likelihood of an outcome (e.g., whether a pharmacy implemented a CMR) and the other examines the positive outcomes (e.g., how many CMRs were delivered to high-risk patients). We used a hurdle regression to model both of these processes and to account for an excess of zeroes in the dependent variable (40.8% of the sample had zero implementation in the program quarter). For the first stage, we used a logistic regression to determine the probability of a pharmacy implementing a CMR for a high-risk patient (e.g., implementer versus non-implementer). For the second stage, we used a zero-truncated negative binomial model to determine how many CMRs were delivered to high-risk patients (e.g., program reach). A negative binomial model was selected over a Poisson model to account for overdispersion in the data (i.e., the variance was larger than the mean). For the negative binomial model, we treated the denominator (i.e., number of high-risk patients) as the exposure to adjust for differences in the opportunity available to deliver the intervention and assumed the
unobserved heterogeneity was gamma distributed (i.e., NB2 model). We compared this model with a zero-inflated negative binomial, which is another two-equation model for count data; we did not find differences in the results. Therefore, we used the hurdle regression.

In the hurdle regression, we included the key variables of interest (e.g., implementation climate, innovation-values fit, and an interaction of the two) and control variables selected a priori (e.g., patient needs and resources, available resources). We assessed the goodness of fit for the interaction term in both stages of the model since interpretation of marginal effects on interaction terms can be complicated in non-linear models. Since the interaction term improved fit in both stages, we included the term. One control variable, past performance with NC-CPESN, was a lagged dependent variable, which can caused biased coefficients if the data generating process is non-stationary. Using the Harris-Tzavalis test, which can be used when the number of time periods is small relative to the number of panels, we rejected the null hypothesis that the data generating process is non-stationary. Therefore, we included the lagged dependent variable in the model. We used cluster-robust standard errors to account for clustering that might occur at the network level. NC-CPESN pharmacies are grouped into regional networks by CCNC and may receive different levels and quality of implementation support across networks. Because the amount of missing data in both equations of the model was less than 10% (8.0% and 5.8% respectively), we addressed missingness using complete case analysis. To test whether missingness might be correlated with the dependent variable, we compared the proportion of implementers and non-implementers between survey respondents and non-respondents and did not find significant differences ($\chi^2 = 2.27, p =0.132$). We conducted the analyses using Stata version 13.0 (College Station, TX).
Results

Of the 191 pharmacies in our sample, 113 (59.16%) were implementers. Pharmacies that successfully implemented a CMR had a significantly higher mean implementation climate (11.81 vs. 3.55, p=0.000) and innovation-values fit (13.55 vs. 11.06, p=0.000) scores (Table 4.1). In terms of patient needs and resources, implementing pharmacies were significantly more likely to participate in the 340B Drug Pricing Program (69.12% vs. 30.88%, p=0.024) and have a higher proportion of high-risk patients (0.42 vs. 0.36, p=0.004). For available resources, implementing pharmacies were more likely to have a clinical pharmacist (86.49% vs. 13.51%, p=0.000) and either a pharmacy student or resident on staff (92.86 vs. 7.14%, p=0.000). Implementing pharmacies had more experience with NC-CPESN (34.37 vs. 27.05, months p=0.000) and had a higher proportion of CMRs performed among high-risk patients in the previous quarter (0.03 vs. 0.00, p=0.000). For structural characteristics of pharmacies, we did not find any significant differences among implementers versus non-implementers.

Exploratory Factor Analysis

All pairwise correlations among the items in the implementation climate and innovation-values scales were greater than >.30, indicating there was sufficient correlation for factor analysis. Further, none of the pairwise correlations exceeded >.80, indicating that high multicollinearity was not a problem. The Bartlett’s test of sphericity was significant for the implementation climate ($\chi^2 = 1975.43, p = 0.000$) and the innovation-values fit scale ($\chi^2 = 1077.83, p = 0.000$). Therefore, we rejected the null hypothesis that either matrix was an identity matrix. The KMO statistic for implementation climate and innovation-values fit scales was 0.773 and 0.818, respectively, which are within an acceptable range to support factor analysis (greater than >.60).
Factor loadings produced from the principal component analysis (Table 4.3) suggest that survey items measuring implementation climate or innovation-values fit load onto two distinct factors. For each set of items, only one factor had an eigenvalue exceeding 1.0 (implementation climate: largest EV = 2.77; innovation-values fit: largest EV = 3.35), and these eigenvalues were greater than eigenvalues from a randomly generated data set, suggesting one factor should be extracted for each set of items. The total amount of variance in the items explained by the two extracted factors was 79.27% for implementation climate and 83.63% for innovation-values fit. There were several items that had double factor loadings (e.g., loaded onto more than one factor) (Table 4.3); however, based on our decision rules as well as our theory we retained one extracted factor for each set of items. Cronbach’s coefficient alpha was 0.845 for the implementation climate scale and 0.833 for the innovation-values scale, suggesting the items have ‘very good’ internal consistency.37

**Hurdle Regression: Equation 1**

*Hypothesis 1.* The first equation of the hurdle regression indicated that a one-unit increase in the implementation climate score increased the probability of NC-CPESN implementation by 2.65 percentage points holding all else constant (p=0.000) (Table 4.4). The predicted probability of NC-CPESN implementation for pharmacies with the median implementation climate score (9.14) was 0.66 compared to 0.84 for pharmacies with an implementation climate score at the 75th percentile (12.50).

*Hypothesis 2.* Similarly, an increase in innovation-values fit score increased the probability of NC-CPESN implementation by 2.17 percentage points (p=0.037). The predicted probability of NC-CPESN implementation for pharmacies with the median innovation-values score (13.07) was 0.61 compared to 0.66 for pharmacies with an implementation climate score at the 75th percentile (14.68).
Hypothesis 3. The marginal effect of innovation-values fit on the probability of NC-CPESN implementation increased as implementation climate score increased. The marginal effect began to decline at an implementation score of 8 (Figure 4.2).

Hypothesis 4. No significant differences in the probability of NC-CPESN implementation was found based on patients’ needs and resources. For available resources, the probability of implementing NC-CPESN was 9.86 percentage points higher for pharmacies that had a clinical pharmacist (p=0.038). In terms of access to knowledge and resources, amount of experience with NC-CPESN (p=0.004), past performance with NC-CPESN (p=0.000), and participation in Medicare Part D MTM (p=0.003) were each positively associated with the probability of implementing NC-CPESN. Within structural characteristics, the probability of implementing NC-CPESN was 4.14 percentage points higher among independently owned pharmacies (p=0.041).

Hurdle Regression: Equation 2

Hypothesis 1. Findings from the second equation of the hurdle regression indicated that a one-unit increase an implementation climate score was associated with a 5.05 increase in implementation of CMRs per high-risk patients holding all else constant (p=0.001). The predicted number of CMRs per high-risk patients for pharmacies with the median implementation-climate score (9.14) was 16.21 compared to 28.10 for pharmacies with an implementation climate score at the 75th percentile (12.50).

Hypothesis 2. Similarly, implementation of CMRs per high-risk patients was positively associated with innovation-values fit score (p=0.000). The predicted number of CMRs per high-risk patients for pharmacies with the median innovation-values score (13.07) was 32.09 compared to 59.36 for pharmacies with an implementation climate score at the 75th percentile (14.68).
Hypothesis 3. The marginal effect of innovation-values fit on the number of CMRs per high-risk patients increased as implementation climate score increased (Figure 4.3).

Hypothesis 4. In terms of patients’ needs and resources, pharmacies located in rural locations were associated with lower implementation of CMRs per high-risk patients (p=0.006). Conversely, pharmacies that participate in the 340B Drug Pricing Program were associated with higher implementation (p=0.026). For available resources, pharmacies with a clinical pharmacist were associated with higher implementation (p=0.002). However, an increase in total staff was associated with a 1.98 decrease in implementation of CMRs per high-risk patients (p=0.000). For available resources, implementation of CMRs per high-risk patients was positively associated with experience with NC-CPESN (p=0.004), past performance with NC-CPESN (p=0.000), and participation in Medicare Part D MTM (p=0.003). No significant differences in implementation were found based on structural characteristics.

Discussion

In this study, we used the organizational theory of innovation implementation effectiveness\textsuperscript{18-20} to test organizational factors that influence implementation effectiveness of a community pharmacy medication management intervention. Consistent with our hypothesis, we found that key constructs from this theory, such as implementation climate and innovation-values fit, were positively associated with implementation activity (e.g., implementation versus non-implementation) and program reach of NC-CPESN. To our knowledge, only one other quantitative study has examined the relationship between implementation climate and implementation effectiveness in healthcare,\textsuperscript{29} and no other study has explored the direct and indirect effects of innovation-values fit on implementation effectiveness. Contrary to our hypotheses of contextual factors, only certain factors, such as having a clinical pharmacist on
staff, participation in Medicare Part D MTM or 340B Drug Pricing Program, predicted both implementation activity and program reach.

We hypothesized that implementation climate and innovation-values fit would be positively and directly associated with implementation effectiveness, which was supported by our findings. These findings suggest that implementation climate and innovation-values fit were useful measures for predicting implementation activity and program reach. Further studies are needed to test whether these measures are predictive of implementation effectiveness across a wider variety of community pharmacy medication management programs. For example, we learned from previous qualitative work that NC-CPESN community pharmacy staff worked collaboratively to implement CMRs. For other medication management programs, organizations may rely on a single staff member to deliver the intervention and therefore group-level measures such as implementation climate may not be predictive of implementation effectiveness. In such settings, individual-referenced measures of implementation climate may be more valid.

The study results also supported the hypothesis that innovation-values fit moderates the effect of implementation climate on implementation effectiveness, indicating that implementation climate and innovation-values fit work in concert. Our findings also suggest that innovation-values fit may have a greater effect on implementation climate at lower levels of implementation climate and that the effect may diminish at higher levels of implementation climate (Figure 4.2). Further research is needed to establish whether there are diminishing returns to the effect of innovation-values fit on implementation climate and whether the relationship changes based on whether the outcome of interest is presence of implementation activity versus level of implementation activity (e.g., program reach). Additionally, future research is needed to determine what factors are positively associated with implementation
climate and innovation-values fit in community pharmacy medication management programs. For example, the organizational theory of innovation implementation effectiveness\textsuperscript{18–20} maintains that management support is an antecedent of implementation climate but there has been little quantitative research on how to operationalize the construct of management support. Recently, researchers have developed a measure for implementation leadership to assess which leadership qualities are correlated with successful implementation.\textsuperscript{38} Future studies could assess whether implementation leadership is associated with implementation climate. This has practical importance because identifying the leadership strategies and traits associated with effective implementation could provide guidance to pharmacy leaders on how to develop a supportive climate for medication management program implementation.

Contrary to our hypotheses, we found that only certain aspects of the organizational context affected both program reach and implementation activity. For example, none of the structural characteristics (e.g., pharmacy type, established pharmacy) were significantly associated with both program reach and implementation activity. Additional research is needed to determine which pharmacy structural characteristics are associated with successful implementation. Consistent with our hypotheses, access to knowledge and information (e.g., participation in Medicare Part D MTM), patient needs and resources (e.g., proportion of high-risk patients, participation in 340B Drug Pricing Program), and availability of certain resources (e.g., clinical pharmacist) positively affect implementation effectiveness. Prior theory suggests that establishing an implementation climate for one intervention may help facilitate implementation climate for a similar intervention.\textsuperscript{27} It is possible that community pharmacies use similar policies to support MTM and medication management services implementation (e.g., staff training on motivational interviewing)—explaining the positive association between
Medicare Part D MTM and NC-CPESN implementation. Future studies should use qualitative methods to explore the implementation policies and practices that community pharmacies establish to foster a climate for medication management services and whether these practices facilitate implementation of similar interventions. Such studies could be used to develop implementation guidance to support community pharmacies participating in multiple medication management programs simultaneously, which may increase as pharmacy participation in alternative payment models grows.

Limitations

This study had several limitations. First, since we measured implementation climate, innovation-values fit, and implementation effectiveness at the same time, we cannot establish the causal order. Second, the generalizability of our findings is limited by: (1) only having data at one time point; (2) conducting the study in NC, the first CPESN organization. Future studies are needed that to examine implementation of medication management programs over time and across settings. Third, our measures of implementation effectiveness, implementation activity and program reach among high-risk patients, are limited in scope and do not assess other important aspects of implementation effectiveness such as fidelity of CMR delivery. Future studies are needed to establish additional measures of implementation effectiveness (e.g., conducting site observations to measure CMR fidelity). Finally, we did not measure other determinants of implementation effectiveness including the presence of an innovation champion or variability in implementation climate perceptions. Future studies should develop and test these measures in medication management program settings.
Conclusion

As more state Medicaid programs adopt pharmacist-led medication management programs, it is important to identify what organizational determinants promote effective implementation of these programs. Our study supported the use of the organizational theory of innovation implementation effectiveness to identify organizational determinants that are associated with effective implementation (e.g., implementation climate and innovation-values fit).\textsuperscript{18-20} Unlike broader environmental factors or structural characteristics (e.g., pharmacy type), implementation climate and innovation-values fit are modifiable factors and can be targeted through intervention. Additional research is needed to determine what implementation strategies can be used by community pharmacy leaders and practitioners to develop a positive implementation climate and innovation-values fit for medication management programs.
Figure 4.1. The impact of implementation climate and innovation-values fit on implementation effectiveness

**Innovation-values fit**
(Perception of how well the innovation fits with mission of the organization and profession)

**Implementation climate**
(Perception of the extent to which the innovation is supported, rewarded, and expected)

**Organizational context**
(Broader environmental and organizational factors including patient needs and resources, available resources, access to knowledge and information, and structural characteristics)

**Implementation effectiveness**
(The quality and consistency of implementation)
Table 4.1. Descriptive statistics of community pharmacies participating in NC-CPESN

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Implementers (n=113)</th>
<th>Non-Implementers (n=78)</th>
<th>Total (n=191)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key independent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation climate</td>
<td>11.81 (3.0252)</td>
<td>3.55 (3.064)***</td>
<td>8.37 (5.087)</td>
<td>0-16</td>
</tr>
<tr>
<td>Innovation-values fit</td>
<td>13.55 (2.0218)</td>
<td>11.06 (3.99)***</td>
<td>12.51 (3.231)</td>
<td>0-16</td>
</tr>
<tr>
<td><strong>Patient needs and resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural location</td>
<td>57.78</td>
<td>42.22</td>
<td>23.56</td>
<td>0-1</td>
</tr>
<tr>
<td>Clinical factors</td>
<td>31.94 (29.78)</td>
<td>39.63 (29.40)</td>
<td>35.08 (29.8)</td>
<td>1-100</td>
</tr>
<tr>
<td>Social factors</td>
<td>44.07 (30.8)</td>
<td>46.36 (33.17)</td>
<td>45.01 (31.8)</td>
<td>1-100</td>
</tr>
<tr>
<td>340B participation</td>
<td>69.12</td>
<td>30.88*</td>
<td>36.76</td>
<td>0-1</td>
</tr>
<tr>
<td>Proportion of high-risk patients</td>
<td>0.42 (0.14)</td>
<td>0.36 (0.18)**</td>
<td>0.40 (0.16)</td>
<td>0-0.87</td>
</tr>
<tr>
<td><strong>Available resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of a clinical pharmacist</td>
<td>86.49</td>
<td>13.51***</td>
<td>19.37</td>
<td>0-1</td>
</tr>
<tr>
<td>Total number of staff</td>
<td>12.83 (6.464)</td>
<td>11.53 (8.827)</td>
<td>12.30 (7.525)</td>
<td>1-40</td>
</tr>
<tr>
<td>Presence of pharmacy student or resident</td>
<td>92.86</td>
<td>7.14***</td>
<td>21.99</td>
<td>0-1</td>
</tr>
<tr>
<td><strong>Access to knowledge and information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of experience with NC-CPESN (months)</td>
<td>34.37 (7.0546)</td>
<td>27.05 (7.96)***</td>
<td>31.38 (8.249)</td>
<td>12.1-44.7</td>
</tr>
<tr>
<td>Past performance with NC-CPESN</td>
<td>0.03 (0.04)</td>
<td>0.00 (0.00)**</td>
<td>0.02 (0.0)</td>
<td>0-0.31</td>
</tr>
<tr>
<td>Participation in Medicare Part D MTM</td>
<td>67.27</td>
<td>32.73***</td>
<td>86.39</td>
<td>0-1</td>
</tr>
<tr>
<td><strong>Structural characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent pharmacy</td>
<td>57.83</td>
<td>42.17</td>
<td>43.46</td>
<td>0-1</td>
</tr>
<tr>
<td>Low prescription volume</td>
<td>56.06</td>
<td>43.94</td>
<td>34.55</td>
<td>0-1</td>
</tr>
<tr>
<td>Established pharmacy</td>
<td>45.13</td>
<td>30.77</td>
<td>39.27</td>
<td>0-1</td>
</tr>
</tbody>
</table>

Note: significance of t-tests or Pearson chi-square tests comparing implementers to non-implementers: * p<0.05, ** p<0.01, *** p<0.001
Table 4.2. Correlation matrix for the implementation climate and innovation-values fit scales

| Item          | Implementation Climate |          |          | | Item          | Innovation-values Fit |          |          |          |
|---------------|------------------------|----------|----------| |                      |                         |          |          |          |
| 1 Support - Time |                        | 1.000    |          | | 1 Professional values | 1.000    |          |          |          |
| 2 Support - Resources |                    | 0.697    | 1.000    | | 2 Organizational values | 0.640    | 1.000    |          |          |
| 3 Expectation   |                        | 0.573    | 0.636    | 1.000 | | 3 Organizational values | 0.661    | 0.677    | 1.000    |          |
| 4 Reward        |                        | 0.486    | 0.531    | 0.493 | 1.000 | | 4 Professional values | 0.730    | 0.638    | 0.645    | 1.000    |
Table 4.3. Factor loadings from the rotated factor structure matrix for implementation climate and innovation-values fit scales

<table>
<thead>
<tr>
<th>Implementation Climate Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Support - Time] Our pharmacy allocates sufficient time to delivering enhanced pharmacy services.</td>
<td>0.523</td>
<td>-0.293</td>
<td>-0.396</td>
<td>0.644</td>
</tr>
<tr>
<td>[Support - Resources] Our pharmacy devotes adequate resources to implementing enhanced pharmacy services.</td>
<td>0.543</td>
<td>-0.296</td>
<td>-0.218</td>
<td>-0.055</td>
</tr>
<tr>
<td>[Expectation] In our pharmacy, we are expected to participate in the delivery of enhanced pharmacy services.</td>
<td>0.487</td>
<td>-0.037</td>
<td>0.565</td>
<td>0.114</td>
</tr>
<tr>
<td>[Reward] In our pharmacy, individuals receive recognition for participating in the delivery of enhanced pharmacy services.</td>
<td>0.442</td>
<td>0.610</td>
<td>-0.216</td>
<td>0.040</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation-Values Fit Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Professional values] Delivering enhanced pharmacy services is what pharmacies should be doing.</td>
<td>0.498</td>
<td>-0.224</td>
<td>0.651</td>
<td>-0.232</td>
</tr>
<tr>
<td>[Organizational values] Delivering enhanced pharmacy services is consistent with providing the best care possible for our patients.</td>
<td>0.501</td>
<td>-0.068</td>
<td>-0.128</td>
<td>0.369</td>
</tr>
<tr>
<td>[Organizational values] Delivering enhanced pharmacy services is important for improving health outcomes for our patient population.</td>
<td>0.506</td>
<td>0.406</td>
<td>-0.308</td>
<td>-0.096</td>
</tr>
<tr>
<td>[Professional values] Delivering enhanced pharmacy services is important for advancing the field of pharmacy.</td>
<td>0.495</td>
<td>0.185</td>
<td>0.295</td>
<td>0.371</td>
</tr>
</tbody>
</table>

Note: Underlined factor loadings indicate double loading on two or more factors. Factor loadings in bold indicate the factor on which the item was placed.
Table 4.4. Parameter estimates from Hurdle regression of NC-CPESN Implementation and Program Reach of NC-CPESN Implementation

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Equation 1: Binary (Implementation)</th>
<th>Equation 2: Positives (Program Reach)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AME&lt;sup&gt;a&lt;/sup&gt; (SE)</td>
<td>AME&lt;sup&gt;b&lt;/sup&gt; (SE)</td>
</tr>
<tr>
<td><strong>Key independent variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation climate&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.65 (1.85 X 10&lt;sup&gt;3&lt;/sup&gt;)&lt;sup&gt;***&lt;/sup&gt;</td>
<td>5.05 (1.5)&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>Innovation-values fit&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.17 (1.041 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>11.79 (3.170)&lt;sup&gt;***&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Patient needs and resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural location</td>
<td>-0.77 (0.016)</td>
<td>-12.81 (4.658)&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>Clinical factors</td>
<td>-0.04 (3 X 10&lt;sup&gt;4&lt;/sup&gt;)</td>
<td>-0.14 (0.11)</td>
</tr>
<tr>
<td>Social factors</td>
<td>-0.06 (3 X 10&lt;sup&gt;4&lt;/sup&gt;)</td>
<td>-0.10 (0.10)</td>
</tr>
<tr>
<td>340B participation</td>
<td>5.70 (3.50 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>12.80 (5.760)&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Proportion of high-risk patients</td>
<td>0.00 (0.00)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>—</td>
</tr>
<tr>
<td>Log of high-risk patients</td>
<td>—</td>
<td>(exposure)</td>
</tr>
<tr>
<td><strong>Available resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of a clinical pharmacist</td>
<td>9.86 (4.75 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>32.33 (10.670)&lt;sup&gt;***&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total number of staff</td>
<td>-0.31 (2.6 X 10&lt;sup&gt;3&lt;/sup&gt;)</td>
<td>-1.98 (0.550)&lt;sup&gt;***&lt;/sup&gt;</td>
</tr>
<tr>
<td>Presence of pharmacy student or resident</td>
<td>6.86 (6.37 X 10&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>14.55 (7.273)</td>
</tr>
<tr>
<td><strong>Access to knowledge and information</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of experience with NC-CPESN (months)</td>
<td>0.43 (1.3 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;**&lt;/sup&gt;</td>
<td>1.57 (0.610)&lt;sup&gt;***&lt;/sup&gt;</td>
</tr>
<tr>
<td>Past performance with NC-CPESN</td>
<td>0.46 (1.3 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;***&lt;/sup&gt;</td>
<td>0.10 (0.031)&lt;sup&gt;***&lt;/sup&gt;</td>
</tr>
<tr>
<td>Participation in Medicare Part D MTM</td>
<td>18.73 (6.246 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;**&lt;/sup&gt;</td>
<td>28.05 (13.83)&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Structural characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent pharmacy</td>
<td>4.14 (2.02 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>0.43 (5.6)</td>
</tr>
<tr>
<td>Low prescription volume</td>
<td>1.08 (0.032)</td>
<td>7.23 (7.21)</td>
</tr>
<tr>
<td>Established pharmacy</td>
<td>2.02 (0.015)</td>
<td>4.14 (7.46)</td>
</tr>
<tr>
<td><strong>Alpha</strong></td>
<td>—</td>
<td>0.56 (7.08 X 10&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-21.04 (4.79)&lt;sup&gt;***&lt;/sup&gt;</td>
<td>-14.03 (1.383)&lt;sup&gt;***&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>180</td>
<td>104</td>
</tr>
</tbody>
</table>

Significance of hurdle regression: * p<0.05, ** p<0.01, *** p<0.001

a. AME, average marginal effect
b. Effect sizes for the stage 1 model are in percentage points; for example, 9.86 for presence of clinical pharmacist indicates that the probability of implementing NC-CPESN was 9.86 percentage points higher for pharmacies that have a clinical pharmacist.
c. Any standard errors that were carried out to the ten-thousandths place value or smaller are represented in scientific notation.
d. Equation 1 and 2 include an interaction term (implementation climate*innovation-values fit), which is represented in the AME of implementation climate and innovation-values fit.
Figure 4.2. Plot of marginal effect of innovation-values fit at representative values of implementation climate score for Equation 1
Figure 4.3. Plot of marginal effect of innovation-values fit at representative values of implementation climate score for Equation 2
REFERENCES


CHAPTER 5. THE ROLE OF NETWORK TIES TO SUPPORT IMPLEMENTATION OF A COMMUNITY PHARMACY ENHANCED SERVICES NETWORK

Introduction

Over the past two decades, the number of individuals with multiple chronic conditions (MCC) has grown, requiring more time and resources from primary care. To treat patients with MCC, primary care providers must address a large number of health issues within a short visit, manage unrelated conditions that require separate treatment plans (e.g., hypertension and depression), and coordinate care with other providers. Failure to effectively coordinate care across providers has resulted in suboptimal care for patients with MCC, leading to medication errors and preventable hospital admissions. Team-based care models, such as patient-centered medical homes and chronic care models, have improved outcomes for patients with MCC and increased system efficiency by allowing primary care providers to collaborate with other providers including pharmacists. Traditionally, team-based care models with pharmacists have been implemented in primary care settings; however, public and private payers have started implementing these programs in community pharmacy settings.

Community pharmacist-led medication management programs have improved patients’ medication adherence and therapeutic outcomes (e.g., blood pressure, blood glucose). Given the effectiveness of these services, many payers are working to scale up and spread existing community pharmacy medication management programs. One approach being used to scale up these programs is community pharmacy enhanced service networks comprised of pharmacies that offer a set medication management services, manage care for a defined patient population, and coordinate services with other healthcare providers as part of an alternative
payment model. Enhanced service networks also provide chronic care management, which includes systematic assessment of patients’ medical and psychosocial needs, development of a comprehensive care plan, and longitudinal follow-up. However, limited evidence exists on how to implement enhanced service networks, as the inclusion of community pharmacy services into alternative payment models is relatively new.

Studies of similar interventions, such as primary care pharmacy services, have found that implementation is largely impacted by the pharmacists’ relationship with other healthcare providers and patients. Studies have found, for example, that physicians may lack knowledge of pharmacists’ clinical training or be unfamiliar with pharmacists’ role in patient care and pharmacists may have difficulty negotiating clear role boundaries with physicians. Additionally, studies have found that patients’ may lack knowledge of or be reluctant to use pharmacists’ medication management services. Building relationships with other healthcare providers and patients may be even more challenging in community pharmacy settings. Community pharmacists may not be co-located or working from the same electronic health record system as the healthcare providers they are partnering with. Patients may also lack awareness of community pharmacy services or be reluctant to have health information shared with community pharmacies. Therefore, research is needed to examine how community pharmacies facilitate relationships with other providers and patients under team-based care arrangements in community pharmacy settings.

**Study Objectives**

The aims of this study are to: (1) identify the role of network ties to support implementation of a community pharmacy enhanced services network, (2) describe how these network ties are formed and maintained, and (3) compare the role of network ties among high- and low-performing community pharmacies participating in an enhanced service network.
Conceptual Framework

Pharmacist participation in team-based care models requires relationship building or establishing network ties with providers in other healthcare and social service agencies (e.g., physicians, care managers). A pharmacy’s network ties can be characterized by the number and types of ties that exist (e.g., whether a pharmacy partners with organizations in pharmacy or non-pharmacy industries)\(^{40}\) and the strength of the relationship between ties (e.g., trust and reciprocal sharing of resources).\(^{41}\) The formation of network ties depends on the pharmacy’s ability to navigate its external environment. For example, a pharmacy might create boundary-spanning roles that link staff members to outside organizations or hire leaders or new staff with beneficial social ties.\(^{40,42-44}\) The likelihood that a pharmacy will maintain a relationship with its network ties depends on several factors including whether the organizations have a history working together, are connected through multiple relationships (e.g., partnering on a grant and being members of a coalition), and use active strategies to maintain the partnership (e.g., putting formal communication structures in place).\(^{41}\) Once formed, a pharmacy’s network ties can facilitate implementation of interventions, such as team-based care models, by increasing adoption of evidence-based practices and transfer of knowledge and resources across organizations.\(^{41,44,45}\)

In addition to forming ties with other organizations, pharmacies participating in team-based care models need to establish ties with patients. A pharmacy’s ability to build relationships with patients is influenced by whether patient-centered care is made a priority by leadership\(^{46}\) as reflected in an organization’s policies and practices.\(^{47,48}\) Pharmacies might, for example, implement practices for identifying patients’ needs, resources, or preferences such as risk and patient-reported outcomes assessment tools\(^{49-51}\), patient decision support tools,\(^{52}\) or conversation guides.\(^{53}\) Similarly, pharmacies might change services based on patient needs or preferences (e.g., tailoring), partner with external organizations that have more resources to better address
patients’ needs and preferences, or develop patient advisory boards. To maintain relationships with patients over time, pharmacies can use clear and transparent communication, get to know patients’ personal and medical history, and engage in shared decision-making to gain patients’ trust, which, in turn, influences whether patients return to a particular provider. The cycle is reinforcing—the more a patient visits a particular provider, the greater the likelihood that trust is established. Building ties with patients can also facilitate implementation of interventions, such as team-based care models, by improving patient engagement and satisfaction with healthcare services.

**Methods**

**Study Setting**

The community pharmacy enhanced services network (CPESN) is a national network of community pharmacies that have agreed to offer chronic disease prevention and management services. This study examines the North Carolina CPESN (NC-CPESN), the pioneer site for CPESN. The NC-CPESN was launched in 2014 by the Community Care of North Carolina (CCNC)—the primary case management provider for NC Medicaid beneficiaries. NC-CPESN not only requires community pharmacies to provide certain chronic disease prevention and management services but it also attributes a defined patient population to the pharmacy, holds pharmacies responsible for the outcomes of those patients through value-based payment, and requires pharmacies to tailor services based on patients’ risk score. Additionally, community pharmacies participating in NC-CPESN must develop a comprehensive care plan for patients and document care plans, services delivered, and patients’ clinical information in a web-based platform provided by CCNC. Patients include Medicaid, Medicare, and NC Health Choice beneficiaries, as well as dual-eligible patients that have MCC. Community pharmacies are
assigned a regional network pharmacist from CCNC that provides technical assistance and support.

**Study Sample**

Pharmacies in NC-CPESN represent diverse settings (e.g., independent, chain, and federally-qualified outpatient pharmacies). Pharmacies also range in their program performance as indicated by risk-adjusted, performance measures (e.g., medication adherence, emergency department utilization, hospital admissions, and total healthcare costs). To obtain diverse perspectives about implementation, we recruited a mix of high- and low- performing pharmacies. High-performing pharmacies were defined as pharmacies that had an above or at the mean overall performance score (e.g., a score that is an aggregate measure of the performance measures listed above) whereas low performing was defined as having a score below the mean. Because chain and federally qualified outpatient pharmacies comprise a smaller percentage of NC-CPESN pharmacies, we oversampled them to ensure they would be represented.

To recruit participants, we asked pharmacies to identify the individual in their pharmacy responsible for, and most knowledgeable about, NC-CPESN implementation, offering them a $50 gift card for study participation. Five pharmacies declined to participate due to lack of time. We were able to recruit an additional five community pharmacies. We stopped recruitment after 40 pharmacies (24 high performing, 16 low performing) since theme saturation was reached.\(^{61}\)

**Data Collection**

Two trained research assistants (KT and CR conducted 40 in-depth interviews (mean = 51 minutes) from June – August 2017. We chose interviews to best understand individual perspectives about NC-CPESN implementation.\(^{62}\) We developed a semi-structured interview guide based on Rogers’ stages of innovation theory and the CFIR.\(^{63,44,62}\) Interviews were conducted over the phone to facilitate participation across the State. The interviews were audio-
record and transcribed verbatim. Prior to beginning the interview, participants provided informed consent over the phone. The Institutional Review Board of the University of North Carolina at Chapel Hill approved this study (IRB # 17-1304).

Data Analysis

We analyzed the transcripts using Dedoose (version 7.0). We used thematic analysis to generate a set of structural codes that were based on network ties theory.\textsuperscript{40,42-44} We categorized network ties into three main categories: inter-personal ties (e.g., between individuals), inter-organizational ties (e.g., between organizations), and ties with patients. Within each category, we examined three questions: 1) how ties are formed, 2) how ties facilitate NC-CPESN implementation, and 3) how ties are maintained. Two members of the research team (KT and CR) coded five transcripts to determine how similarly codes were being applied; develop a set of emergent codes (e.g., themes that emerge from the data);\textsuperscript{62} and reach consensus on code definitions. The remaining transcripts were coded by one author (KT). After transcripts were coded, a summary of the results were sent to three of the interview participants to confirm the findings; this member-checking process helps ensure that the interpretation is consistent with the experiences of the study participants.\textsuperscript{64} The interview participants who were consulted agreed with the interpretation of the findings and did not suggest any modifications. We used the Consolidated Criteria for Reporting Qualitative Studies checklist to guide our reporting of qualitative methods and findings.\textsuperscript{65}

Results

Sample Characteristics

The majority of participants had a single role within the pharmacy (Table 5.1). The sample included a mix of high- (60\%) and low-performing (40\%) pharmacies from single independently owned pharmacies (20\%), multiple independently owned pharmacies (50\%),
chain pharmacies (10%), and outpatient pharmacies including federally qualified health centers (20%); this distribution is similar to pharmacies participating in NC-CPESN. On average, pharmacies in this sample employed 2.6 full-time equivalent (FTE) pharmacists, 4.0 FTE pharmacy technicians, and a total of 12.5 staff members (full-time and part-time). In terms of weekly prescription volume, 35.2% of pharmacies reported filling 1,000 or fewer prescriptions, 34.6% reported between 1,001 and 2,000 prescriptions, and 30.3% reported more than 2,001 prescriptions. About half of pharmacies (54.9%) had been in operation for ten years or more.

**Interpersonal Ties**

*Tie formation.* High- and low-performing pharmacies described how pharmacy owners and employees formed interpersonal ties with pharmacy colleagues; however, only high performing pharmacies discussed ties with non-pharmacy colleagues. Many pharmacy owners and staff members had developed interpersonal ties through pharmacy professional organizations, schools of pharmacies, and pharmaceutical distributors. Pharmacy owners and staff from high-performing pharmacies also developed ties with non-pharmacy colleagues, such as healthcare providers, by joining local civic or business organizations, participating in parent teacher associations, or by serving on hospital or other healthcare organizations’ board of directors.

*Role of ties in implementation.* Both high- and low-performing pharmacies used their interpersonal ties with pharmacy colleagues to gain an awareness of NC-CPESN; however, only high-performing pharmacies used their ties to gain information about NC-CPESN implementation (Table 5.2). Specifically, high- and low-performing community pharmacies indicated that their pharmacy learned about NC-CPESN because of the pharmacy owners’ relationship with pharmaceutical distributors, professional pharmacy organizations, and pharmacies that were considered early adopters of NC-CPESN. Pharmacy owners and staff from
high-performing pharmacies obtained advice from their interpersonal ties about NC-CPESN implementation on training staff, documenting enhanced services efficiently, and incorporating enhanced services into workflow. A small subset of owners from high-performing pharmacies also used their external ties to arrange for their personnel to conduct observations and receive training in early-adopter, NC-CPESN pharmacies to learn how to best implement NC-CPESN. A pharmacy technician explained, “Our owner set up a time for me to go and observe at [name of pharmacy]. Their pharmacist sat down with me, showed me how to use the web-based platform, and what they [CCNC] was looking for as far as reimbursement.”

A small number of high-performing pharmacies described using their interpersonal ties with healthcare providers to facilitate NC-CPESN implementation. Specifically, these pharmacy staff reported reaching out to their friends who are healthcare providers to discuss NC-CPESN and determine what barriers or facilitators might be encountered during implementation from the providers’ perspective. Additionally, pharmacy staff asked their provider colleagues for recommendations of other local healthcare providers who might be interested in participating in NC-CPESN. Providers included physicians, physician’s assistants, nurses, and nurse practitioners.

Maintenance of ties. A small group of high- and low-performing pharmacies described using strategies to maintain their inter-personal ties with pharmacy colleagues, particularly staff in other pharmacies participating in NC-CPESN. Staff described the importance of sharing resources, such as tools for NC-CPESN implementation (e.g., co-management protocol templates) and referring patients to their pharmacist colleagues for services that their own pharmacy may not offer. This was not widespread however. Many pharmacies described the challenges of collaborating with other pharmacies that are perceived as competitor pharmacies,
even though the pharmacies are part of the same network. One pharmacist explained, “We are a part of this network but at the same time we are still competitors. I think that limits resource sharing unless you already have a strong relationship with that pharmacy.”

High-performing pharmacies described strategies to maintain ties with their healthcare provider colleagues such as setting up monthly meetings and inviting their colleagues to attend pharmacy events such as annual award ceremonies. Participants described the importance of regular meetings so that their healthcare provider colleagues are aware of the services in their pharmacy.

**Inter-organizational Ties**

*Formation of ties.* High-performing pharmacies had developed ties with other healthcare provider organizations, care management organizations, and public health agencies whereas low-performing pharmacies did not have such relationships. High-performing pharmacies described how their relationships with other healthcare organizations often developed due to physical proximity to a provider’s office (e.g., having one next door or across the street). Independently owned pharmacies also described how it was easier to partner with independently-owned physician practices because the organizations’ shared a similar, less-formalized organizational structure. Pharmacies described how many of their relationships with healthcare providers were initiated by the pharmacy rather than by the healthcare provider.

A smaller group of high-performing pharmacies had also formed relationships with care management organizations (e.g., CCNC) and public health agencies (e.g., local agencies on aging, public health departments). These relationships were most often facilitated by previous collaboration on similar interventions. Additionally, several pharmacies explained that they initiated relationships with care managers and public health agencies because of a need to improve care for high-risk patients. One pharmacist shared, “We were not equipped to identify
patients at risk for [opioid] overdose or how to educate patients on naloxone. We’ve reached out to our health department and have had a lot of great meetings about how to work with those patients and how to have that conversation [about naloxone].”

Role of ties in implementation. Participants from high-performing pharmacies indicated that relationships with healthcare providers enabled NC-CPESN implementation by making providers aware of the pharmacy’s services and the clinical knowledge of pharmacists while increasing provider trust in the pharmacy. One pharmacy owner remarked, “We were already working closely with our doctors. That rapport was built before we joined CPESN. I think that made it easier for the physicians to accept the therapeutic recommendations we were making.” High-performing pharmacies also collaborated with other providers to gain information about patient needs. For example, pharmacies reported calling primary care providers to discuss the health history of patients experiencing medication problems or adherence issues. Low-performing pharmacies, on the other hand, described difficulty obtaining patient information from providers due to lack of pre-existing relationships.

High-performing pharmacies used ties with care managers to gain information about patients’ social needs. As an example, one pharmacist explained, “If they have other needs like need for home health, things like that, we can engage a care manager to help with some of the needs that as a pharmacist we may not feel comfortable doing or don’t have the resources available.” Pharmacies also used care managers to help engage patients in time-intensive interventions such as home visits. One pharmacy owner described, “Whenever we do a home visit we like for the care manager to join us. The care manager knows that patient better and the patient is going to be more receptive to us [pharmacy staff].” In contrast, a few of the low-performing pharmacies indicated that they could see the value in working with care managers but
had not considered it and had never reached out to the care managers during their participation in NC-CPESN.

*Maintenance of ties.* High-performing pharmacies used strategies to maintain their relationships with other healthcare providers, such as updating providers on patients’ health issues and inviting providers to pharmacy events. High-performing pharmacies, for example, used strategies such as preparing patient report cards for physicians to make them aware of changes in medication adherence or inviting primary care practice staff to attend pharmacy events such as annual awards ceremonies for pharmacy employees. One pharmacy owner explained, “We send a report card to the physician to let them know how their [the patient’s] adherence is. If we identify any medication problems when we’re talking to them [the patient] each month, we stay in close contact with the physician’s office. That keeps the lines of communication open.” Since low-performing pharmacies were building relationships with healthcare providers for the first time, some described using strategies such as arranging face-to-face meetings with providers to introduce them to the pharmacy’s services. However, most low-performing pharmacies did not describe using any strategies to build relationships with healthcare providers outside of routine communication about specific patients.

Pharmacy owners at high-performing pharmacies created staff positions with boundary spanning roles—a strategy that was not used by low-performing pharmacies to maintain relationships with providers. For example, high-performing pharmacies had pharmacists who worked in healthcare provider offices for 1-2 days a week and collaborated with providers at co-sponsored healthcare fairs or immunization events. Some high-performing pharmacies also had healthcare providers, such as nurses or dieticians, work in their pharmacy for 1-2 days a week. Participants explained that boundary-spanning helped the pharmacy to learn about the priorities
...and goals of healthcare providers (e.g., meeting performance measurement goals) and to increase healthcare providers’ knowledge about the clinical skills of pharmacists and community pharmacy services. One pharmacy manager described, “We [the owner and the manager] created a partnership with a local [primary care] practice where I work there one day a week and assist with annual wellness visits. It’s been great for me to get a better understanding of their [physician’s] day-to-day and it helps the physicians to gain a better understanding of what pharmacists can do.”

To maintain relationships with care managers, some high-performing pharmacies set up regular monthly meetings to discuss difficult-to-treat patients or ideas for additional collaborations (e.g., new medication management services that could be supported by care manager involvement). For the small group of pharmacies working with public health agencies, they were at the relationship formation rather than maintenance stage.

**Ties with Patients**

*Formation of ties.* Both high- and low-performing pharmacies described how factors such as years of operation and staff knowledge about the local community helped facilitate ties with patients. Pharmacies that had been operating in the community for many years, for example, had frequent interactions with certain high-risk patients and had gained their trust over time. Additionally, staff members’ knowledge of the local community such as location of community resources (e.g., behavioral health agencies) helped facilitate relationships with patients by allowing staff members to serve as resources for patients. A pharmacy manager explained, “We’re pretty in tune with what’s going on in our community as far as if somebody needs a support group or where to find that resource. Our patients have learned that they can come to us for anything.” Additionally, a few high-performing pharmacies used delivery drivers as a
mechanism for building relationships with patients. These pharmacies explained that delivery drivers are less intimidating to patients and may have an easier time building rapport with them.

*Role of ties in implementation.* Both high- and low-performing pharmacies described using their ties with patients to improve the quality of patient-pharmacist conversations about patients’ medication adherence and health outcomes. However, only high-performing pharmacies described using their ties with patients as a mechanism for engaging patients in medication management services and to spread the word about medication management services to their friends and family members. High-performing pharmacies explained that it was important to first build a relationship with a patient before introducing medication management services to patients to prevent patient resistance. Low-performing pharmacies, however, described making the mistake of trying to introduce medication management services to new patients with whom they had not established a relationship, leading to patient resistance.

*Maintenance of ties.* Both high- and low-performing pharmacies discussed the importance of repeated interactions with patients; for example, making sure pharmacy staff ask about patients’ personal well-being and health each time they visit the pharmacy to build rapport over time. Both high- and low-performing pharmacies used patient engagement strategies to maintain ties with patients (e.g., motivational interviewing and getting caregivers involved) and pairing high-risk patients with a staff member to serve as their point of contact within the pharmacy. However, only high-performing pharmacies discussed the importance of developing a pharmacy climate that is supportive of patient engagement to ensure that the pharmacy builds strong relationships with all patients. To create such a climate, some pharmacy owners created reward systems for staff members who were able to engage hard-to-reach patients or developed processes for sharing patient engagement success stories at staff meetings.
Discussion

In this study, we interviewed representatives from 40 community pharmacies that were participants in NC-CPESN to identify the role of network ties to support implementation of a community pharmacy enhanced services network, to describe how these ties are formed and maintained, and to compare these network ties among high- and low-performing pharmacies. We found that community pharmacies use numerous network ties to support implementation of medication management services including ties with healthcare providers and care managers, public health agencies, patients, and inter-personal ties of pharmacy staff. We also found that community pharmacies greatly vary in the experience with relationship building with other healthcare providers and patients, which may result in differential implementation quality of medication management programs. To our knowledge, this is the first study examining the network ties of community pharmacies participating in a team-based care model. There are similar studies examining relationships among healthcare providers and pharmacists in primary care, team-based care models\textsuperscript{33,34} but these studies focus on the healthcare provider-pharmacist dyad and do not look at other members of healthcare team (e.g., care managers, public health agencies, patients) or describe how these relationships are formed and maintained.

The results from this study suggest that pre-existing relationships, repeated interactions, and multiple relationships (e.g., collaborating on two interventions) strengthen inter-organizational partnerships over time—a finding replicated in other studies.\textsuperscript{41,66} For interventions that require pharmacies to coordinate care with other providers, it may be beneficial to assess pharmacies’ prior experience with inter-organizational partnerships and develop interventions to support pharmacies with less experience (e.g., creation of learning collaborative to disseminate effective organizational networking practices). Our findings also suggest that repeated interactions—such as scheduling regular meetings—and multiple relationships strengthened
relationships between pharmacies, providers, and care managers. Future studies could examine whether leveraging previous collaborations through interventions such as patient-centered medical homes improves implementation of future collaborations. Similar to another study, we found that many of the provider-pharmacist relationships were pharmacist initiated, which may limit inter-organizational relationship building. Collaboration across organizations may require more systematic efforts from both entities involved. Recent theories have hypothesized that inter-organizational partnerships may be facilitated by inter-organizational alignment or similarities in organizational values, characteristics, and support for implementation across partnering organizations. Future studies should test implementation strategies for developing organizational alignment across pharmacies, healthcare provider, and care management organizations for team-based care.

Our findings suggest that partnerships among community pharmacists and care managers may be limited—even within team-based care models that include a care manager. In this study, some pharmacies, for example, did not consider care managers as a potential partner in delivering medication management services. Team-based care models assume that it is valuable to coordinate care with all types of providers; however, some organizational partners may not view certain healthcare providers as belonging to their network. Additional research could explore how pharmacies define the boundaries of their network and how these cognitions influence the structure of the pharmacy’s network (e.g., whether a pharmacy has ties with care managers or public health agencies). Studies of inter-organizational relationships have less commonly studied cognitions about social networks, such as how organization leaders define which individuals or organizations are a part of their network. The findings of this study suggest that leaders of high-performing pharmacies may have a broader definition of the
organizations included in their network since they used active strategies to build relationships not only with pharmacy organizations but also healthcare providers, care managers, and public health agencies.

Community pharmacies in our study used a wide variety of strategies to develop and maintain ties with patients. Since community pharmacies vary in the staff and resources available for implementation, it would be beneficial for future research to identify which patient engagement strategies might have the largest impact on enhanced service implementation effectiveness and for which settings and patient populations is the largest benefit observed. Findings from this study suggest that creation of formal policies may be an effective strategy for maintaining relationships with patients. Prior studies have shown that implementation policies and practices can influence an organization’s implementation climate (i.e., the extent to which an innovation is supported, rewarded, and expected). Therefore, future studies could examine how implementation policies and practices affect a pharmacy’s climate for patient-centered care and the pharmacy’s ability to build ties with patients.

Limitations

This study had several limitations. First, the interviews were conducted with community pharmacies and do not capture healthcare providers, care managers, or patients’ perspectives about their ties with community pharmacies. Future studies could employ network analysis methods to determine whether community pharmacies and their network ties have similar perspectives about their relationship quality. Second, this study examined implementation of enhanced services in North Carolina, the site of the first CPESN, and therefore findings from this study may not be generalizable to other states with less experience integrating community pharmacists into team-based care models. Third, the community pharmacies participating in NC-CPESN and in this study are more likely to be independently owned rather than chain
pharmacies. Therefore, the findings from this study may not be representative of chain pharmacies. Independently owned pharmacies may have more flexibility to facilitate relationships with external organizations and with patients than chain pharmacies, which have a more formal organizational structure. Finally, participants’ responses during an interview can be influenced by how questions are phrased and participants’ comfort with the interview. To minimize risk of respondent bias, we used a community pharmacist as one of the co-facilitators and had a group of researchers and community pharmacists review the interview guide to ensure the questions would be easily interpreted.

**Conclusion**

Community pharmacies are increasingly being integrated into team-based care models because they are highly accessible settings for delivering medication management services to patients who might otherwise be difficult to reach. Across settings, however, community pharmacies may vary in their ability to develop relationships with other healthcare providers and patients. As enhanced services interventions that require care coordination are scaled up and spread in community pharmacies in other states, additional research is needed to test implementation strategies that support community pharmacies with developing and maintaining relationships across a diverse group of stakeholders (e.g., healthcare providers, care managers, public health agencies, patients).
Table 5.1. Community pharmacy staff and site characteristics (n=40)

<table>
<thead>
<tr>
<th>Staff and Site Characteristics</th>
<th>Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% or Mean (SD)</td>
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<tr>
<td><strong>Staff Role</strong></td>
<td></td>
</tr>
<tr>
<td>Pharmacy owner and pharmacist</td>
<td>20.0</td>
</tr>
<tr>
<td>Pharmacy manager and pharmacist</td>
<td>17.5</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>47.5</td>
</tr>
<tr>
<td>Pharmacy technician</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>Staff Tenure</strong></td>
<td></td>
</tr>
<tr>
<td>0 to 3 years</td>
<td>32.5</td>
</tr>
<tr>
<td>4 to 5 years</td>
<td>45.0</td>
</tr>
<tr>
<td>6 years or more</td>
<td>22.5</td>
</tr>
<tr>
<td><strong>Pharmacy Performance</strong></td>
<td></td>
</tr>
<tr>
<td>Low-performing pharmacy</td>
<td>40.0</td>
</tr>
<tr>
<td>High-performing pharmacy</td>
<td>60.0</td>
</tr>
<tr>
<td><strong>Pharmacy Setting</strong></td>
<td></td>
</tr>
<tr>
<td>Single independent pharmacy</td>
<td>20.0</td>
</tr>
<tr>
<td>Multiple independent pharmacy</td>
<td>50.0</td>
</tr>
<tr>
<td>Chain pharmacy</td>
<td>10.0</td>
</tr>
<tr>
<td>Outpatient pharmacy (e.g., FQHC)</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>Total Full-Time Equivalent Pharmacist</strong></td>
<td>2.6 (1.4)</td>
</tr>
<tr>
<td><strong>Total Full-Time Equivalent Pharmacy Technician</strong></td>
<td>4.0 (2.5)</td>
</tr>
<tr>
<td><strong>Total Number of Staff (part-time and full-time)</strong></td>
<td>12.5 (7.6)</td>
</tr>
<tr>
<td><strong>Weekly Prescription Volume</strong></td>
<td></td>
</tr>
<tr>
<td>0 to 1,000</td>
<td>35.2</td>
</tr>
<tr>
<td>1,001 to 2,000</td>
<td>34.6</td>
</tr>
<tr>
<td>2,001 or more</td>
<td>30.3</td>
</tr>
<tr>
<td><strong>Years in Operation</strong></td>
<td></td>
</tr>
<tr>
<td>0 to 5 years</td>
<td>23.5</td>
</tr>
<tr>
<td>6 to 10 years</td>
<td>21.6</td>
</tr>
<tr>
<td>10 years or more</td>
<td>54.9</td>
</tr>
</tbody>
</table>
Table 5.2. Differences in the role of network ties among high- and low-performing pharmacies

<table>
<thead>
<tr>
<th>Pharmacy characteristics</th>
<th>High performers</th>
<th>Low performers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inter-personal ties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Leadership ties</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain awareness of NC-CPESN from leadership ties</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Gain knowledge about NC-CPESN implementation from leadership ties</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><em>Employee ties</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain awareness of NC-CPESN from employee ties</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Gain knowledge about NC-CPESN implementation from employee ties</td>
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<td><strong>Inter-organizational ties</strong></td>
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<td><em>Ties with healthcare providers</em></td>
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<td>Increase provider knowledge of pharmacists’ clinical knowledge</td>
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<td>Increase provider trust of community pharmacists</td>
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<td>Gain information about patients’ health history and needs</td>
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<td>To learn about healthcare providers’ goals and priorities for patient care</td>
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<td>Gain information about patients’ social needs</td>
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<td>Increase outreach to new patients</td>
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<td><em>Ties with patients</em></td>
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<td>Facilitate conversations about medication adherence</td>
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<td>Engage patients in medication management services</td>
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<td>Ask patients to share information with family and friends about medication management services</td>
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**Note:** + indicates use of strategy and – indicates absence of strategy
REFERENCES


CHAPTER 6. STAGES OF CHANGE: MOVING COMMUNITY PHARMACIES FROM A DRUG DISPENSING TO POPULATION HEALTH MANAGEMENT MODEL

Introduction

The aging of our population, the increasing prevalence of chronic illnesses, and the expansion of insurance coverage are expected to increase the demand for primary care in the next ten years.\textsuperscript{1-5} Patient complexity will also increase as the number of patients with multiple chronic conditions grows, requiring more time and resources from primary care.\textsuperscript{6,7} However, access to primary care providers (PCPs) is projected to be insufficient due to workforce shortages and uneven geographic distribution.\textsuperscript{1,2,8} To strengthen the capacity of the primary care system, innovative solutions are needed, including redistributing primary care functions to other healthcare team members.\textsuperscript{2,8}

Given their clinical training and accessibility, community pharmacists are well-positioned to support primary care, especially in providing medication management services.\textsuperscript{9-11} Community pharmacists receive doctoral-level training that is increasingly focused on direct patient care, population health, and coordination with other healthcare professionals.\textsuperscript{12} In addition to training, community pharmacists are well-suited to support primary care because of their accessibility and frequent interactions with patients. Community pharmacies are geographically accessible to most patients; nearly 90\% of the population lives within five miles of a community pharmacy.\textsuperscript{13,14} Community pharmacies also frequently interact with patients managing chronic conditions. A recent study, for example, found that Medicaid patients with multiple chronic conditions had ten times the annual visits to their community pharmacy.
compared to their PCP (35 versus 3.5). Therefore, community pharmacies may be an ideal setting to deliver medication management services.

Over the past decade, community pharmacies have expanded their medication management services in response to healthcare reform and declining drug reimbursement margins. Community pharmacist-led medication management services have proven valuable by reducing medication errors, improving adherence, reducing hospital readmissions, and decreasing healthcare costs. Although their value has been demonstrated, these services have been underutilized in alternative payment primary care models. Part of the difficulty stems from the community pharmacy workflow, which is subject to frequent interruptions that can hinder implementation of medication management services. Additionally, payers and state regulations have limited community pharmacists’ ability to bill for medication management.

Given the small number of models in practice, there is limited evidence on how to integrate community pharmacist-led medication management services into primary care delivery. Implementing these services requires community pharmacies to establish new relationships with PCPs and move from a drug dispensing to population health management model. Because population health management interventions often affect the entire organization rather than targeted units or departments, they require large-scale changes to care organization and delivery. Past studies of innovation implementation have tended to focus on interventions that affect a single dimension of an organization. Therefore, research is needed on how to implement large-scale organizational change, particularly in community pharmacy settings where these interventions are being tested for the first time. To address this need, we examine the implementation process of community pharmacies in North Carolina participating in a population health management intervention.
Objectives

Our objectives are to: 1) compare implementation strategies of high- and low-performing community pharmacies at different stages of the innovation implementation process and 2) identify the implementation strategies that pharmacies use to sustain the innovation post-implementation.

Conceptual Framework

Process models recognize a temporal order of implementation activities and can guide practitioners on how to implement innovations.\textsuperscript{42,43} Although there is diversity across process models (e.g., linear versus iterative), three stages are common across models: pre-implementation, implementation, and sustainment.\textsuperscript{44-53} We chose Rogers’ Stages in the Innovation Process in Organizations because it has been applied to a wide variety of innovations and settings\textsuperscript{44} and is well-suited for population health management interventions that require numerous organizational changes\textsuperscript{36,38,39} in response to innovation implementation.\textsuperscript{44}

Pre-implementation begins with the innovation-adoption process during which organizations identify the need for innovation (e.g., performance gap) and strategies that might meet the organization’s needs (“agenda-setting”) and is the right fit for the organization (“matching”).\textsuperscript{44} Organizations may identify the need for innovation by recognizing, and seeking innovations to address a problem (“problem-initiated approach”).\textsuperscript{44} More commonly, however, organizations become aware of an innovation and evaluate whether it could solve broader organizational problems (“innovation-initiated approach”).\textsuperscript{44} Metrics to assess fit include organizational capacity (e.g., resource and staff availability), staff and patient acceptability, and compatibility with the organization’s mission.\textsuperscript{44,48,50,54,55} Organizations might also consider aspects of the innovation itself—such as its complexity\textsuperscript{44,56}, environmental context (e.g., external
funding, political climate, patient needs and resources), and adoption decisions of competitors. \(^{42,44,49,52,56}\)

The **implementation** stage begins once an organization decides to adopt an innovation. \(^{44,52}\) To prepare for implementation, the organization may change its structure including hiring and training personnel, purchasing equipment, and/or developing policies and procedures. \(^{44,46,52,54}\) Additionally, organizations go through a redefining process to adapt the innovation to its context and needs. \(^{44,57}\) Innovations can be adapted by changing the setting, mode of delivery, format or audience to achieve a better fit with the organization. \(^{57}\) After an organization has gained experience with implementation, it may refine its implementation process and scale the innovation within the organization; this is called the clarifying stage and may include increasing the number of patients receiving, or personnel involved in delivering, a service. \(^{44}\) The clarifying stage might also involve reflection and evaluation on the implementation process—such as the quality of implementation or whether the innovation is reaching its intended audience. \(^{48,50,52}\)

**During sustainment**, organizations focus on making the intervention a routine, sustainable part of the organization (i.e., the routinizing stage). An organization might allocate personnel permanently to be responsible for implementation, incorporate the innovation into the organizations’ standards or protocols, or devote part of the budget to implementation. \(^{47,50,52,54}\)

Within these three stages, practitioners may use different implementation strategies to support the implementation process. Implementation strategies are “methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical program or practice.” \(^{58-60}\) We have categorized implementation strategies using the following categories: plan, educate, restructure, quality-management, and finance strategies. \(^{58,59}\) **Plan strategies** assist organizations with gathering data about a problem, building buy-in among key stakeholders, initiating
leadership to support implementation, and developing relationships among implementation partners.58,59 Educate strategies are used to inform external and internal stakeholders about the intervention and processes for its implementation.58,59 Restructure strategies change the organization’s infrastructure to better support implementation (e.g., revising professional roles, hiring new personnel, or purchasing new equipment or technology).58,59 Notably, restructure strategies are not the same as the restructuring phase of implementation defined in Rogers’ model 44 and can be employed at different phases of the innovation process. Quality-management strategies facilitate performance monitoring, improvement, and evaluation by creating quality-monitoring tools, systems, and processes for feedback.58,59 Finance strategies are used to create incentives and provide resources for implementation.58,59

**Methods**

**Intervention Description**

The Community Pharmacy Enhanced Services Network (CPESN℠) is a national network of community pharmacies that have agreed to offer a set of medication management services.61 This study examines the North Carolina CPESN (NC-CPESN), the pioneer CPESN site.15 The NC-CPESN was launched in 2014 by the Community Care of North Carolina (CCNC)—the primary case management provider for NC Medicaid beneficiaries.15,62 NC-CPESN not only requires community pharmacies to provide certain medication management services, but also holds pharmacies responsible for the outcomes of a defined patient population through value-based payment that is tailored to services based on patients’ risk score. Additionally, participating pharmacies must document their medication management services and patients’ clinical information in a web-based platform provided by CCNC. Patients include Medicaid, Medicare, and NC Health Choice beneficiaries as well as dual-eligible patients.
Selection of Study Sites

Because pharmacies could enroll at the beginning of the program year in 2014 (first year of the program), 2015, or 2016, they have varying levels of experience with NC-CPESN. Pharmacies in NC-CPESN also represent very different settings (e.g., independently-owned pharmacies, chain pharmacies, and federally-qualified outpatient pharmacies). To obtain diverse perspectives about implementation, we recruited 24 high- and 16 low-performing pharmacies on selected measures (e.g., medication adherence, emergency department utilization, hospital admissions, and total healthcare costs) (Figure 6.1).

To recruit participants, we asked pharmacies to identify the individual in their pharmacy who was responsible for NC-CPESN implementation. We offered participants a $50 gift card for study participation. Five pharmacies declined to participate due to lack of time. Therefore, we asked study participants to suggest additional participants, and we were able to recruit an additional five community pharmacies. We stopped recruitment after 40 pharmacies when clear patterns began to emerge in the data (theme saturation).

Data Collection

Two trained research assistants (KT and CR) conducted 40 semi-structured interviews (mean=51 minutes) from June – August 2017 to understand individual perspectives about NC-CPESN implementation. The interview guide was based on Rogers’ theory. Interviews were conducted over the phone to facilitate participation across the State. The interviews were audio-record and transcribed verbatim. Prior to beginning the interview, participants provided informed consent over the phone. The Institutional Review Board of the University of North Carolina at Chapel Hill approved this study (IRB # 17-1304).
Data Analysis

We used Dedoose (version 7.0) to generate a set of deductive codes based on Rogers’ theory\textsuperscript{44,64} and the five categories of implementation strategies: plan, educate, restructure, quality-management, and finance.\textsuperscript{58,59} Two members of the research team (KT and CR) coded five transcripts to: determine how similarly codes were being applied; develop a set of inductive codes;\textsuperscript{64} and reach consensus on code definitions. The remaining transcripts were coded by one author (KT). After transcripts were coded, a summary was sent to five of the interview participants to confirm the findings; this member-checking process helps ensure that the interpretation is consistent with the experiences of study participants.\textsuperscript{65} Interview participants who were consulted agreed with the interpretation of the findings and did not suggest any modifications. We used the Consolidated Criteria for Reporting Qualitative Studies checklist to guide our reporting of qualitative methods and findings.\textsuperscript{66}

Results

Sample Characteristics

Nearly half of 40 participants had a single role as a pharmacist (Table 6.1). Other participants occupied either dual roles as a pharmacy owner and pharmacist (20%), a pharmacy manager and pharmacist (17.5%), or a single role as a pharmacy technician (15%); 32.5% worked at their current pharmacy less than three years, 45% for 4-5 years, and 22.5% worked for six years or more. Participants came from multiple pharmacy settings including single independent pharmacies (20%), multiple independent pharmacies (50%), chain pharmacies (10%), and outpatient pharmacies including federally qualified health centers (20%). This distribution is similar to pharmacies participating in NC-CPESN.
**Pre-implementation Stage: High-performing Pharmacies**

*Agenda-setting.* High-performing pharmacies discussed two planning implementation strategies to support the agenda-setting process: conducting site visits to other pharmacies to learn about their experiences with NC-CPESN, and conducting a local needs assessment to determine whether there was a need for NC-CPESN in the pharmacy (Table 6.2). During site visits, pharmacies gathered information about NC-CPESN, such as ease-of-implementation and the usability of the required documentation software. Pharmacies also evaluated whether NC-CPESN would meet the needs of the pharmacy including patients’ needs, financial needs, and performance gaps. Pharmacies varied in the order these planning strategies were initiated. Some pharmacies first identified the need for innovation in their pharmacy and then conducted an environmental scan to identify potential solutions (“problem-initiated approach”). One pharmacy technician described her pharmacy’s process as, “We’re constantly looking for ways to improve our performance. Our clinical pharmacist was researching clinical services and came across NC-CPESN.” Other pharmacies, through their employees’ social networks, leadership ties, and relationships with professional and academic organizations, learned about NC-CPESN and then determined whether NC-CPESN would meet the needs of their pharmacy (“innovation-initiated approach”).

*Matching.* After identifying a need for NC-CPESN, pharmacies used three planning strategies to determine whether NC-CPESN was a good match for their pharmacy. Pharmacies first assessed their pharmacy’s readiness for NC-CPESN. Specifically, pharmacies assessed fit with the mission of the pharmacy (e.g., impact on patient care and outcomes) and whether their pharmacy had the organizational capacity to support NC-CPESN (e.g., staffing and resource availability, workspace). Second, pharmacies conducted local consensus discussions with external stakeholders (e.g., PCPs, care managers) and internal stakeholders (e.g., pharmacy
personnel) to obtain their buy-in. For external stakeholders, participants recommended discussing NC-CPESN’s purpose and identifying whether or not NC-CPESN would meet the needs of other healthcare providers’ patient population. For example, a pharmacy manager described assessing interest among PCPs: “We went to the providers that we already had a good relationship with and asked them if they would like to participate and whether it would be helpful for their patients.” For internal stakeholders, pharmacies discussed the importance of communicating information about NC-CPESN’s purpose, fit with the pharmacy’s mission, impact on staff roles and responsibilities, and implementation. Finally, participants identified both potential barriers to implementation (e.g., resistance among personnel and providers) and strategies for addressing challenges (e.g., including personnel in the implementation planning process).

**Pre-implementation Stage: Low-performing Pharmacies**

*Agenda-setting.* Unlike high-performing pharmacies, low-performing pharmacies did not visit other sites to learn about other pharmacies’ experiences with NC-CPESN or conduct a local needs assessment to determine whether the pharmacy had a need for NC-CPESN. As an example, one pharmacy manager described that her pharmacy did not assess whether NC-CPESN met the needs of the pharmacy’s patient population prior to implementation. She explained, “We have a small percentage of Medicaid patients and thinking back on when we enrolled in the program, I don’t think we had the critical mass needed to justify this intervention and how much time we’ve spent on it.”

*Matching.* Low-performing pharmacies also used planning strategies to determine whether NC-CPESN was a good match for their pharmacy. Low-performing pharmacies, for example, assessed whether NC-CPESN fit with the pharmacy’s mission and organizational capacity, such as a pharmacy management system that supports medication synchronization.
Low-performing pharmacies, however, failed to assess whether their pharmacy had sufficient staffing for NC-CPESN. Specifically, these pharmacies did not consider how much pharmacist time, outside of the time allotted to dispensing, would need to be dedicated to medication management services. Low-performing pharmacies also failed to identify potential implementation barriers (e.g., lack of patient engagement) and strategies for addressing those barriers, as well as failing to have local consensus discussions with external and internal stakeholders. One pharmacy owner, for example, explained that she did not engage her personnel prior to NC-CPESN implementation, which caused staff resistance to NC-CPESN. She explained,

If I could go back, that’s something I’d change. Don’t wait until six months down the road, when you’ve already started the program, to tell them [personnel], this is what I want you to do. Because they won’t understand why you’re doing what you’re doing and they’ll be resistant.

**Implementation Stage: High-performing Pharmacies**

*Restructuring.* During implementation, participants from high-performing pharmacies discussed using planning and education implementation strategies to prepare for NC-CPESN. They developed a formal blueprint, recruited and designated personnel for implementation leadership positions, identified and prepared NC-CPESN champions, and pilot tested medication management services with a small number of patients and personnel. Pharmacies typically appointed pharmacists as implementation leaders responsible for developing implementation blueprints, training staff, and monitoring implementation efforts. Interestingly, pharmacies typically appointed pharmacy technicians to serve as champions for NC-CPESN including gaining buy-in for NC-CPESN among staff and patients and advocating for NC-CPESN within the pharmacy. To educate pharmacy personnel on NC-CPESN, some pharmacies used a train-the-trainer approach, whereas others cross-trained multiple staff members on NC-CPESN.
activities. Participants emphasized the importance of training personnel not only on the intervention, but also clinical training, especially for pharmacy technicians.

Pharmacies used several strategies during the restructuring phase. They redefined job roles to include NC-CPESN activities, for example, appointing personnel to be responsible for recruiting patients for medication management services, delivering medication management services, or documenting services in the pharmacy’s management system. Some pharmacies hired new personnel to support NC-CPESN implementation—most commonly, clinical pharmacists and data entry specialists. Participants changed how they used their information systems to support NC-CPESN implementation, and they invested time into learning how to use the CCNC-provided software for documentation. Many pharmacies obtained advice from their software vendors on how to use their existing pharmacy management software alongside of the CCNC-provided software to support NC-CPESN implementation. One pharmacy owner said, “Whenever we start something new like NC-CPESN, we start with our software vendor. We explain what we are trying to implement, what we’d like the software to do, and ask them [the vendor] if it is possible.”

A smaller number of high-performing pharmacies used quality-management strategies (e.g., developing and organizing quality-monitoring systems) to track performance data from their management system and share performance data with personnel (e.g., success stories and areas of improvement). Some pharmacies also developed posters, webinars, and report cards that visually compared current progress on performance measures.

Redefining. High-performing pharmacies used several planning strategies to adapt NC-CPESN to the pharmacy’s local context. For example, pharmacies tailored the intervention to better meet patients’ needs including its setting (e.g., using a public location or provider’s office
for homeless patients requiring home services), the mode of delivery (e.g., using delivery drivers to collect patient information about medication adherence), and the cost (e.g., lowering patient fees for low-income patients). One pharmacist explained, “We started seeing a trend that we knew that our delivery drivers were our eyes and ears in the field. And it grew organically from there where we started using our drivers to support our adherence programs.” Participants also developed processes for prioritizing patients for medication management services such as using information collected during the patient encounter (e.g., availability of transportation, low literacy) in addition to risk.

High-performing pharmacies were more purposeful about establishing relationships with PCPs, care managers, and patients. Prior to adopting NC-CPESN, many participants engaged with PCPs by fax and very rarely interacted with CCNC care managers. With NC-CPESN, participants reported setting up face-to-face meetings with PCPs and care managers to discuss NC-CPESN overall as well as specific patient cases. Pharmacies used motivational interviewing techniques to build rapport with patients prior to introducing medication management services to them. Additionally, participants collaborated with PCPs and care managers to engage hard-to-reach patients. One pharmacy manager explained, “We have some patients that receive information better from their medical providers than from pharmacy staff. So we’ll call the physician and get them to reinforce what we’ve recommended to the patient.”

**Clarifying.** Participants from high-performing pharmacies expanded medication management services using planning (e.g., staging implementation scale-up) and education (e.g., creating and distributing materials) strategies. They planned an implementation scale-up by enhancing outreach to recruit additional patients, increasing the number of personnel involved in service delivery, and partnering with community-based organizations, such as local agencies for
aging services and public housing authorities. Additionally, pharmacies developed and distributed educational materials to patients including flyers, brochures, and tags stapled to prescription bags.

Pharmacies also adjusted their implementation processes after gaining experience with NC-CPESN. They used restructuring strategies such as redefining professional roles based on experiences with implementation. For example, pharmacies matched hard-to-reach patients with a staff member who successfully engaged them. Some pharmacies also employed quality-management strategies such as purposefully reexamining implementation to determine if their pharmacy’s processes should be adjusted or if certain medication management services should be de-implemented. As an example, some pharmacies had to build in more time for developing care plans for complex patients. One pharmacist explained,

We have really gotten more complex patients than what we were getting at the beginning [of NC-CPESN], people that are on 12 to 15 medicines, people that are in and out of the hospital. When we started to evaluate our process and workflow, we realized we needed to set aside more time for these patients.

**Implementation Stage: Low-performing Pharmacies**

*Restructuring.* Low-performing pharmacies used many of the same planning strategies as high-performing pharmacies but executed them differently. For example, when developing an implementation blueprint, low-performing pharmacies included details on how to deliver medication services but unlike high-performers, did not include a procedure for documentation. As a result, services were inadequately documented for reimbursement requirements and caused confusion about which services a patient had received; sometimes documentation had too much detail, leading to pharmacies seeing fewer patients due to time constraints. Low-performing pharmacies were less likely to use planning strategies such as piloting medication management services, which caused problems with implementation (e.g., mismatch between the number of
patients and staffing capacity). Additionally, low-performing pharmacies failed to appoint local champions and/or designate implementation leaders—resulting in confusion about who was responsible for leading implementation.

Low-performing pharmacies experienced challenges with education (e.g., training personnel) and restructuring (e.g., redefining professional roles) strategies. They described either failing to train personnel prior to implementation or including insufficient detail in staff training. One pharmacy technician said, “I was just thrown in the water, sink or swim, with very little training. I did a lot of it incorrectly and wasted a lot of time and became very frustrated.” Similarly, low-performing pharmacies reported either failing to redefine professional roles or redefining professional roles in a way that hindered implementation. For example, some pharmacies designated only one pharmacist to be responsible for NC-CPESN-related activities, resulting in burnout for some staff members. None of the low-performing pharmacies reported using quality-management strategies.

Redefining. Low-performing pharmacies used some of the planning and finance strategies as high performing pharmacies (e.g., tailoring intervention to patients’ needs, reducing patient fees); however, they failed to develop relationships with PCPs, care managers, and patients. Some low-performing pharmacies introduced medication management services without first building relationships with individual patients, causing patient resistance. Others introduced too many services to a patient at a time—causing the patient to become overwhelmed and resistant to enrolling in medication management services. Similarly, participants described trying to request patient health information from providers without first building a relationship, resulting in resistance from the provider to share patient information. Low-performing pharmacies also described failing to reach out to care managers: “We haven’t really worked with them [care
managers]. It would probably be beneficial but in the day-to-day we barely have a minute to step away from the counter.”

*Clarifying.* Similar to high-performing pharmacies, low-performing pharmacies used planning strategies to scale up implementation and education strategies to introduce medication management services. Where high- and low- performers differed was the use of restructuring and quality-management strategies. High-performing pharmacies described being purposeful in ensuring that professional roles were defined, for example, using pharmacists and pharmacy technicians at the top of their license. Low-performing pharmacies described failing to use pharmacist and pharmacy technicians at the top of their license—causing inefficiency and assigning too much work to the pharmacist. Low-performing pharmacies also described not taking the time to assess implementation quality and make adjustments to the process—resulting in continued poor quality implementation. For example, one pharmacist stated: “We had a lot of enthusiasm at the beginning [of NC-CPESN] from everyone and then that sort of waned. Thinking back, we should have checked the temperature of things and maybe changed course to reenergize our staff.”

**Sustainment Stage**

*Routinizing.* Although all pharmacies reached the implementation stage, a smaller group (all high-performing) of pharmacies had reached a sustainment stage. These pharmacies discussed planning strategies such as obtaining formal commitments and developing resource-sharing agreements with PCPs (e.g., collaborative practice agreements, gaining electronic health record (EHR) access). Pharmacies also integrated medication management services into personnel policies (e.g., hiring and performance evaluation processes and new staff orientation) and created incentives for employee participation in NC-CPESN. Pharmacies that were part of a larger organization (e.g., multiple-independent pharmacies) used quality-management strategies
such as creating centralized support systems for pharmacy personnel implementing NC-CPESN, for example, hiring centralized pharmacists to assist local pharmacies with recruiting patients for medication management services.

Pharmacies that had reached the routinizing stage also described realizing benefits from NC-CPESN participation, such as recruiting new patients, gaining confidence in their clinical skills, and getting providers and patients accustomed to pharmacists’ role in patient care. One pharmacist described, “We’ve seen a change in working with providers. In the beginning they were like, ‘Why are you asking about my patients?’ But now, they’re actually coming to the pharmacy and asking for our advice.” Pharmacies that had realized benefits from NC-CPESN indicated that their pharmacy intended to sustain medication management services beyond the NC-CPESN grant program. Pharmacies that had not yet realized benefits from the program were more uncertain about whether medication management services would be sustained in their pharmacy.

**Discussion**

We interviewed representatives from 40 community pharmacies that were implementing NC-CPESN, a complex Medicaid population health management intervention, to compare implementation strategies of high- and low-performing pharmacies within stages of implementation and to identify the strategies used to sustain the intervention. Similar to other complex healthcare innovations, implementation of NC-CPESN required multiple implementation strategies (e.g., plan, educate, restructure, quality management, finance) to support the implementation process.\(^{58,59,67}\) Different strategies were needed at different stages of implementation and some strategies were repeated and refined throughout the implementation process.\(^{69}\) Findings also revealed that (1) high- and low-performing pharmacies relied on some of the same implementation strategies but employed them differently and (2) high-performing
Participants used a wide variety of implementation strategies to support community pharmacy medication management services. For example, pharmacies used a number of education strategies to increase individual patients’ awareness of community pharmacy services, but continued to encounter resistance from some patients—a finding that is consistent with other studies.30,31,69 Future studies could examine population-level, education strategies (e.g., media campaigns) on awareness and acceptability of community pharmacist-led medication management services by patients and their caregivers. Similar to other medication management interventions,70-72 pharmacies used restructuring strategies, including redefining the professional roles of pharmacists, pharmacy technicians, and other pharmacy personnel. Past studies have shown that, with training, pharmacy technicians can support medication management activities by gathering patient information and documenting medication histories.73-75 Future studies should test the effectiveness of restructuring strategies that delegate components of population health management interventions to non-pharmacist personnel.

Although high- and low-performing pharmacies utilized many of the same strategies, their approach varied, resulting in different implementation outcomes (e.g., acceptability among personnel and efficiency).76 To better understand variation in implementation, future studies could document a small set of implementation strategies in detail and compare how the implementation strategies are employed across high- and low-performing pharmacies. Future
work could use existing guidelines for implementation documentation to describe the actors involved with carrying out an implementation strategy, why one implementation strategy was chosen over another (i.e., justification), and the frequency and length of time an implementation strategy was used (i.e., dosage). Future research could also examine which core components of implementation strategies are associated with effective implementation of medication management interventions.

We also found that low-performing pharmacies omitted certain implementation strategies used by high-performing pharmacies and were less likely to progress to later stages of implementation (i.e., routinizing stage), suggesting that some strategies may have a bigger impact on implementation effectiveness. For example, low-performing pharmacies did not use quality-monitoring strategies and failed to assess whether there was a need for NC-CPESN in their pharmacy (e.g., sufficient number of Medicaid patients). Determining early on whether the innovation is a good match for the organization is critical for sustainability but often gets neglected in implementation research. Future studies could tailor existing tools for tracking implementation progress and milestones, such as the Stages of Implementation Completion measure, to community pharmacy settings. Such studies could examine whether reaching certain stages of implementation or achieving specific implementation milestones (e.g., enrolling a certain number of patients in medication management services) impact program performance and sustainability.

**Limitations**

This study had several limitations. First, although the interview guide was informed by Rogers’ theory, we may have neglected other factors that affect implementation (e.g., external factors such as reimbursement policies and availability of PCPs). Second, we used a qualitative
approach to assigning community pharmacies to different stages of the implementation process based on subjective information provided by participants during an interview. Future studies could develop more objective measures, such as checklists, to assign community pharmacies to different phases of implementation for population health management interventions.\textsuperscript{46,80} Third, our study examined the implementation strategies employed by the pharmacies (e.g., delivery system) and did not examine strategies used other actors involved in the implementation process such as the developer of NC-CPESN, CCNC (e.g., support system).\textsuperscript{81} Future studies could examine the implementation strategies used by systems that provide support to community pharmacies implementing population health management interventions. Finally, because our aim was to capture the breadth of implementation strategies used by community pharmacies to implement a complex intervention, our study did not document implementation strategies in sufficient depth for replication.\textsuperscript{60}

Conclusion

Community pharmacies nationwide are increasingly delivering medication management services under alternative payment models seeking to improve population health. In the process, these models may redefine how community pharmacies collaborate with other healthcare providers and patients. Since these collaborations are relatively new to healthcare, continued research is needed to identify how to effectively implement community pharmacist-led medication management services in collaboration with other members of the healthcare team. As the healthcare system moves toward greater collaboration across otherwise disparate providers, there is also the need to better understand how to implement complex innovations that require simultaneous changes to many facets of a healthcare organization. This study contributes to the understanding of complex innovation implementation by identifying and comparing the implementation strategies used by high- and low-performing community pharmacies over time.
Figure 6.1. Selection of community pharmacy study sites

Included (n=40)
- Based on program year and performance

Excluded (n=5)
- Refused to participate due to time constraints

Recruited additional participants (n=5)

Year 1 pharmacies (n=15)
- High performing (n=8)
- Low performing (n=7)

Year 2 pharmacies (n=13)
- High performing (n=7)
- Low performing (n=6)

Year 3 pharmacies (n=12)
- High performing (n=9)
- Low performing (n=3)
Table 6.1. Community pharmacy staff and site characteristics (n=40)

<table>
<thead>
<tr>
<th>Staff and Site Characteristics</th>
<th>Interviews %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff Role</strong></td>
<td></td>
</tr>
<tr>
<td>Pharmacy owner and pharmacist</td>
<td>20.0</td>
</tr>
<tr>
<td>Pharmacy manager and pharmacist</td>
<td>17.5</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>47.5</td>
</tr>
<tr>
<td>Pharmacy technician</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>Staff Tenure</strong></td>
<td></td>
</tr>
<tr>
<td>0 to 3 years</td>
<td>32.5</td>
</tr>
<tr>
<td>4 to 5 years</td>
<td>45.0</td>
</tr>
<tr>
<td>6 years or more</td>
<td>22.5</td>
</tr>
<tr>
<td><strong>Pharmacy Setting</strong></td>
<td></td>
</tr>
<tr>
<td>Single independent pharmacy</td>
<td>20.0</td>
</tr>
<tr>
<td>Multiple independent pharmacy</td>
<td>50.0</td>
</tr>
<tr>
<td>Chain pharmacy</td>
<td>10.0</td>
</tr>
<tr>
<td>Outpatient pharmacy (e.g., FQHC)</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>Year of Program Enrollment</strong></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>37.5</td>
</tr>
<tr>
<td>Year 2</td>
<td>32.5</td>
</tr>
<tr>
<td>Year 3</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Pharmacy Performance</strong></td>
<td></td>
</tr>
<tr>
<td>Low-performing pharmacy</td>
<td>40.0</td>
</tr>
<tr>
<td>High-performing pharmacy</td>
<td>60.0</td>
</tr>
<tr>
<td><strong>Total pharmacies</strong></td>
<td>40</td>
</tr>
<tr>
<td>Stage of Implementation</td>
<td>High-Performing Pharmacies</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Pre-Implementation</td>
<td>Agenda-setting</td>
</tr>
<tr>
<td></td>
<td>Plan strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Visit other sites to gather information about NC-CPESN implementation and perceived benefits of NC-CPESN (+)</td>
</tr>
<tr>
<td></td>
<td>Conduct a local needs assessment to determine whether there is a need for NC-CPESN (e.g., patient need, financial need, performance gap)</td>
</tr>
<tr>
<td></td>
<td>Matching</td>
</tr>
<tr>
<td></td>
<td>Plan strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Assess for readiness including staffing, resources, and mission fit (+)</td>
</tr>
<tr>
<td></td>
<td>Conduct local consensus discussions among external and internal stakeholders (+)</td>
</tr>
<tr>
<td></td>
<td>Identify potential barriers and strategies for overcoming those barriers (+)</td>
</tr>
<tr>
<td>Implementation</td>
<td>Restructuring</td>
</tr>
<tr>
<td></td>
<td>Plan strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Develop a formal implementation blueprint for service delivery and documentation (+)</td>
</tr>
<tr>
<td></td>
<td>Recruit and designate for leadership (+)</td>
</tr>
<tr>
<td></td>
<td>Identify and prepare champions (+)</td>
</tr>
<tr>
<td></td>
<td>Pilot test medication management services (+)</td>
</tr>
<tr>
<td></td>
<td>Educate strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Conduct training with personnel via train-the-trainer or cross-training approaches (+)</td>
</tr>
<tr>
<td></td>
<td>Restructure strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Revise professional roles and hire new personnel (+)</td>
</tr>
<tr>
<td></td>
<td>Change record systems (+)</td>
</tr>
<tr>
<td></td>
<td>Quality-management strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Develop and organize quality-monitoring systems (+)</td>
</tr>
<tr>
<td></td>
<td>Redefining</td>
</tr>
<tr>
<td></td>
<td>Plan strategies (+)</td>
</tr>
<tr>
<td></td>
<td>Tailor strategies to overcome barriers and honor preferences (+)</td>
</tr>
<tr>
<td></td>
<td>Develop relationships with PCPs, care managers, and patients (+)</td>
</tr>
<tr>
<td></td>
<td>Finance strategies</td>
</tr>
<tr>
<td>(+) Reduce patient fees for low-income patients</td>
<td>(+) Reduce patient fees for low-income patients</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
| **Clarifying**  
Plan strategies  
(+) Stage implementation scale up | **Clarifying**  
Plan strategies  
(+) Stage implementation scale up |
| **Educate strategies**  
(+) Develop and distribute educational materials | **Educate strategies**  
(+) Develop and distribute educational materials |
| **Restructure strategies**  
(+) Revise professional roles based on experience with implementation (e.g., using pharmacist and pharmacy technicians at the top of their license) | **Restructure strategies**  
(-) Revise professional roles based on experience with implementation (e.g., using pharmacist and pharmacy technicians at the top of their license) |
| **Quality-management strategies**  
(+) Purposefully reexamine implementation and decide whether to continue, adjust implementation, or de-implement | **Quality-management strategies**  
(-) Purposefully reexamine implementation and decide whether to continue, adjust implementation, or de-implement |

**Sustainment**

| **Routinizing**  
Plan strategies  
(+) Obtain formal commitments  
(+) Develop resource sharing agreements | **Routinizing** |
|---|---|
| **Quality-management strategies**  
(+) Create centralized support systems for pharmacy personnel implementing NC-CPESN | **Routinizing**  
Not applicable. (None of the low-performing pharmacies reached the routinizing stage). |
| **Restructure strategies**  
Revise professional roles in personnel policies to include NC-CPESN implementation (e.g., hiring, new staff orientation) | |
| **Finance strategies**  
Alter incentive structure for employee performance to reward participation in NC-CPESN | |

**Note:** (+) indicated implementation strategies that were used and (-) indicates implementation strategies that were omitted.
REFERENCES


CHAPTER 7. SUMMARY OF FINDINGS AND IMPLICATIONS FOR POLICY, PRACTICE, AND RESEARCH

Summary of Findings

The purpose of this research was to explore the determinants of implementation effectiveness of a community pharmacy population health management program for Medicaid beneficiaries. In the first study, we examined the organizational determinants of implementation effectiveness using the organizational theory of innovation implementation.\(^1,2\) In the second study, we identified and compared the use of network ties to support implementation among high- and low-performing community pharmacies. In the third study, we identified and compared the implementation strategies used at different stages of the innovation process among high- and low-performing community pharmacies using the Rogers’ stages of the innovation process in organizations.\(^4\)

The first study quantitatively tested the organizational theory of innovation implementation, which has only been tested in a few other studies and never tested in a community pharmacy setting.\(^1,2,5,6\) In this study, we found that key constructs from this theory (e.g., implementation climate, innovation-values fit) were positively associated with implementation effectiveness including implementation activity and program reach. Additionally, we found evidence that innovation-values fit moderated the effect of implementation climate on implementation effectiveness, which has not been tested previously. This study contributes to the literature by confirming the relationships hypothesized in this theory and demonstrating that this theory has relevance for community pharmacy settings.
The second study qualitatively explored the use of network ties to support implementation of a population health management program. Previous studies have examined pharmacist-provider relationships in primary care population health management programs\textsuperscript{33,34} but have not examined these relationships in community pharmacy settings. We found key differences in how high- and low-performing pharmacies managed relationships with external organizations including healthcare providers, care managers, public health agencies, and patients. High-performing pharmacies, for example, had a broader network of ties with healthcare providers, care managers, and public health agencies whereas low-performing pharmacies had not formed such relationships. High-performing pharmacies also described using strategies to maintain relationships with healthcare providers outside of standard communication about patients, such as creating boundary-spanning positions within their pharmacy (e.g., having their pharmacist work in a primary care practice one day a week) to learn more about physicians’ needs for medication management services. Both high- and low-performing pharmacies used a number of strategies to building relationships with patients including appointing staff members to engage specific high-risk patients and learning more about resources in the local community to assist patients’ with social needs such as housing or utility assistance.

The third study qualitatively explored the implementation process used by community pharmacies to implement a Medicaid medication management intervention using Rogers’ theory\textsuperscript{4}, which has not been studied previously. We found that community pharmacies employed a number of implementation strategies such as redefining job responsibilities to ensure pharmacists and pharmacy technicians are working at the top of their license. Findings also revealed differences in the implementation process among high- and low-performing pharmacies. High-performing pharmacies, for example, were more likely to reach later stages of
implementation and used strategies such as establishing collaborative practice agreements with providers and gaining EHR access. Low-performing pharmacies were less likely to gain stakeholder buy-in prior to implementation, resulting in staff resistance to change.

**Practice Implications**

The main findings from this dissertation were that organizational determinants (e.g., implementation climate and innovation-values fit), relationship building with other healthcare providers and patients, and the implementation process affected implementation effectiveness of a population health management program in community pharmacies. The findings from the first study suggest that community pharmacies may need assistance with developing a supportive implementation climate for medication management programs. Pharmacies, for example, may need leadership training on how to reward staff for participation in medication management programs or how to set expectations for staff participation. The findings from the second study suggest that some pharmacies have more experience with relationship building with other healthcare providers and therefore implementation assistance may be needed for pharmacies with less experience. As an example, pharmacies with less experience working with other healthcare providers could be paired with pharmacies with more experience to learn best practices for engaging other healthcare providers in medication management services. The findings from the third study suggest that some pharmacies may need guidance on the process of implementation (e.g., pilot testing, engaging stakeholders prior to implementation) to ensure medication management services are implemented effectively and are sustainable.

**Policy Implications**

The findings from this dissertation suggest that community pharmacies have varying levels of experience with implementing medication management services and partnering with other healthcare organizations—skills that are required for participating in population health
management programs. Given that, it will be important for public payers sponsoring medication management programs to test which implementation strategies are associated with effective implementation and to encourage grantees (e.g., state Medicaid agencies) to develop implementation guidance for community pharmacies and develop mechanisms for sharing best practices across high- and low-performing pharmacies.

The findings from this study also suggest that using staff at the top of their license (e.g., pharmacist and pharmacy technicians) facilitates implementation of medication management programs. Past studies have shown that, with proper training, pharmacy technicians can assist with medication management activities such as gathering patient information and documenting medication histories.\textsuperscript{7-9} Researchers could assess whether state-level differences in regulation and recognition of national certification for pharmacy technicians impact the level of pharmacy technician involvement in population health management and medication management activities.\textsuperscript{10,11}

Additionally, findings from this study indicate that collaborating with healthcare providers and gaining access to patient health information (e.g., EHR access) are challenges for community pharmacies participating in medication management programs. Currently, there are a number of structural barriers limiting community pharmacist access to EHRs and health information exchange (HIE) programs including differences in state laws, user fees for HIEs, and lack of reimbursement for community pharmacist use of the EHR.\textsuperscript{12-14} Since community pharmacists are not defined as eligible providers for meaningful use incentives, future interventions could test payment models that allow healthcare organizations to share incentives with community pharmacists or payment models that support community pharmacist integration into HIEs.\textsuperscript{15}
**Research Implications**

The findings from this dissertation suggest several areas for future research. The study results from the first study indicated that implementation climate and innovation-values fit work in concert to produce effective implementation. Future studies could identify which implementation strategies are associated with improved implementation climate and innovation-values fit. The findings from the second study suggest that some pharmacies are better at building inter-organizational relationships in response to changes in the healthcare environment, which is consistent with studies of inter-organizational relationships.\(^7\) High-performing pharmacies in this study were more effective at creating boundary-spanning roles and leveraging external ties to support implementation. Future studies could examine interventions that assist community pharmacies with developing inter-organizational relationships to support implementation of medication management services (e.g., creation of learning collaborative to disseminate effective organizational networking practices). The findings from the third study revealed that reorienting community pharmacies from a dispensing to a population health management model required a multi-faceted and multi-staged approach to implementation. Although high- and low-performing pharmacies utilized many of the same strategies, their approach was different, resulting in different implementation outcomes (e.g., acceptability among personnel, efficiency, and fidelity\(^9\)). Future research could identify the core components of implementation strategies that are associated with effective implementation of medication management interventions—a research need that has been identified in other implementation studies.\(^6\)
REFERENCES


