

**Dissemination and Implementation of Evidence-based Chronic Pain Management Among
Primary Care Providers**

by

Laura Ellen Gochnauer Ashcraft

Bachelor of Arts in Social Work, Millersville University of Pennsylvania, 2012

Masters of Social Work, University of Pittsburgh, 2013

Submitted to the Graduate Faculty of
School of Social Work in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

University of Pittsburgh

2021

UNIVERSITY OF PITTSBURGH
SCHOOL OF SOCIAL WORK

This dissertation was presented
by

Laura Ellen Gochnauer Ashcraft

It was defended on

July 30, 2021

and approved by

Elizabeth M.Z. Farmer, PhD, Dean and Professor, School of Social Work

Jessica S. Merlin, MD, PhD, MBA, Associate Professor, School of Medicine

Shari S. Rogal, MD, MPH, Assistant Professor of Medicine, Surgery, and Clinical and
Translational Science, School of Medicine Pitt; Core Investigator, Center for Health Equity
Research and Promotion, VAPHS

Deborah J. Moon, PhD, Assistant Professor, School of Social Work

Dissertation Director: Shaun M. Eack, PhD, James and Noel Browne Endowed Chair, Associate
Dean for Research, and Professor, School of Social Work

Copyright © by Laura Ellen Gochnauer Ashcraft

2021

Dissemination and Implementation of Evidence-based Chronic Pain Management Among Primary Care Providers

Laura Ellen Gochnauer Ashcraft, PhD

University of Pittsburgh, 2021

Chronic pain and its consequences are pervasive in the United States. Most people living with chronic pain receive care from their primary care providers (PCPs). PCPs are asked to synthesize evidence-based treatments and find the options that work best for their patients. This dissertation leveraged implementation science and Diffusion of Innovations Theory, the Model for Dissemination of Research, and the Consolidated Framework for Implementation Research to identify current and preferred dissemination channels and implementation strategies for evidence-based chronic pain management among primary care providers in Pennsylvania. This study used snowball sampling to survey 101 Pennsylvania PCPs about their current and preferred dissemination channels and implementation strategies and used Cohen's kappa to assess the degree of concordance. The survey collected professional factors, context factors and predicted moderators of concordance including urbanicity, academic affiliation, openness to trying new treatments, perceptions of incongruence between existing and new practices, and knowledge of evidence-based chronic pain management. Study results found significant dissemination gaps in learning about evidence-based chronic pain management from workshops, clinical experts, seminars, and researchers; and implementation gaps in developing workgroups, creating targeted supports, identifying chronic pain champions, using data to inform care, and engaging patients and families. This sample of Pennsylvania PCPs had average levels of dissemination concordance and implementation concordance higher than that expected by chance. The study

used multiple linear regression to understand potential moderators of the congruence relationship. Only self-identifying as female was statistically significantly related to lower levels of dissemination concordance. Increased years of experience was statistically significantly related to slightly higher levels of implementation concordance. It is important to consider the named limitations for interpreting the results and should not be generalized beyond the current sample. Findings hold implications for future methodological approaches in implementation science to quantify and benchmark dissemination and implementation gaps in various settings. The results also highlight the important role of social work practitioners and social work scholars in leveraging their existing roles to bring together interdisciplinary teams and patients and families with the goal to bridge the gap between existing practice and preferences in addressing chronic pain management in primary care.

Table of Contents

| | |
|--|------------|
| Acknowledgements | xii |
| Dedication | xiv |
| 1.0 Introduction..... | 1 |
| 1.1 The Problem of the Dissemination and Implementation of Evidence-based Chronic Pain Management to Primary Care Providers | 2 |
| 1.2 Relevance to Social Work | 7 |
| 1.3 Overview of Study | 10 |
| 1.3.1 Specific Aims | 11 |
| 2.0 Literature Review | 14 |
| 2.1 Overview..... | 14 |
| 2.2 Chronic Pain | 16 |
| 2.2.1 The Problem | 16 |
| 2.2.2 Chronic Pain in Primary Care..... | 18 |
| 2.2.3 Chronic Pain Management | 19 |
| 2.3 Diffusion of Innovations Theory | 26 |
| 2.3.1 Components of Diffusion of Innovations Theory | 26 |
| 2.3.2 Types of Adopters | 27 |
| 2.3.3 Stages of Diffusion of Innovations | 29 |
| 2.4 Dissemination Research | 31 |
| 2.4.1 Definition..... | 31 |
| 2.4.2 The Model for Dissemination of Research | 32 |

| | |
|---|-----------|
| 2.5 Implementation Research | 35 |
| 2.5.1 Definition..... | 35 |
| 2.5.2 Consolidated Framework for Implementation Research (CFIR) | 35 |
| 2.6 Relationship between Dissemination Research and Implementation Research..... | 41 |
| 2.7 Dissemination Research and Implementation Research in Chronic Pain | 45 |
| 2.7.1 Dissemination Research in Chronic Pain..... | 46 |
| 2.7.2 Implementation Research in Chronic Pain | 48 |
| 2.8 Moderators of Dissemination and Implementation Concordance..... | 53 |
| 2.8.1 Individual Factors | 53 |
| 2.8.2 Contextual Factors | 57 |
| 2.9 Study Aims and Hypotheses | 61 |
| 3.0 Research Design and Methodology | 63 |
| 3.1 Study Design..... | 63 |
| 3.2 Participants | 63 |
| 3.2.1 Sample Design | 63 |
| 3.2.2 Inclusion/Exclusion | 64 |
| 3.2.3 Recruitment | 65 |
| 3.3 Incorporation of the Dillman Method | 70 |
| 3.3.1 Survey Development | 70 |
| 3.3.2 Survey Recruitment | 71 |
| 3.4 Measures..... | 73 |
| 3.4.1 Professional Characteristics | 74 |
| 3.4.2 Clinic Context Factors | 75 |

| | |
|---|-----|
| 3.4.3 Dissemination Preferences | 75 |
| 3.4.4 Implementation Preferences | 76 |
| 3.4.5 Moderators | 77 |
| 3.5 Study Procedure | 80 |
| 3.5.1 Piloting | 81 |
| 3.6 Data Analysis | 81 |
| 3.6.1 Sample Description | 82 |
| 3.6.2 Preliminary Analysis..... | 82 |
| 3.6.3 Analyses of Specific Aims and Hypotheses | 83 |
| 3.6.4 Power Analysis | 87 |
| 3.7 COVID-19 | 87 |
| 4.0 Results | 89 |
| 4.1 Sample Characteristics | 90 |
| 4.2 Preliminary Analyses | 93 |
| 4.2.1 Internal Consistency | 94 |
| 4.2.2 Parametric Assumptions | 97 |
| 4.2.3 Assessment of Bias in Sample | 98 |
| 4.3 Aim 1: Identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management..... | 100 |
| 4.4 Aim 2: Compare existing dissemination and implementation strategies for evidence-based chronic pain management with stated preferences of primary care providers..... | 104 |

| | |
|---|------------|
| 4.5 Aim 3: Explore the effect of professional characteristics and clinic context on the concordance of dissemination/implementation strategies and preferences for chronic pain management in primary care providers. | 110 |
| 5.0 Discussion..... | 116 |
| 5.1 Summary of Findings..... | 116 |
| 5.2 Limitations | 123 |
| 5.3 Implications for Social Work | 126 |
| 5.3.1 Role for Primary Care Social Workers..... | 126 |
| 5.3.2 Role for Social Work Scholars..... | 128 |
| 5.3.3 Role for Macro Social Workers | 132 |
| 5.4 Conclusions | 135 |
| Appendix A Study Survey | 138 |
| Bibliography | 163 |

List of Tables

| | |
|--|------------|
| Table 1 Study Aims with corresponding variables, measures, and analyses | 73 |
| Table 2 Dissemination Concordance, Cohen’s kappa individual data example | 85 |
| Table 3 Participant Characteristics | 91 |
| Table 4 Urban Rural Counties..... | 93 |
| Table 5 Internal Consistency for Study Scales..... | 96 |
| Table 6 Preliminary Analysis: Included and Excluded Sample | 99 |
| Table 7 Description of Dissemination Channels | 101 |
| Table 8 Description of Implementation Strategies | 103 |
| Table 9 Description of Dissemination and Implementation Concordance..... | 105 |
| Table 10 Categorical Dissemination Concordance | 106 |
| Table 11 Categorical Implementation Concordance | 108 |
| Table 12 Bivariate Correlation with Dissemination and Implementation Concordance... | 111 |
| Table 13 Multiple Linear Regression Results | 112 |
| Table 14 Differences between PCPs in Academic and Non-Academic Settings..... | 113 |
| Table 15 Differences between PCPs in Urban and Rural Settings..... | 114 |

List of Figures

| | |
|--|------------|
| Figure 1 Dissemination of Evidence-based Chronic Pain Management to Primary Care Providers | 13 |
| Figure 2 Implementation of Evidence-based Chronic Pain Management by Primary Care Providers | 13 |
| Figure 3 A Model for Dissemination of Research (Brownson et al., 2018) | 33 |
| Figure 4 The Consolidated Framework for Implementation Research (Damschroder et al., 2009) | 36 |
| Figure 5 Implementation Science Conceptualization (Mitchell & Chambers, 2017) | 42 |
| Figure 6 The Relationship Between Dissemination Research and Implementation Research | 43 |
| Figure 7 Dissemination Concordance | 107 |
| Figure 8 Implementation Concordance | 109 |

Acknowledgements

I acknowledge the never-ending support and patience of my husband and life partner, Justin. I acknowledge the wisdom, love, and encouragement my three sisters and best friends, Heather, Kristen, and Renae. I acknowledge the immeasurable gift of my parents, David and Becky who instilled in me a desire to learn and be a woman of integrity.

I acknowledge the early support of Dr. David “Mudcat” Johnson who told me in 2011 that he could see me getting a PhD. I acknowledge the support and ongoing mentorship of Dr. Jeremy Kahn who took a risk on a newly graduated MSW student to work in Critical Care Medicine and allowed me to make mistakes, learn, and grow.

I acknowledge the significant contributions of my three primary mentors, Dr. Shaun Eack for his guidance through the field of social work, Dr. Jessie Merlin, for her constant enthusiasm and support of my gifts and guidance through the field of chronic pain, and to Dr. Shari Rogal, my implementation science guide and co-conspirator in developing DISC and believing in my outlandish (and time consuming) dreams. I acknowledge the contribution of my other two committee members Dr. Debby Moon and Dean Farmer for their guidance and insights as I designed, implemented, and finalized this dissertation.

I acknowledge the critical role that the Pittsburgh Dissemination and Implementation Science Collaborative has had on my intellectual and career development. Additionally, I acknowledge the career coaching funded by the TL1 pre-doctoral fellowship which has been an invaluable resource. I acknowledge the support of the leadership and faculty of the Division of General Internal Medicine at the University of Pittsburgh for their ongoing support of this project.

I acknowledge the significant contribution of the Anti-Racism Doctoral Student Group in helping me to think more critically about the world around me and my role in anti-racist work. I acknowledge the contribution of my doctoral cohort and other doctoral students in the School of Social Work. I acknowledge the innumerable people who have contributed to my personal, professional, and academic journey by laughing, debating, and giving words of wisdom. I acknowledge this intellectual village who have listened, bought coffees, and supported this journey.

I acknowledge Dr. Ray Engel who has been a source of laughter, guidance, and healthy sporting competition.

Finally, I acknowledge the miles of walks, puzzles, and statistical support of Dr. Billie Davis without which this dissertation could not have existed.

This study was funded by: National Institutes of Health, TL1TR001858; University of Pittsburgh Center for Interventions to Advance Community Health (CiTECH); and the Kevin Corcoran Endowed Dissertation Fund.

Dedication

To Rayna Jean Gochnauer Ashcraft

1.0 Introduction

Chronic pain affects millions of people every year and is most often managed by primary care providers (PCPs). There are many evidence-based approaches to treating chronic pain; yet primary care providers often face barriers to knowing about and using these treatments. The result of which is untreated or inappropriately treated chronic pain and physical, psychological, economic, and social consequences. Dissemination research and implementation research propose strategies to increase the effectiveness of communicating chronic pain evidence and uptake by providers. Social work offers a unique contribution to addressing this problem by integrating a biopsychosocial and person-in-environment perspective of the patient, clinic, and community settings to collaboratively overcome the dissemination and implementation gap of evidence-based chronic pain management in primary care.

Limited research exists at the intersection of chronic pain management in primary care and implementation science. The long-term goal of the current line of research is to move both fields of chronic pain and implementation science forward. However, the scope of this dissertation centers on the methodological contributions to implementation science by quantifying gaps and identifying research priorities in dissemination and implementation gaps. These advances may also be used in clinical settings by highlighting targets for the dissemination and implementation of chronic pain management interventions. The following section describes chronic pain management in primary care with the goal to highlight gaps well-suited for implementation science to address. The results of this work act as a foundation for advances in methodological approaches to quantify dissemination concordance and implementation concordance not only among primary care providers but in other populations as well. As such,

the following will situate the current topic (evidence-based chronic pain management in primary care settings) before describing implementation science and then will discuss the intersection of the two to contextualize and introduce the current study.

1.1 The Problem of the Dissemination and Implementation of Evidence-based Chronic Pain Management to Primary Care Providers

Chronic pain is a serious problem in the United States affecting the physical, social, psychological, and economic well-being of millions (Institute of Medicine of the National Academies, 2012; National Center on Complementary and Integrative Health, 2015). Chronic pain is pain that lasts longer than a normal healing time or for more than three to six months (Treede et al., 2015) and affects anywhere from 25.3 million (National Center on Complementary and Integrative Health, 2015) to 100 million people (Institute of Medicine of the National Academies, 2012) annually. Not only does chronic pain impact a significant portion of the U.S. population, it also costs \$635 billion annually in medical treatment and lost productivity (Institute of Medicine of the National Academies, 2012).

Chronic pain exists beyond a physical condition and involves psychological challenges such as depression and anxiety (Brennan et al., 2007; Institute of Medicine of the National Academies, 2012). There are many non-pharmacologic and pharmacologic ways to manage and treat chronic pain ranging from physical therapy (Assendelft et al., 2004; Hayden et al., 2005; Kinney et al., 2018) and cognitive behavioral therapy (Hoffman et al., 2007; Morley et al., 1999; Niesen et al., 2018) to opioids (Allegri et al., 2019; Furlan et al., 2006; Reinecke et al., 2015) and antidepressants (Salerno et al., 2002).

Chronic pain is a serious condition which is most often treated in primary care settings (Breuer et al., 2010; Nguyen et al., 2005). While many definitions to primary care exist for the purposes of this dissertation the National Academy of Medicine, formally known as the Institute of Medicine, defines primary care as follows:

“Primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal healthcare needs, developing a sustained partnership with patients, and practicing in the context of family and community.” (Donaldson et al., 1996, p. 31)

Primary care providers (PCPs) are the entry point for the healthcare system for the majority of people in the United States (Donaldson et al., 1996). PCPs are often responsible for between 1,200 to 1,900 patients (Raffoul et al., 2016) and manage many chronic conditions (Chen et al., 2009) including most chronic pain management (Breuer et al., 2010; Nguyen et al., 2005). Often PCPs are uncertain about how to treat chronic pain which may result in untreated chronic pain or overreliance on pharmacologic treatments (e.g. opioids) (Breuer et al., 2010; Institute of Medicine of the National Academies, 2012; Jamison et al., 2014; Pizzo & Clark, 2012).

Many interventions exist to manage chronic pain; yet little work exists on addressing the gap between chronic pain management research and primary care practice. Implementation science is the investigation of effective ways to distribute evidence, integrate this evidence into care, and influence determinants (Mitchell & Chambers, 2017). This approach offers a solution to address the gap between research evidence and provider knowledge and utilization. Implementation science is grounded in Diffusion of Innovations Theory which seeks to explain

how interventions are spread and used by examining individual and contextual factors (Rogers, 2003).

The purpose of Diffusion of Innovations Theory is to understand how novel interventions are adopted (or not) and explore how this adoption is related to internal and external factors (Rogers, 2003). Individual, organizational, and systems factors are considered as potential moderators of the Innovation-Decision Process (Rogers, 2003). In this way, Diffusion of Innovations Theory provides a useful foundation for identifying dissemination channels and implementation strategies in evidence-based chronic pain management.

Primary care providers are often responsible for many patients (Raffoul et al., 2016) and the care of numerous chronic conditions (Chen et al., 2009), including chronic pain (Breuer et al., 2010; Nguyen et al., 2005). PCPs are asked to navigate large and complex bodies of literature and make patient-centered determinations for the management of chronic pain. The investigation of dissemination research and implementation research in evidence-based chronic pain management in primary settings is still in its infancy with very little known about PCPs preferences for dissemination channels or implementation strategies.

Dissemination research seeks to understand and improve the distribution of information (National Institutes of Health, 2019). The Model for Dissemination of Research builds on both Diffusion of Innovations Theory and dissemination research with the goal to understand the translation gap between research and practice (Brownson et al., 2018). Both Diffusion of Innovations Theory and the Model for Dissemination of Research provide a foundation to help understand existing dissemination and develop strategies to improve dissemination of evidence.

Dissemination research in chronic pain management in primary care is limited with no studies using Diffusion of Innovations Theory or the Model for Dissemination of Research.

While they did not use the same models, three chronic pain dissemination studies found self-reported increases in chronic pain knowledge as a result in toolkits, guidelines, and change models (Cardarelli et al., 2017), train-the-trainer models were most successful in rural settings (Zisblatt et al., 2017), and the availability of online resources (as passive dissemination) does not improve chronic pain knowledge (Jamison et al., 2002). Even as the dissemination of chronic pain evidence is an ongoing priority (Webster, 2013), little is known about how to do so successfully or how PCPs would prefer to receive information about chronic pain management.

Implementation research examines how innovations are integrated into practice (National Institutes of Health, 2019). The Consolidated Framework for Implementation Research (CFIR) uses a theoretical foundation partially based on Diffusion of Innovations Theory with the goal to help implementation researchers understand the implementation process using a set of domains and constructs (Damschroder et al., 2009). The CFIR provides the structure to assess implementation processes by examining barriers and facilitators with the goal to improve implementation in clinical settings. The Expert Recommendations for Implementing Change (ERIC) implementation strategies complements this framework by operationalizing ways to promote implementation of an evidence-based practice (Powell et al., 2015).

The implementation of evidence-based chronic pain management is more commonly studied in the peer-reviewed literature. Existing literature at the intersection of implementation science and chronic pain management focuses on the chronic pain management strategies of peer support (Shue et al., 2018), self-management (Niesen et al., 2018), and the appropriate use of opioids (Becker et al., 2018). Implementation strategies to support the use of these interventions include systems consultation (Jacobson et al., 2019; Quanbeck et al., 2018) and academic detailing (Becker et al., 2018; Jacobson et al., 2019; Midboe et al., 2018; Quanbeck et al., 2018).

These studies demonstrate a growing field of implementation research on the topic of chronic pain management in primary care settings. Yet, there is little evidence to suggest what strategies PCPs want to use when implementing evidence-based chronic pain management with their patients.

Together dissemination research and implementation research provide a systematic approach to addressing the serious problem of chronic pain management in primary care settings. Chronic pain is a significant source of disability with far-reaching physical, psychological, economic, and social consequences. Social work scholars offer a unique skillset to addressing the issue of chronic pain in the US, given their professional training which centers on the person-in-environment perspective while also understanding the importance that not only biology, but also psychological and social factors have in the ongoing management of chronic conditions. This framework, in conjunction with implementation science, provides a novel approach to examining dissemination and implementation of evidence-based chronic pain management in primary care settings. Further, clinical social workers are well-positioned to put the results of this scholarship into practice given their strengths in translating evidence and working in interdisciplinary settings.

As described above, previous research often focuses on the barriers and facilitators of evidence-based chronic pain management, but stops short of moving to the next step of describing how primary care providers themselves would prefer to leverage facilitators to overcome dissemination and implementation barriers. To date, no research exists on dissemination and implementation concordance of evidence-based chronic pain management among primary care providers. The development of tailored implementation strategies is crucial to increasing the uptake and ongoing utilization of evidence-based chronic pain management

among primary care providers. Therefore, scholars should first understand current dissemination channels and implementation strategies used by primary care providers and then solicit information about what PCPs would like to experience in an ideal world. This information can then provide insights into the degree of dissemination concordance and implementation concordance for evidence-based chronic pain management among primary care providers. Finally, using this measure of dissemination concordance and implementation concordance, scholars must understand what factors may influence dissemination and implementation concordance. This work builds on the existing knowledge about barriers and facilitators of evidence-based chronic pain management to move the field forward by understanding dissemination and implementation concordance of evidence-based chronic pain management in primary care and potential moderating factors.

1.2 Relevance to Social Work

Social work addresses social problems, specifically problems that inhibit the quality of life, functioning, and social justice. Chronic pain is a serious medical *and* social problem with consequences that reach beyond physical functioning to include mental health and interpersonal relationships. As previously defined, primary care settings seek to address a variety of conditions and support the health of families and the community. Within this context, primary care is an appropriate setting for addressing social determinants of health as this holistic perspective alongside integrated care teams has been shown to improve health outcomes (Cornell et al., 2020; Katon et al., 2010; Reiss-Brennan et al., 2016). This intersects with the field of social work as social workers are being increasingly incorporated into multidisciplinary primary care teams

particularly as integrated behavioral health increases (Stanhope et al., 2015).

The American Academy of Social Work and Social Welfare Grand Challenges provides a guide for social work scholarship to address chronic pain. The twelve Grand Challenges for social work, research, and policy include the goal to Close the Health Gap including a sub-goal to address health inequity (American Academy of Social Work & Social Welfare, 2016). Health inequalities exist based on numerous factors, often described as social determinants of health, including geography, socioeconomic status, and race (Walters et al., 2016). People living with chronic pain experience complex biopsychosocial needs and often experience a gap between best practices and the care they receive which may exaggerate existing health inequity.

Social work scholarship is limited in chronic pain and most existing investigation focuses on mental and behavioral health treatments. Social work has long focused on evidence-based practices (EBP) in service to vulnerable populations (Proctor & Rosen, 2008). However, this work often stops at developing an effective and efficacious intervention leaving a gap between research and practice. Implementation science offers a novel approach to address this social problem and takes the EBP the next step by tailoring interventions to application settings (Proctor, 2017; Proctor & Rosen, 2008). Social work is well prepared to leverage existing evidence-based practices and use implementation science to move them into practice.

Social work provides a unique skillset and perspective missing in the fields of dissemination and implementation research and chronic pain management. The biopsychosocial perspective provides a foundation to consider not only pharmacologic interventions to treat chronic pain but also non-pharmacologic. This holistic approach is necessary to understand the complexity of chronic pain treatment. Further, social work has long acknowledged the critical and unique role that patients, providers, and policy play in ensuring evidence-based treatment is

used in practice (Proctor & Rosen, 2008).

The current study has developed a foundational understanding of dissemination and implementation of chronic pain management in primary care settings which is understudied. Further, it has integrated the biopsychosocial perspective offered by social work, to understand how dissemination research and implementation research can be leveraged to improve health equity.

The intersection of implementation science, chronic pain, and social work is unique with few scholars addressing this serious social problem. Further, the current study was one of the first of its kind to examine dissemination and implementation concordance of chronic pain management in primary care. For the purposes of this study, concordance is the individual-level degree of agreement between current and preferred dissemination channels and implementation strategies.

This contribution is needed, not just for the management of chronic pain in primary care, but also for social work and implementation science. Social work has long been at the forefront of a holistic approach to healthcare going back to the first hospital social workers (Cannon, 1913). Additionally, social work has been a leader in implementation science (Proctor, 2017; Proctor & Rosen, 2008). Social work scholars can and should promote effective dissemination and implementation of evidence-based chronic pain management in primary care settings. In doing so, social workers will work to promote well-being and functioning for millions of people in the United States who live with chronic pain. The current study builds on this foundation to advance implementation science methods in understanding moderators of dissemination and implementation concordance.

Social workers are increasingly well-positioned within primary care settings (Lombardi et

al., 2019) and are able to use this position to provide holistic support for both patients and the interdisciplinary team as a whole. Primary care-based social workers may support the translation of research into practice by leveraging profession-specific training of person-in-environment and systems to address the needs of patients and health systems at large. The current study builds on this knowledge and expertise and provides additional tools and guidance for implementation scientists and primary care-based social workers to further contribute to the well-being of people living with chronic pain.

1.3 Overview of Study

The purpose of this study was to understand current and preferred dissemination and implementation strategies for evidence-based chronic pain treatment in primary care settings and to understand the role of clinic context and professional factors on the alignment between existing and preferred dissemination channels and implementation strategies.

The study employed an online survey of 100 Pennsylvania primary care providers. The survey included: 1) professional questions assessing individual-level characteristics such as the number of years of clinical experience, days per week in the clinic, and self-identified gender and race, etc., 2) clinic context questions assessing contextual factors including the type of insurances accepted, academic affiliation, and urbanicity, etc., 3) current and preferred dissemination channels for chronic pain evidence to primary care providers, and 4) current and preferred implementation strategies for putting evidence-based chronic pain management into practice. The results of this study provided a foundational understanding of existing and preferred dissemination channels and implementation strategies to primary care providers. The

results of the current study will also guide the development of dissemination and implementation tools with the goal to improve the management of chronic pain in primary care.

1.3.1 Specific Aims

The purpose of this study was to understand the existing and preferred dissemination channels and implementation strategies that providers used for evidence-based chronic pain management in primary care settings. To meet this goal, the study investigated the following aims (displayed visually in Figure 1.1. and Figure 1.2.):

Aim 1: Identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management. The study used a survey to collect data on how primary care providers currently receive and prefer to receive information about chronic pain treatment using the Model for Dissemination of Research as a guide. The study also collected data on existing and preferred implementation strategies. Descriptive statistics were used to examine and describe these characteristics and preferences, with frequencies and percentages used for categorical variables and mean, standard deviation, and range for continuous variables.

Aim 2: Compare existing dissemination and implementation strategies for evidence-based chronic pain management with stated preferences of primary care providers. The study compared existing dissemination channels and implementation strategies with stated preferences to examine the degree of concordance between current strategies and those that are preferred. Cohen's kappa (κ) was used to examine the individual-level degree of agreement between existing and preferred dissemination channels and existing and preferred implementation strategies.

Aim 3: Explore the effect of professional characteristics and clinic context on the concordance of dissemination/implementation strategies and preferences for chronic pain management in primary care providers. Professional characteristics (training, profession, days in clinic per week, and years of experience) and clinic context factors (urbanicity, academic affiliation, EBPAS Openness subscale, and EBPAS Divergence subscale) were collected and used to examine what factors may influence the degree of concordance between existing and preferred dissemination channels and implementation strategies. A series of multiple linear regression models were used to investigate the moderating impact of professional characteristics and clinical context on concordance between existing and preferred dissemination channels and existing and preferred implementation strategies.

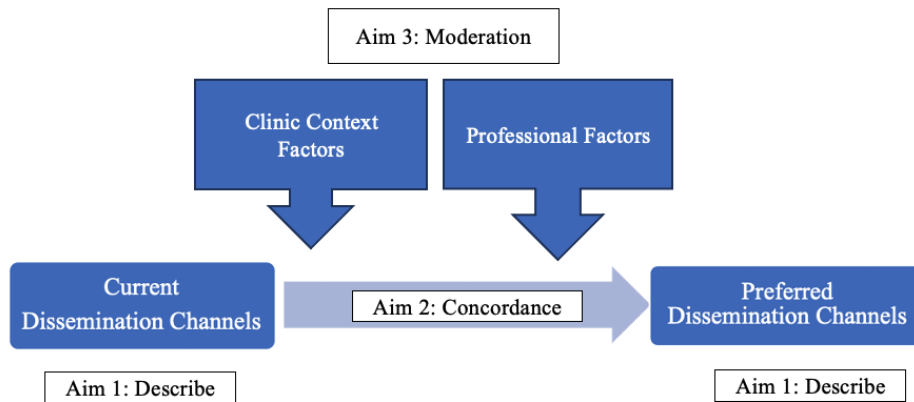


Figure 1 Dissemination of Evidence-based Chronic Pain Management to Primary Care Providers

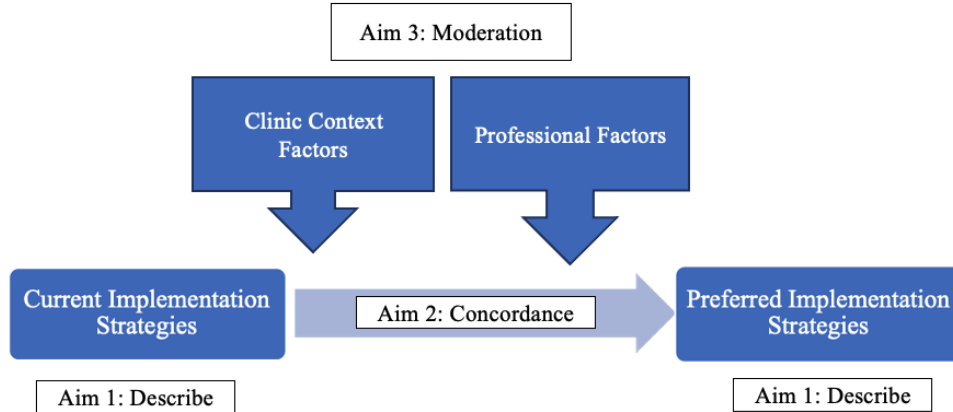


Figure 2 Implementation of Evidence-based Chronic Pain Management by Primary Care Providers

2.0 Literature Review

2.1 Overview

The following first describes the severity and far-reaching consequences of chronic pain in the United States and evidence-based strategies for its management with the goal to highlight gaps suitable for implementation science. This section then describes the theoretical foundation of implementation science to address these gaps and finally examines existing implementation science research in the management of chronic pain in primary care settings.

Chronic pain is a serious problem with far-reaching physical, social, and economic consequences. Millions of people suffer every year and significant efforts have been made to develop evidence-based treatments. People with chronic pain most often manage their treatment with a primary care provider (PCP). Opioids are the most common treatment for chronic pain which has resulted in an epidemic of prescriptions and corresponding overdose-related deaths. Investigation into the link between chronic pain and the opioid epidemic is critical; however, it is not the focus of this dissertation. Effective chronic pain management strategies exist but often do not reach and, therefore, are not utilized by primary care providers. The use of dissemination research and implementation research may address this gap in knowledge and practice.

Diffusion of Innovations Theory provides a theoretical foundation for both dissemination research and implementation research. Diffusion of Innovations Theory provides more than the commonly known “s-curve.” Additional contributions, of equal if not greater importance, include the overarching premise that diffusion occurs by 1) the innovation 2) communicated through a

channels 3) over time 4) to members of a social system and the Innovation-Decision Process (Rogers, 2003).

The Model for the Dissemination of Research builds on Diffusion of Innovations Theory to provide a meta-theoretical framework for understanding dissemination research and builds on the Mathematical Theory of Communication to include the source, message, audience, and channel (Brownson et al., 2018). The Consolidated Framework for Implementation Research (CFIR) describes five domains and 39 constructs which propose possible factors for consideration in implementation research studies (Damschroder et al., 2009).

Dissemination research and implementation research rely on Diffusion of Innovations Theory, have complementary purposes, and fall under the umbrella of Implementation Science. Dissemination research seeks to understand the most effective strategies for spreading information about an evidence-based practice. Whereas implementation research seeks to understand the best way to utilize the evidence-based practice in a clinical setting (broadly defined). These distinct areas of research build on one another in unique and complementary ways.

Research which uses Diffusion of Innovations Theory, the Model for the Dissemination of Research, and/or the CFIR to examine the treatment of chronic pain in primary care is limited. No dissemination studies use these theoretical approaches with only three studies broadly evaluating dissemination channels. In implementation research, eight studies use the selected models as a framework to explore the treatment of chronic pain in primary care and of these, six focus on opioid-related interventions.

The following describes the issue of chronic pain and current treatments and discusses the theoretical foundation of Diffusion of Innovations Theory. It then describes two meta-theoretical models which support dissemination research and implementation research

respectively. Next, the relationship between dissemination research and implementation research is discussed. This chapter concludes with an examination of dissemination and implementation research of evidence-based treatment of chronic pain in primary care settings.

2.2 Chronic Pain

2.2.1 The Problem

Chronic pain is a serious problem with vast variations in prevalence estimates. Some work estimates between 25.3 million (National Center on Complementary and Integrative Health, 2015) to 100 million (Institute of Medicine of the National Academies, 2012) people in the United States experience chronic pain. However, this may not fully encompass marginalized populations who experience health disparities in diagnosing and treatment (Institute of Medicine of the National Academies, 2012). About 11 percent of people experience generalized pain lasting more than three months (Hardt et al., 2008) and about 30.7 percent of the population experiences pain lasting more than six months (Johannes et al., 2010). Chronic pain is a serious social problem independent of variations in estimates.

Chronic pain is pain that persists beyond a normal healing time or lasting more than three to six months (Treede et al., 2015). Operational definitions range from clinical assessments (Dansie & Turk, 2013; Haefeli & Elfering, 2006) to administrative codes for reimbursement (Treede et al., 2015). Traditionally, clinical pain assessments use patient self-report to understand the intensity and effect of pain which typically includes rating on a 1 to 10 scale or the use of a pain questionnaire, such as the McGill Pain Questionnaire (Haefeli & Elfering, 2006).

Inconsistency in defining chronic pain intensity makes it difficult to understand its epidemiology; especially as estimates are based on representative samples and self-report which may under or overestimate the severity of disease.

The consequences of chronic pain are vast, ranging from physiological symptoms such as increased heart rate, psychological symptoms like anxiety and depression, to economic consequences like decreased participation in the workforce and strain on familial relationships (Brennan et al., 2007). Social work has long been a proponent of moving away from the medical model in the treatment of chronic pain (MacDonald, 2000; Roy, 1981; Subramanian & Rose, 1988). While some of these efforts have materialized as indicated by lower opioid prescribing rates (Guy et al., 2017), the ongoing opioid epidemic demonstrates the continued need for work in this area as the medical model is still the predominate approach.

Chronic pain is neither fully a physical condition nor a psychosocial one (Sullivan et al., 1991). This means that both physical and psychological factors play a role in how chronic pain manifests. Psychosocial factors play a role in the transition from acute pain to chronic pain and therefore both must be addressed to effectively treat chronic pain (Sullivan et al., 1991). As an example, acute pain as a result from an ankle injury may evolve into chronic pain. The patient may then develop depression as their experience with chronic pain and chronic pain management continues which may result in biologic processes which increase pain sensitivity. In this case, healthcare providers need to address the physical aspect of the ankle injury as well as the psychological factors related to the perception that the injury and pain will never heal.

2.2.2 Chronic Pain in Primary Care

Primary care providers (PCPs) are responsible for addressing most health care needs over the lifespan with a focus on the family and community (Donaldson et al., 1996). PCPs include providers from the specialties of family medicine, general internal medicine, obstetrics and gynecology, and nurse practitioners and physician assistants who work in primary care settings (Donaldson et al., 1996). Most PCPs have a patient panel of between 1,200 and 1,900 patients, which is widely agreed to be too high (Raffoul et al., 2016). Additionally, over time primary care visits continue to increase (Chen et al., 2009). PCPs are asked to manage many chronic conditions such as hypertension and diabetes which often results in longer appointment times (Chen et al., 2009). The combination of the increasing number of visits with the complexity of chronic conditions puts additional pressure on PCPs to continue to provide high quality care with less time and resources.

Pain is one of the top reasons why people seek medical treatment, in both primary care and other settings (Dahlhamer, 2018). Most people with chronic pain receive treatment from primary care providers and not from pain specialists (Breuer et al., 2010; Nguyen et al., 2005). PCPs refer about 29% of patients with chronic pain to physical therapists and about 26% to pain specialists (Breuer et al., 2010). PCPs report treating about half of their patients with chronic pain with non-steroidal anti-inflammatory drugs (NSAIDs) and treat about 36.4% short-acting opioids (Breuer et al., 2010). Primary care providers self-report that they often do not have adequate knowledge about chronic pain and its management (Breuer et al., 2010; Institute of Medicine of the National Academies, 2012; Jamison et al., 2014; Pizzo & Clark, 2012). They also face systemic barriers related to fears of regulatory oversight in the prescribing of opioids to patients with chronic pain (Breuer et al., 2010; Jamison et al., 2014), particularly in light of the

ongoing opioid epidemic. Collaboration with pain specialists often mitigates this hesitancy (Jamison et al., 2014).

Primary care providers (PCPs) must navigate both physical and psychosocial treatments for chronic pain by focusing on functionality and integrating physical care concerns (e.g. a muscle is torn), and psychosocial concerns (e.g. fear of future injury; Sullivan et al., 1991). Psychosocial assessment should consider both concerns related to the chronic pain and underlying psychiatric disorders such as situational depression versus a history of major depressive episodes (Sullivan et al., 1991). Both physical and psychosocial treatment should center on functionality and also recognize that chronic pain is neither fully physical or fully psychological (Sullivan et al., 1991).

Chronic pain is a serious issue in the United States and with far reaching physical, psychological, social, and economic consequences. Most people who experience chronic pain receive treatment from their primary care provider. PCPs want to provide high-quality care for their patients but often do not have the information they need. Primary care settings are the best place to target interventions for the dissemination and implementation of chronic pain evidence-based practices.

2.2.3 Chronic Pain Management

Many people in the United States experience chronic pain with significant physical and psychosocial consequences. Most people with chronic pain receive treatment in the primary care setting. Aside from self-report, little is known about what types of non-pharmacologic treatments primary care providers (PCPs) use to manage chronic pain among their patients. Preliminary data indicates that PCPs use both pharmacologic and non-pharmacologic strategies to treat chronic

pain independent of the evidence base (Ashcraft et al., *in preparation*). The following describes the evidence-base for common chronic pain treatments ranging from non-pharmacologic strategies such as physical therapy and psychological treatment, to pharmacologic approaches, such as opioids.

Physical therapy. Physical therapy involves a specific set of hands-on exercises with the focus on movement to improve quality of life and mobility (American Physical Therapy Association, 2019). A systematic review of the use of physical therapy to address chronic pain found that the therapeutic alliance between physical therapists and patients had a positive effect on treatment outcomes (Kinney et al., 2018). Exercise therapy, which focuses on increasing movement, flexibility, and strength, for chronic low back pain resulted in no significant improvements in pain over time. There were some small improvements in pain when exercise therapy occurred in a healthcare setting versus a home setting (Hayden et al., 2005).

Chiropractic. Spinal manipulation therapy follows a unique hands-on treatment focused on a range of motion for the target joint (Assendelft et al., 2004). Another systematic review of subacute or chronic pain studies found that spinal manipulative therapy is as effective as other types of therapies for low back pain such as traditional physical therapy, analgesics, or exercises (Assendelft et al., 2004).

Acupuncture. Acupuncture uses needles at specific places on the body with the goal to reduce pain (Vickers et al., 2018). A meta-analysis of studies using acupuncture for non-specific back, neck, or shoulder pain, chronic headaches, and osteoarthritis for a duration longer than four weeks found that acupuncture does provide some pain relief benefit (effect sizes range from $d=.42-.57$). However, the benefit specific to acupuncture decreased when compared with sham acupuncture (effect sizes ranging from $d=.15-.23$; Vickers et al., 2012). An updated systematic

review and meta-analysis finds that effect sizes range from $d=.20$ when compared to placebo and $d=.50$ when compared with a no treatment control (Vickers et al., 2018). Battlefield acupuncture, a type of auricular acupuncture (within the ear), resulted in decreased self-reported pain (Federman et al., 2017).

Psychological Interventions. Psychological interventions include a wide range of approaches which may include cognitive behavioral therapy (CBT), acceptance-based therapy, and mindfulness. A meta-analysis of psychological interventions found that across all types of treatment the combination CBT, including behavior therapy, biofeedback, and multidisciplinary teams found improvements in pain intensity ($d=.41$), pain interference ($d=.23$), and health-related quality of life measures ($d=.41$) (Hoffman et al., 2007). A meta-analysis of 25 studies found that CBT is effective in changing the pain experience when compared with waitlist control and continues to prove effective when compared with active treatment (Hedge's $g=.40$; Morley et al., 1999). A more targeted implementation study examined the effect of a nurse-led intervention which taught patients with functional abdominal pain CBT skills (Niesen et al., 2018). Even with a small sample size ($n=12$), the intervention demonstrated promising results with improvements in physical well-being and decreases in frequency and severity of pain and fatigue and anxiety at two week follow-up (Niesen et al., 2018). These results demonstrate promising possibilities for the use of CBT and CBT-oriented interventions to treat chronic pain.

Mindfulness asks participants to focus on the present with openness and curiosity (Hilton et al., 2017). Mindfulness approaches are also found to have a statistically significant effect on patients' chronic pain (SMD, .32; 95 % CI, .09, .54; 30 RCTs), specifically for depression (SMD= .15; 95 % CI=.03, .26; 12 RCTs; $I^2= 0$ %) and overall quality of life (SMD=.49; 95 % CI=.22, .76; $I^2= 74.9$ %) (Hilton et al., 2017). Acceptance-based treatment asks participants to

stay engaged (rather than avoid) unpleasant emotions and attempts to change irrational responses (Veehof et al., 2011). A review of 22 studies found that acceptance-based treatment has a moderate effect on pain (SMD = .47; 95% CI: .28 to .66) and depression (SMD = .64; 95% CI: .43 to .85). There was also a moderate pooled effect on anxiety, well-being, and overall quality of life (SMD ranging from .48 to .69). (Veehof et al., 2011).

Peer Support. Peer support encompasses information and support about chronic pain delivered by someone who also experiences chronic pain (Shue et al., 2018). A small study conducted at a Veterans Health Administration hospital found that clinicians perceived patient benefit from peer support. Patients received information from the peer support specialist and clinicians gained additional insights into the patient experience (Shue et al., 2018). Some barriers include the time necessary to train peer coaches and concerns about patient acceptance, especially for patients with a high number of prescriptions (Shue et al., 2018).

Multidisciplinary Treatment. Multidisciplinary chronic pain management and treatment involves a team-based approach for managing chronic pain including medical and psychological providers (Scascighini et al., 2008). Patients of multidisciplinary teams saw 75 percent increase in functioning over those in control or single treatment arms when the team included members from psychology, medicine, and physical or occupational therapy (Flor et al., 1992). A systematic review of multidisciplinary team treatment for chronic pain found that multidisciplinary teams performed stronger in pain outcomes than treatment as usual or waitlist (Scascighini et al., 2008). Scascighini and colleagues (2008) recommend that multidisciplinary teams include a minimum of individual exercise, relaxation techniques, group therapy, patient education, physiotherapy, cognitive behavioral therapy, medical training, and neuro-physiologic information from a physician (Scascighini et al., 2008).

Opioids. Opioids are a specific class of synthetic drugs (US Department of Health and Human Services, 2017) and are one of the most well-known pharmacologic approaches to managing chronic pain. Opioids have been thought to be efficacious in reducing chronic pain and increasing functionality (Furlan et al., 2006). However, compared to other pharmaceutical approaches, such as NSAIDs, there is no difference in functionality or effectiveness of pain reduction (SMD = $-.05$, 95% CI $-.32$ to $.21$) except with oxycodone and morphine which are more effective at pain relief but less effective for functional outcomes (SMD = $-.34$, 95% CI $-.67$ to $-.01$). (Furlan et al., 2006). A recent randomized-control trial confirms this and shows that opioids did not significantly reduce chronic pain when compared to the non-opioid group over 12 months (Krebs et al., 2018).

An examination of high quality randomized controlled trials found that there is no significant difference in the total benefits of opioids to managing chronic pain over other treatments (e.g. ultrasound, thermotherapy, or nerve stimulation) and does not support the sole use of opioids to treat chronic pain (Reinecke et al., 2015). A 2019 systematic review and meta-analysis by Allegri and colleagues found that long-term opioid treatment does not result in pain relief. When considering the neuropsychological effects of opioids, participant attention-span decreased (Allegri et al., 2019). However, there was no change in reaction time, executive function, psychomotor speed, memory or working memory between patients receiving opioids and those in control or other treatment (Allegri et al., 2019).

PCPs expressed concerns about opioids, but continue to prescribe them even when they are incentivized to prescribe tamper-resistant opioids (pills designed to prevent crushing or dissolving) to increase barriers to abuse (Turk et al., 2014). These results highlight the disconnect between provider beliefs about opioids and existing evidence which indicates that

opioids are not necessarily the best strategy for addressing chronic pain. A more recent study examined physician prescription drug monitoring programs and found that physicians (all specialties, not just primary care) who are higher earners, older, and prescribe more opioids tend to not be as supportive of these types of government oversight (Wright et al., 2017).

As a result of the opioid epidemic, recent research evaluates strategies to reduce opioid prescribing among primary care providers. The use of clinical guidelines along with audit and feedback, academic detailing, and external facilitation may be successful strategies to improve mental health screening, treatment agreements, drug screenings, and prescribing benzodiazepine alongside opioids but may not reduce opioid prescribing (Quanbeck et al., 2018). Another strategy which may decrease opioid prescribing may be the use of tele-conference among primary care physicians to have facilitated case discussions (Shea et al., 2019). PCPs perceived these sessions to be helpful specifically within the context of buprenorphine treatment for opioid use disorder (Shea et al., 2019). These studies provide potential strategies for curtailing opioid prescribing and addressing a serious consequence of overprescribing – opioid use disorder.

Antidepressants. Antidepressants provide a non-opiate approach to treating chronic pain. A review of nine studies of moderate quality found that patients experienced a small significant improvement in the mean difference of pain severity (SMD=0.41; 95% CI= 0.22-0.61) when assigned to treatment (antidepressants) but saw no significant improvement in activities of daily living (Salerno et al., 2002). One important limitation of this study is that one fifth of participants experienced some type of adverse event during the course of the trial which may indicate the need for increased hesitation for treating chronic pain with antidepressants (Salerno et al., 2002). A more recent meta-analysis finds anti-depressants often have limited reductions in chronic back pain, sciatica, and osteoarthritis (Ferreira et al., 2021).

For example, in the case of back pain, Ferreira and colleagues (2021) found that serotonin-noradrenaline reuptake inhibitors (SNRIs) have some benefit for people with back pain (SMD=-5.30; 95% CI= -7.31- -3.30) from 3-13 weeks (Ferreira et al., 2021). Selective Serotonin reuptake inhibitors (SSRIs) have more limited benefit across 3-13 weeks (SMD=1.53; 95% CI= -5.38-8.45) (Ferreira et al., 2021). Tricyclic antidepressants (TCAs) demonstrate some greater benefit across 3-13 weeks (SMD=-9.96; 95% CI=-21.50-1.58) and 3-12 months (SMD=-7.8; 95% CI= -15.63 – 0.01) (Ferreira et al., 2021). Noradrenaline-dopamine reuptake inhibitors (NDRIs) show limited benefit at 3-13 weeks (SMD=-1.0; 95% CI=-12.23-10.23) (Ferreira et al., 2021). Finally, serotonin antagonist and reuptake inhibitors (SARIs) have some benefit (SMD=-5.40; 95% CI -22-12.14) as do tetracyclic antidepressants (SMD= -4.50; 95% CI= -20.43-11.43) across 3-13 weeks (Ferreira et al., 2021). Yet, while there are some benefit to patients with chronic back pain, Ferreira and colleagues (2021) found that studies for SSRIs, TCAs, NDRIs, SARIs, and tetracyclic antidepressants have low certainty of evidence.

As demonstrated in the above section, there are many pharmacological and non-pharmacological approaches to managing chronic pain that have some support from scientific evidence. Primary care providers are often expected to synthesize and navigate the complex landscape of evidence-based chronic pain management and then determine what approaches will work best for their patients within a given context. Therefore, it should not be surprising that PCPs at times struggle to understand and utilize (or implement) evidence-based chronic pain management with their patients.

2.3 Diffusion of Innovations Theory

Diffusion of Innovations Theory was borne out of the agricultural revolution in the 1950s and 1960s and has been subsequently used to explain change across a wide range of disciplines, including anthropology, public health, medical sociology, geography (Rogers, 2003), technology (Lyytinen & Damsgaard, 2001), and social media (Chang, 2010). While social work has adopted some strategies from Diffusion of Innovations Theory, it has not been a leader in this area (Dearing, 2009). Diffusion of Innovations Theory serves as the foundational dissemination and implementation theory for the current research as it proposes causal pathways for the effective spread and adoption of information. Further, Diffusion of Innovations Theory concepts and terminology inform other foundational frameworks in dissemination and implementation, including the Model for Dissemination of Research and the Consolidated Framework for Implementation Research (both explained below).

The goal of Diffusion of Innovations Theory is to explain how an innovation spreads and is (or is not) adopted. It guides investigators to examine how the characteristics of individuals, groups, and systems influence dissemination and implementation. The following discusses the core components of Diffusion of Innovations Theory applied to the dissemination of chronic pain evidence and implementation by primary care providers.

2.3.1 Components of Diffusion of Innovations Theory

At its core, Diffusion of Innovations Theory is broken into four elements. These elements are 1) the innovation 2) communicated through channels 3) over time 4) to members of a social system (Rogers, 2003). An innovation is an idea, practice, or object that is perceived as new by

the potential adopting entity, such as new opioid prescribing practices in a primary care setting. A communication channel is a way for messages about innovations to get to a potential adopter or non-adopter. An important characteristic of communication channels is the degree of homophily (i.e. shared attributes) and heterophily (i.e. differences in attributes; Rogers, 2003). As an example, primary care providers may be more likely to receive information about an innovation from another primary care provider than from a researcher (see examples in implementation research in Jacobson et al., 2019; Quanbeck et al., 2018 described below).

A social system is comprised of units (individuals or organizations) that work together to achieve a common goal. The structure of social systems influences the diffusion process including how information flows, system norms, opinion leaders, and change agents (Rogers, 2003). An example of the structure of the social system may include the hierarchy within primary care settings which influences the degree to which an innovation is adopted.

The innovation, communication channel, and social system of Diffusion of Innovations Theory create a foundation for understanding other aspects of how innovation is distributed and then adopted within a social system. These dimensions are all assessed over time via the Innovation-Decision Process (described below) and includes the consideration for discontinuation or terminating adoption and the rate of adoption within the system (Rogers, 2003).

2.3.2 Types of Adopters

The most common aspect of Diffusion of Innovations Theory is the “s-curve” of cumulative adoption. The s-curve of adoption identifies five types of adopters including innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). Innovators

generally are described as having expendable financial resources, understand complex technical language, and are able to exist with a high degree of uncertainty and risk, often launching new ideas into social systems (Rogers, 2003). Innovators may be academically affiliated physician-researchers who integrate their research on chronic pain with their primary care practice.

Early adopters are well integrated into the social system and have a high degree of opinion leadership functioning as role models for others (Rogers, 2003). Early adopters may be the clinical leadership within academic primary care clinics who, because of their close proximity to chronic pain researchers, are more likely to implement chronic pain treatment innovations.

The early majority frequently interacts with their peers and is well connected with the social system. Yet, their time to adoption is typically longer than that of innovators and early adopters (Rogers, 2003). The early majority may be primary care providers within an academic health system who do not work with physician-researchers directly but have one or two degrees of separation.

The late majority adopts a technology out of economic necessity or increasing peer pressure and has relatively few resources (Rogers, 2003). This group may include urban and suburban community primary care clinics and their providers who, in order to compete with academic primary care clinics, need to adopt certain chronic pain treatment innovations. The laggards have no opinion leadership and are isolated within the social system. Laggards often are late to adopt an innovation as a result of systemic factors (Rogers, 2003). While the term “laggards” often carries a negative connotation, at times there may be advantages to being a laggard. These primary care providers may not have the opportunity be exposed to an innovation which may later need to be de-adopted (e.g., opioids for treating chronic pain) as they may work

in a rural setting or have access to few traditional or commonly used dissemination channels. Further they may want more information, including about the potential harms of an intervention, before adopting an innovation.

The characteristics of the five groups provide an invaluable framework to understand how units within a social system may respond to the dissemination and implementation of chronic pain evidence. Indicators regarding resource availability and integration within a social system help to target key audiences (e.g., opinion leaders) for dissemination and implementation. The aforementioned characteristics also help to identify potential barriers to dissemination and reasons for later adoption (e.g., perceived benefit or uncertainty). Diffusion of Innovations Theory also helps to understand the process of innovation itself.

2.3.3 Stages of Diffusion of Innovations

Units (e.g., primary care providers individually, clinics corporately, or a health system as a whole) move through the Innovation-Decision Process which includes five stages, 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation. Each stage requires different types of communication channels dependent upon individual and system characteristics (Rogers, 2003). Often units within a social system will participate in selective exposure or exposure to information that agrees with their existing assumptions. This information is further interpreted within the context of existing attitudes.

Early “knowers” are likely to have more education, higher socioeconomic status, more exposure to mass media, and more interpersonal channels of communication (Rogers, 2003). Within the context of primary care, early knowers may exist in urban or academically affiliated clinics which provide additional support for knowledge translation (i.e., dissemination) and

innovation adoption (i.e., implementation). The persuasion stage focuses on attitudes and is feeling-oriented. In this stage, a unit will determine what information is credible and how to interpret it (i.e., hypothetical and counter-factual assessment). This often is the intersection between dissemination and implementation. For primary care providers (or clinics or health systems) the persuasion stage encompasses the gathering of information about a chronic pain innovation (i.e., dissemination) and the decision to adopt (i.e., implement) the intervention in clinical practice. The outcome of the persuasion phase is a decision to adopt or reject the innovation—the decision phase (Rogers, 2003).

In the decision stage, a unit decides whether or not to adopt or reject the innovation often on a trial basis. Knowledge, persuasion, and decision may not occur linearly and after a trial period, a unit may decide to actively reject the innovation or sometimes passively reject the innovation (i.e. without a trial; Rogers, 2003). The implementation phase typically immediately follows the decision stage. In this stage, the innovation is put into practice. This process may take a significant period of time, especially if a unit is an organization. The implementation stage is also a time for re-invention or adaptation of the innovation to better fit the needs of the adopting unit (Rogers, 2003). In primary care, the implementation process may include adapting an intervention to fit within the culture and structure of the primary care setting such as changing the length of time for case facilitation to better adhere to primary care providers' schedule (Shea et al., 2019). Finally, the confirmation stage is the process of seeking information about the innovation after the decision to adopt or reject. Often the goal of this stage is to avoid dissonance or information which is in conflict with the adoption/rejection decision. This information may lead to discontinuance which is more common among late adopters (Rogers, 2003).

The Innovation-Decision Process guides dissemination research and implementation

research by providing additional guidance to the ways in which the different groups and their characteristics may navigate the decision-making process. This allows for further examination into the barriers and facilitators of dissemination and implementation of an innovation. As an example, the dissemination strategy for early adopters (e.g., primary care providers who work in academically affiliated clinics) will focus on strategies that work directly with change agents (e.g., physician researchers) because of their high level of technological knowledge versus strategies for late adopters and laggards (e.g. community primary care providers in suburban and rural settings) who are more likely to discontinue or reject an innovation. Further, implementation strategies must also adapt to the characteristics of the individual primary care provider and social system (e.g., clinic) within which they work. The key principles of Diffusion of Innovations Theory help to explain the underlying factors surrounding dissemination and implementation of evidence-based chronic pain management in primary care.

2.4 Dissemination Research

2.4.1 Definition

The National Institutes of Health (NIH) distinguishes between dissemination and implementation research. Dissemination research is, “the scientific study of targeted distribution of information and intervention materials to a specific public health or clinical practice audience. The intent is to understand how to best communicate and integrate knowledge and the associated evidence-based interventions” (National Institutes of Health, 2019, p. 5). A key difference between dissemination and implementation research is the focus on the broad distribution of

available information versus focused adoption of an intervention into a specific setting. To date, the dissemination of chronic pain research findings has largely focused education strategies, including using train-the-trainer techniques (Zisblatt et al., 2017) and creating and disseminating information such as treatment guidelines and briefs (Cardarelli et al., 2017; Jamison et al., 2002).

2.4.2 The Model for Dissemination of Research

The purpose of the Model for Dissemination of Research is to highlight the gap between research and practitioners and improve dissemination research by outlining key factors and their characteristics to improve evaluation and outcomes. Brownson and colleagues combine Diffusion of Innovations Theory and Mathematical Theory of Communication (see Shannon, 1948; Shannon & Weaver, 1975 for full description) with contributions from Social Marketing Theory and Kingdon's Three Streams Theory to develop a framework for dissemination of research evidence (Brownson et al., 2018). Model for Dissemination Research uses the concepts of information source, message, channel, and audience from the Mathematical Theory of Communication (Brownson et al., 2018). Concepts from Diffusion of Innovation Theory include the "s-curve" of adoption and the ordered nature of the process (Brownson et al., 2018).

The Model for Dissemination of Research acknowledges the translation gap and addresses the problem by describing the source, message, audience, channel, and strategies to measure impact (Brownson et al., 2018). This framework clearly explains the dissemination process and is specifically focused on practitioners and policymakers as target audiences (See **Figure 3**; used with permission).

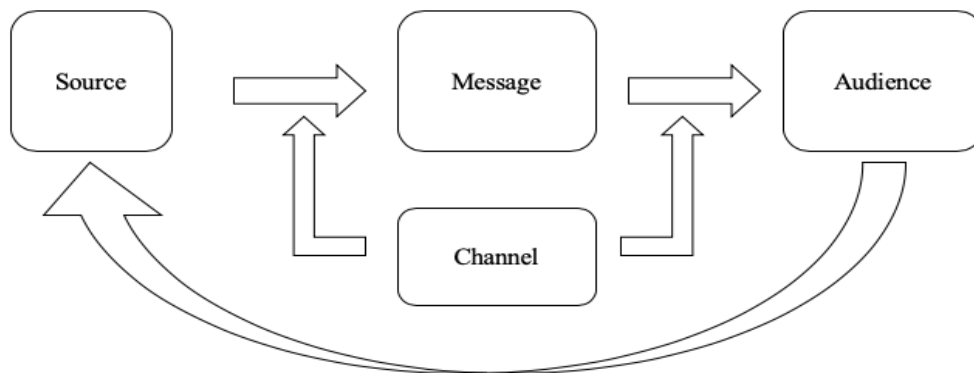


Figure 3 A Model for Dissemination of Research (Brownson et al., 2018)

The source, researchers who generate evidence, acknowledges that traditional strategies for dissemination, such as publications in the peer reviewed literature, are ineffective. It also identifies the motivations of researchers are often influenced by institutional expectations (Brownson et al., 2018). Chronic pain researchers are not the only source of information, even as they may generate the knowledge. The source may often take the form of chronic pain professional or patient organizations, the media, and colleagues. The message is the information being sent (Brownson et al., 2018). For the current social problem, the message is the evidence for the effective management of chronic pain (outlined above).

The audience includes practitioners and policymakers. Practitioners have heterogeneity in skills, experience, and access to resources (Brownson et al., 2018). As discussed earlier, this may include primary care providers in high or low resource settings or those who work in academic or community-based clinics. There is often a misalignment of dissemination channels

as it relates to the characteristics of the target audience (Brownson et al., 2018). For example, innovations in chronic pain management may be disseminated at conferences. However, some primary care providers may not have the funds and/or time to attend a conference and therefore miss the opportunity to learn about new innovations. The misalignment can make it difficult for low-resource practitioners (e.g., primary care providers) to receive and understand chronic pain evidence, which corresponds with concepts found in Diffusion of Innovations Theory. While not the focus of this dissertation, policymakers, both elected and appointed, benefit from anecdotes and local relevance of data. Staff of policymakers are also key to understanding this target audience (Brownson et al., 2018). These two target audiences highlight the importance of audience segmentation and framing information in a way that can be best understood within the context of audience perceptions (Brownson et al., 2018).

The channel is how the message gets from the source to the target audience. Dissemination interventions or strategies may include the news media, social media, issue or policy briefs, one-on-one meetings, and workshops and seminars (Brownson et al., 2018). Dissemination channels specific to chronic pain research may include practice briefs, trainings, and workshops.

The impact of dissemination of research is measured in long and short-term outcomes. Long-term outcomes may include things like prevention or burden of disease. Short-term outcomes include awareness or knowledge of the benefits and threats of a disease or social problem (Brownson et al., 2018). In the short-term, this may look like increased knowledge about a chronic pain management strategy and in the long-term effective dissemination may manifest as evidence-based treatment and de-implementation of harmful or less effective strategies.

2.5 Implementation Research

2.5.1 Definition

Implementation research is “the scientific study of the use of strategies to adopt and integrate evidence-based health interventions into clinical and community settings to improve individual outcomes and benefit population health” (National Institutes of Health, 2019, p. 5). This contrasts with dissemination research (described earlier) which seeks to understand how to spread information about evidence (Rabin et al., 2008). Implementation research employs a variety of strategies to support the adoption and sustainment of evidence-based practices. Implementation researchers also strive to understand how well an intervention must adhere to the original design (fidelity) to maintain effectiveness and what aspects of the innovation can change to meet the needs of the specific setting (adaptation; Rabin et al., 2008).

2.5.2 Consolidated Framework for Implementation Research (CFIR)

The Consolidated Framework for Implementation Research (CFIR) is a meta-theoretical model which builds on existing theories to provide a cohesive set of terminology and definitions (Damschroder et al., 2009). Damschroder et al. (2009) built on previous work by Greenhalgh and colleagues (2004) who evaluated existing theories to identify gaps in dissemination and implementation science. The CFIR expands this work by analyzing additional models and frameworks (e.g. the Promoting Action on Research Implementation in Health Services (PARiHS) Framework). The purpose of CFIR is to provide implementation scientists with a set of domains and constructs to apply to a particular setting (Damschroder et al., 2009). The CFIR

contains five domains and 39 constructs. The five domains (described below) include 1) intervention characteristics, 2) outer setting, 3) inner setting, 4) characteristics of individuals, and 5) process (Damschroder et al., 2009) (See **Figure 4**; used with permission). The following describes each domain and highlights factors about corresponding constructs.

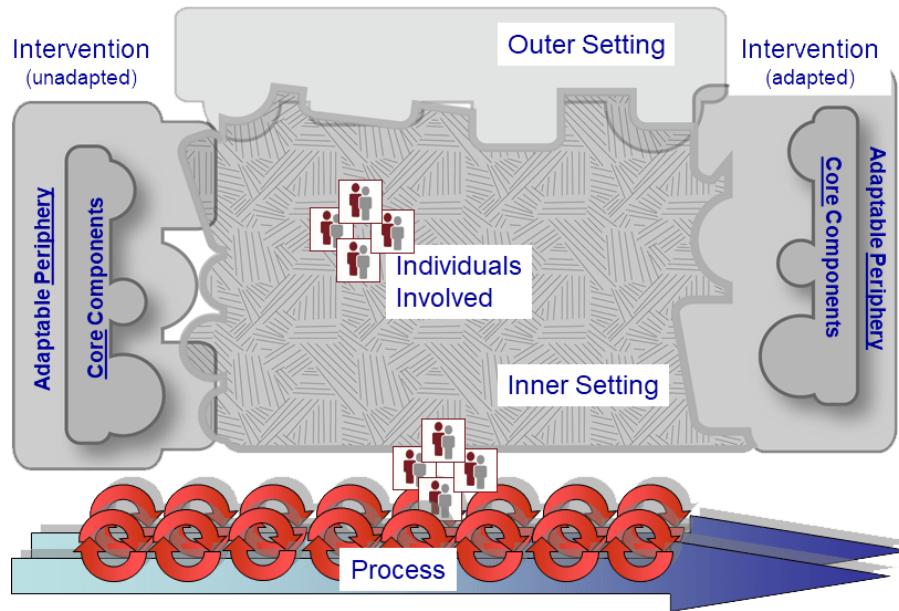


Figure 4 The Consolidated Framework for Implementation Research (Damschroder et al., 2009)

The Intervention Characteristics domain describes perceptions of stakeholders about the intervention and its applicability to the implementation setting (Damschroder et al., 2009). Most of the constructs within the domain of intervention characteristics align with Diffusion of Innovations Theory and include the intervention source, evidence strength and quality, relative advantage, adaptability, trialability, complexity, design quality and packaging and cost (Damschroder et al., 2009). These constructs are measured through self-report and seek to understand how the intervention meets the needs of the setting, which components are core and which are peripheral (this may be determined over time). The constructs require a balance

between flexibility and retaining the rigor of the intervention. At times, a paradigm shift is necessary within the implementation context in order for the intervention to be adopted by stakeholders. Finally, it is important to understand how much the intervention will cost aside from existing organization resources as perceived quality and presentation are key factors (Damschroder et al., 2009).

The Outer Setting is the second CFIR domain and focuses on the context (described above). The Outer Setting includes patient needs and resources, cosmopolitanism, peer pressure, and external policies and incentives (Damschroder et al., 2009). These constructs seek to understand how the organization prioritizes the needs of patients (or the people they serve) and connections with external entities. External connections (i.e., cosmopolitanism) describes the social capital that the target organization has with similar organizations. This domain further captures the competition and external pressure to adopt (e.g. if the organization is a laggard) or if intervention implementation may be influenced by policies or incentives (Damschroder et al., 2009).

The Inner Setting includes the constructs of structural characteristics, networks and communications, culture, implementation climate, and readiness for implementation (Damschroder et al., 2009). The inner setting allows for some quantitative evaluation which differentiates it from the two more qualitatively oriented domains. This may include the number of departments or amount of turnover within an organization. The construct of networks and communications attempts to capture the complex social network and social capital within an organization and also recognizes that relationships between individuals are more important than the individuals' factors themselves (Damschroder et al., 2009). Culture relates to organizational assumptions that exists. Culture is distinct from climate in that culture is a stable social construct

or subconscious whereas climate is local and tangible and varies across teams or units (Damschroder et al., 2009). The implementation climate includes tension for change, compatibility, relative priority, organizational incentives and rewards, goals and feedback and learning climate (Damschroder et al., 2009). Finally, the readiness for implementation includes tangible indicators which are more easily quantifiable. This includes leadership engagement, both long and short-term thinking, available resources, and access to information and knowledge.

The Characteristics of Individuals domain includes the constructs of knowledge and beliefs about the intervention, self-efficacy, individual stage of change, individual identification with organization, and other personal attributes (Damschroder et al., 2009). This domain may be measured at the individual, team, or unit level. As an example, this may be a primary care provider or primary care practice who treat patients with chronic pain. This is determined by the intervention itself and implementation context. Knowledge and beliefs about the intervention includes both attitudes, knowledge, and the skills to use the intervention. Self-efficacy describes the confidence to change oneself to meet the goals of the intervention. The stages of change rely on the underlying theory drawn from Diffusion of Innovation Theory and the Five-Stage model of change outlined by Grol and colleagues (2007). Another important construct within the domain of Characteristics of Individuals encompasses the buy-in or loyalty someone has with the organization. This individual identification with organization also includes the psychological climate. Finally, other individual factors such as motivation, intellectual ability, openness, and capacity are included in a final construct (Damschroder et al., 2009).

Process is the fifth domain within the CFIR and includes both formal and informal essential constructs of the innovation implementation process. These constructs include planning, engaging, executing, and reflecting and evaluating (Damschroder et al., 2009). The planning

process includes both individual and corporate action which is specific to the setting. The planning stage relies on the underlying model or theory being used (Damschroder et al., 2009). The engaging construct is a multifaceted approach of stakeholder engagement which looks at the early adopters, experts and peers, formal leaders, champions, and external experts and each of their roles in promoting the innovation implementation. The executing construct, when the innovation is implemented, seeks to understand the implementation fidelity to the original design. Finally, reflecting and evaluating can use both qualitative and quantitative approaches to understand objectives, often using the SMART (specific, measurable, action-oriented, realistic, and timely) framework (Damschroder et al., 2009).

The CFIR contains five domains including Intervention Characteristics, Outer Setting, Inner Setting, Characteristics of Individuals, and Process and 39 constructs which help to guide implementation research (Damschroder et al., 2009). Damschroder and colleagues (2009) recommend that implementation researchers select several, but not all, constructs to examine before, during, or after the implementation of an innovation. Yet, most uses of the CFIR are during or after implementation and evaluate barriers and facilitators and not implementation outcomes (Kirk et al., 2016).

Kirk and colleagues (2016) recommend that implementation researchers clearly report which CFIR constructs they choose and provide a rationale. Some studies use existing knowledge about CFIR and the implementation setting to determine which domains and constructs best fit (Kirk et al., 2016). Other studies used pilot interviews to guide researchers (Kirk et al., 2016). However, they do not provide additional guidance as to a preferred strategy for justifying the selection of CFIR domains and/or constructs.

It is critical to understand some key factors prior to employing the CFIR in implementation research. These factors include, the need for theory, the relationship between constructs, and the implementation environment. First, Damschroder and colleagues (2009) are very clear that theory must still be used as a foundation for the CFIR or put another way, the CFIR does not replace theory, instead it supplements it. However, few studies used a theory in addition to the CFIR (Kirk et al., 2016). The rationale for this relates to the second factor, the relationship between constructs.

The CFIR proposes a set of domains and constructs but does not describe or hypothesize a relationship between the constructs themselves or the implementation outcome (Damschroder et al., 2009). This further highlights the need for the use of theory to help develop relational hypotheses in order to select which constructs are most appropriate for the given intervention and context.

The implementation environment includes two components: the context and the setting. The context describes the broad set of factors, including circumstances and characteristics. The setting describes the specific environment within which intervention implementation occurs (Damschroder et al., 2009). This definitional distinction promotes clarity for implementation researchers when selecting which constructs are most relevant for a particular implementation study. As an example, the context may include reimbursement policies or, as it relates to chronic pain, the ongoing opioid epidemic. By contrast, the inner setting is a specific primary care clinic with its unique internal culture as an example.

2.6 Relationship between Dissemination Research and Implementation Research

There are many ways to conceptualize the relationship between dissemination research and implementation research and while a consensus distinction and relationship may exist within particular disciplines or topics of research; it does not exist universally. For the purposes of the current study, dissemination and implementation are defined in the following ways:

Dissemination research: “the scientific study of targeted distribution of information and intervention materials to a specific public health or clinical practice audience. The intent is to understand how to best communicate and integrate knowledge and the associated evidence-based interventions” (National Institutes of Health, 2019, p. 5).

Implementation research: “the scientific study of the use of strategies to adopt and integrate evidence-based health interventions into clinical and community settings to improve individual outcomes and benefit population health” (National Institutes of Health, 2019, p. 5).

The following discussion provides clarity on the distinction and areas of overlap of dissemination research and implementation research.

The term, implementation science is broad and encompasses both dissemination research and implementation research as well as health communication and quality improvement (Mitchell & Chambers, 2017). Implementation science fits within health services research which often stops at efficacy and does not focus on *how* interventions will be put into practice (Mitchell & Chambers, 2017). However, more work is needed beyond efficacy to understand *how* to increase uptake of evidence-based practices. Health communication research is embedded within

dissemination research as a more passive approach to dissemination (Mitchell & Chambers, 2017). Quality improvement science and quality improvement are embedded into implementation research with the goal to improve care in a specific setting but without efforts to generalize to other settings (Mitchell & Chambers, 2017). Mitchell and Chambers (2017) propose a model for conceptualizing the relationship between these types of research (See **Figure 7**; used with permission). Based on this model, the purpose of implementation science (as an overarching term) is to 1) find effective ways to distribute evidence, 2) integrate this evidence into care, and 3) influence determinants of implementation (Mitchell & Chambers, 2017).

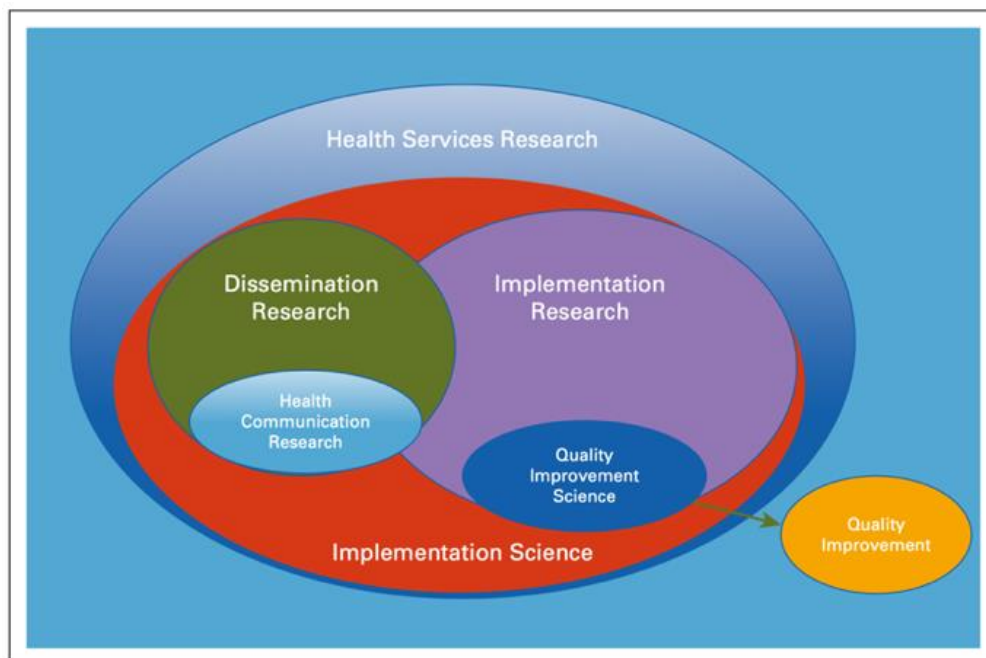


Figure 5 Implementation Science Conceptualization (Mitchell & Chambers, 2017)

This broad conceptualization of implementation science aligns with the diffusion—dissemination—implementation continuum. The diffusion—dissemination—implementation continuum cites diffusion as the passive spread of information, dissemination as the active

spread, and implementation as the use of evidence (Rabin et al., 2008). However, the diffusion—dissemination—implementation continuum is not linear.

The relationship between dissemination research and implementation research should not be considered a linear function. Instead, the relationship between dissemination research and implementation research should be thought of as coexisting with ongoing interactions such that as implementation research produces evidence-based practices and application in real-world settings, dissemination research is able to effectively communicate that information to target audiences. Further, it is critically important to recognize the areas of overlap between dissemination research and implementation research (See **Figure 8**). The following discusses strategies and settings which help to better understand this relationship.

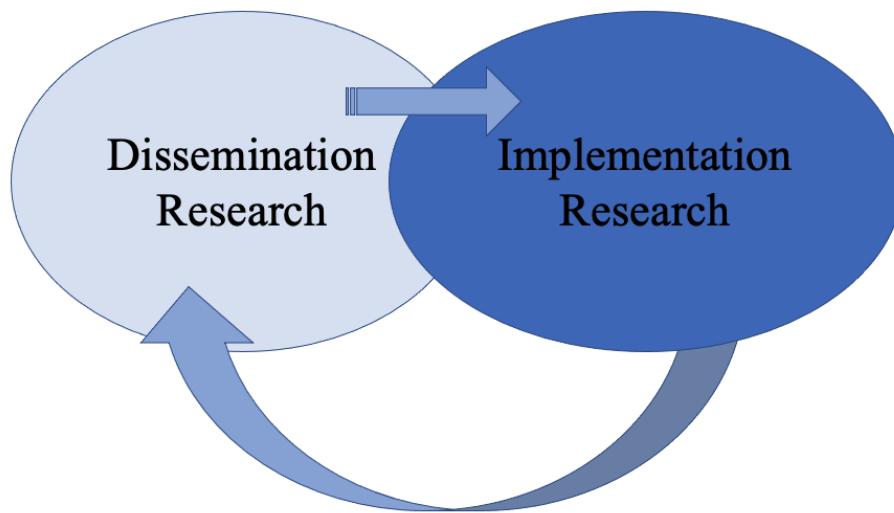


Figure 6 The Relationship Between Dissemination Research and Implementation Research

Dissemination channels mirror some implementation strategies. These may include developing and distributing educational materials, as an example. These strategies are often used in implementation science within an organization to promote the adoption of interventions.

Dissemination research also uses these strategies; however, the purpose is distinct. Dissemination research seeks to understand what factors of education materials (as an example) best communicate information. Dissemination research outcomes may include perceptions of the educational materials themselves, objective knowledge, perceptions of evidence, or self-efficacy. Implementation research uses educational materials as a tool to meet the goal of adoption and utilization of the evidence-based practice. This may mean that the educational materials are a small component of the overarching implementation research approach.

The settings of dissemination research and implementation research help provide additional clarity for understanding the nuances between these two types of implementation science. Often, dissemination research seeks to target a broad audience (Rabin et al., 2008) such as primary care providers (overall). In contrast, implementation research focuses on the use of an intervention within a setting (Rabin et al., 2008), such as primary care.

The purpose of this discussion is not to pit dissemination research and implementation research against each other or to indicate that one is superior to the other. Rather, the purpose is to understand the role that both dissemination research and implementation research may play in supporting the knowledge and use of evidence-based practices in a specific population. Researchers may more effectively select outcomes, strategies, and methods by understanding the purpose, key outcomes, and distinct and overlapping characteristics of both dissemination research and implementation research.

2.7 Dissemination Research and Implementation Research in Chronic Pain

Dissemination research and implementation research provide valuable insights to improve the communication and the utilization of evidence-based practices. Scientists use these approaches to understand a variety of issues, and a growing body of research exists in the dissemination and implementation of evidence-based practices for treating chronic pain in primary care settings.

That said, little evidence exists on perceptions of evidence and strategies to increase use of evidence. For example, a systematic review of qualitative studies examining barriers to PCP use of guidelines for low back pain included 17 studies and 705 participants (Slade et al., 2016). The review found that perceptions such as feeling clinically constrained by guidelines or lack of understanding with how the guidelines were developed, or lack of knowledge of the guidelines themselves acted as a barriers for using guidelines (Slade et al., 2016). Further, factors such as time constraints and limited knowledge about diagnosing low back pain were barriers to implementing guidelines (Slade et al., 2016). While these studies provide some insights into barriers of implementation of chronic pain management, the literature has yet to define what dissemination channels and implementation strategies primary care providers want, specifically when it comes to chronic pain.

Given this context, the following describes what does exist by reporting the results of a scoping review of dissemination research and implementation research of chronic pain treatment in primary care settings which use Diffusions of Innovations Theory, the Model for the Dissemination of Research, and/or the CFIR.

2.7.1 Dissemination Research in Chronic Pain

The scoping review found no research studies which examine the process by which information about evidence-based chronic pain management strategies is communicated to primary care providers using the selected theory and corresponding models. Limited dissemination research exists outside of these parameters and is described below. Ideally, dissemination research studies should include a clear dissemination outcome, theoretical foundation, a related framework, and a qualitative, quantitative, or mixed methods approach to examine the effectiveness of the dissemination channel. The follow synthesizes three illustrative studies which examine the dissemination of evidence-based chronic pain treatment to primary care providers.

The first study utilized a network model approach using a Practice-Based Research Network to allow practitioners have access to toolkits, guidelines, and readiness to change models centered around generalized information about chronic pain and safe prescribing practices (Cardarelli et al., 2017). This is supplemented through continuing education focused on biopsychosocial aspects of chronic pain, risk management, and shared decision-making. The dissemination strategy is further supported by continual updates of progress to network participants (Cardarelli et al., 2017). This study was primarily an ongoing quality improvement initiative. Eighty percent of participating primary care providers self-reported increases in chronic pain knowledge (Cardarelli et al., 2017); however no quantitative measurement of knowledge was assessed.

Train-the-trainer (TTT) is another approach to disseminate guidelines and information about evidence-based chronic pain management (Zisblatt et al., 2017). This dissemination research focused on comparing the effectiveness of the TTT-led trainings versus expert-led

trainings on safe opioid prescribing practices. The study found that physician knowledge, confidence, attitudes, and self-reported practice immediately after the training and two months post training were similar between the two groups (Zisblatt et al., 2017). Further, in rural communities, the TTT-led sessions were more successful at disseminating chronic pain evidence to PCPs (Zisblatt et al., 2017).

The third dissemination study is a hybrid model between dissemination and implementation research. Jamison and colleagues (2002) developed an intervention to use a chronic pain treatment algorithm for primary care providers in a clinical setting. The use of the algorithm blends dissemination research with implementation research as it focuses on changes in clinical practice and factors related to patient outcomes. The results of the study found that while the algorithm increased physician confidence, providers did not use the supplemental online information and expressed several barriers to using the algorithm overall (Jamison et al., 2002). The passive dissemination of information through the availability of supplemental online materials was not successful (Jamison et al., 2002).

Even as little dissemination research is being done specifically in the area, it continues to be a priority by the professional chronic pain community. In 2013, the President of the American Academy of Pain Medicine described five strategies to address the opioid crisis. The first strategy was the dissemination of evidence, specifically focused on the risks associated with prescribing opioids (Webster, 2013). This highlights the need and desire for increased research about the best channels to disseminate chronic pain evidence to providers.

Dissemination research covers a range of topics and dissemination about chronic pain to primary care providers is limited. Common strategies include the use of toolkits and guidelines (Cardarelli et al., 2017), train-the-trainer (Zisblatt et al., 2017), and treatment algorithms

(Jamison et al., 2002). Few chronic pain or dissemination scholars look at the intersection of these two critical issues which indicates the need for additional research.

Beyond chronic pain, dissemination of evidence to practitioners takes many forms including training (Brothers et al., 2014; Brownson et al., 2007; Ellis et al., 2005; Grimshaw et al., 2006; Rabin et al., 2010; Seaberg, 1982; Sholomskas et al., 2005; Zisblatt et al., 2017), briefs and guidelines (Benmarhnia et al., 2017; Medves et al., 2010), and data visualization (Burke et al., 2015; Jamieson & Bodonyi, 1999). Research on the dissemination of chronic pain evidence to primary care providers mirrors these overarching themes with evidence demonstrating some success in active dissemination efforts and train-the-trainer models. The results of these studies find mixed to low effectiveness of existing dissemination channels to primary care providers. Researchers need to examine existing practices and innovations to increase the effectiveness of dissemination to primary care providers.

2.7.2 Implementation Research in Chronic Pain

Implementation research focused on the treatment of chronic pain in primary care settings is a growing field of study. The following synthesizes these implementation research studies focused on peer support, self-management, and opioids as treatments for chronic pain in primary care settings. This section focuses on how studies employed implementation research methodology; the results describing effects on chronic pain and its treatment are found above.

Shue and colleagues (2018) conducted interviews with clinicians to understand the barriers and facilitators of peer support for people with chronic pain. This implementation research occurred alongside the Evaluation of a Coach-Led Intervention to Improve Pain Symptoms (ECLIPSE) clinical trial within the US Veterans Affairs (VA) Health System.

Originally, investigators used the RE-AIM framework (reach, efficacy, adoption, implementation, and maintenance) but changed to the CFIR framework during data analysis as it was a better fit for the data (Shue et al., 2018). Authors organized findings in their discussion into three domains and seven CFIR constructs which corresponded to twelve themes (Shue et al., 2018).

Primary care providers (PCPs) had overall positive perceptions of the intervention (connected to CFIR construct of relative advantage) and also had some concerns about ongoing sustainability and support from administration and patient buy-in (CFIR constructs of implementation climate, readiness for implementation, and available resources) (Shue et al., 2018). This study provides an example of how the CFIR can be used to analyze existing qualitative data even as another implementation research framework (RE-AIM) was used to develop the interview guide. While this does not demonstrate the ideal use of the CFIR; it does show one way to use the framework to guide the results and future research and practice by describing clinician perspectives of a peer support intervention to treat chronic pain.

Another strategy for treating chronic pain is the use of cognitive-behavioral therapy (CBT). Niesen et al. (2018) used Diffusion of Innovations Theory to guide the implementation of an intervention which educated nurses on CBT approaches to support patients with functional abdominal pain, a type of chronic pain. The intervention included 60-minute appointments for patients with the nurse who provided tailored patient education with additional resources given to the patient on a CD (Niesen et al., 2018). In the discussion, the authors state the Diffusion of Innovations Theory provided guidance for the implementation of the intervention; however, this process was not fully outlined in the manuscript. So, while this study provides additional insights

into a CBT-focused intervention to treat chronic pain in primary care, it does not take the extra step to evaluate what about the implementation process worked and how it could be improved.

Most implementation research in the treatment of chronic pain in primary care settings centers on the appropriate use of opioids. This section will focus on the use of implementation research as the chronic pain results have been previously discussed. Implementation facilitation includes engagement by stakeholders, academic detailing, and marketing and education and was employed to conduct a formative evaluation on decreasing high risk opioid prescribing in a VA primary care setting (Becker et al., 2018). This evaluation used a mixed-methods approach including a survey to examine organizational readiness using the Organizational Readiness for Implementing Change instrument and semi-structured interviews guided by CFIR (Becker et al., 2018). The formative evaluation occurred prior to the implementation of the Primary Care-Integrated Pain Support (PIPS) clinical trial. The results then helped to inform and refine the implementation strategy and improve adoption of the PIPS Program (Becker et al., 2018). This study provides an excellent example of how implementation strategies can be used alongside clinical trials to improve adherence and uptake of the target intervention.

Systems consultation builds on the Expert Recommendations for Implementing Change (ERIC) implementation strategies and includes bringing together a diverse groups of stakeholders including content experts, implementation science experts, and providers to develop an intervention, audit and feedback, academic detailing, and external facilitation (Jacobson et al., 2019; Quanbeck et al., 2018). Briefly, the intervention included adapting opioid prescribing guidelines into a checklist and providing support to multidisciplinary clinicians in the form of coaches and team meetings (Jacobson et al., 2019; Quanbeck et al., 2018). Qualitative evaluation before and during the intervention guided the implementation and led to changes of the

implementation itself (e.g. using the term consultants instead of coaches) (Jacobson et al., 2019). The quantitative findings relied on the RE-AIM framework and suggest that building on existing ERIC strategies was successful for this intervention (Quanbeck et al., 2018). These two articles provide another important example of how qualitative and quantitative methods benefit the implementation of interventions. By utilizing qualitative methods, investigators were able to adapt and improve the intervention during its use in order to better understand its effectiveness and also increase the probability of future use.

Academic detailing, a component of the previous three studies (Becker et al., 2018; Jacobson et al., 2019; Quanbeck et al., 2018), is a form of education by experts to clinicians to promote the voluntary adoption of an intervention (Midboe et al., 2018). Midboe and colleagues (2018) conducted semi-structured interviews based on CFIR with academic detailers to understand their role in improved opioid prescribing safety within the VA. The CFIR was also used to analyze and present the data (Midboe et al., 2018). This study is an example of a post-hoc analysis to understand key factors of success of an already implemented process. This strategy provides limited insights as some key details may be missed due to the passage of time (i.e. recall bias).

The UNC Extension for Community Healthcare Outcomes for Rural Primary Care Medication Assisted Treatment (UNC ECHO for MAT) provides a tele-conference session for rural primary care providers to discuss cases for Medicated Assisted Treatment and a didactic session (Shea et al., 2019). This study used the CFIR to develop an interview guide, analyze, and present the data (Shea et al., 2019). Semi-structured interviews were conducted while the tele-conference sessions were occurring and allows for improvements to be made in the implementation of UNC ECHO for MAT (Shea et al., 2019). However, the text of the results

section was organized by theme and therefore missed the opportunity to organize the findings by CFIR domain and construct. This makes it difficult to apply the results of this study to other implementation research studies.

Finally, Varley and colleagues (2020) conducted semi-structured interviews of primary care providers to understand barriers and facilitators of providing evidence-based treatment of patients with chronic pain and opioid use disorder. The CFIR guided the development of the interview guide, analysis, and presentation of results (Varley et al., 2020). While this study used the CFIR, it did not specifically focus on implementation research. However, there is the opportunity to use the results of this study to inform the development and implementation of an intervention to support the treatment of people with chronic pain and opioid use disorder.

Implementation research in chronic pain is more common than dissemination research. That said, there is still relatively little evidence (7 studies, 8 publications) examining the implementation of interventions to treat chronic pain using Diffusion of Innovation Theory, the CFIR, or ERIC and the majority of these studies (5) focus on opioids. This focus makes sense given the severity of the opioid epidemic. The use of implementation science methods and strategies are varied and included excellent examples of integrating implementation methods with clinical trials (i.e. Becker et al., 2018; Jacobson et al., 2019; Quanbeck et al., 2018). However, there is the significant need for improvement and additional research at the intersection of implementation research and the treatment of chronic pain in primary care settings.

2.8 Moderators of Dissemination and Implementation Concordance

Both theory and the existing literature contribute to predicted moderators of current and preferred dissemination channels and implementation strategies of evidence-based chronic pain management among primary care providers. The following describes the theoretical foundation for the selection of these moderators, existing evidence for their selection, and anticipated outcomes.

2.8.1 Individual Factors

Understanding individual-level factors is widely accepted as critically important to improving dissemination and implementation of evidence-based practices (Aarons, 2004; Damschroder et al., 2009; Rogers, 2003). Individual-level factors (aside from demographic characteristics) often focus on an individual's perceptions of a specific intervention or innovations broadly (Rogers, 2003). Two individual-level perceptions that may influence implementation are openness and divergence (Aarons, 2004; Rogers, 2003). The following describes the existing literature for the relationship between these two factors and implementation. Finally, this section illustrates the importance of knowledge of the evidence supporting an innovation as a third individual-level factor.

Openness and Divergence. The anticipated relationship between the dissemination concordance and implementation concordance and the openness and divergence is mixed. Openness is defined as individual perceptions of and/or willingness to try new innovations (Aarons, 2004). Divergence is the degree to which evidence-based practices are perceived to fit (or not) with existing practice (Aarons, 2004).

While openness has been connected with implementation success in some literature (Hammond et al., 2011), other examinations find the relationship to be mixed (Louie et al., 2021; Powell et al., 2014). A 2011 meta-analysis of individual-level factors associated with innovation found that openness was mostly strongly linked with implementing new interventions out of the “big five” personality traits (agreeableness, extraversion, conscientiousness, neuroticism, and openness) with a population correlation estimate of .25 ($k=9$, $n=1,868$) (Hammond et al., 2011).

In contrast, other evidence demonstrates a less clear relationship. A 2014 systematic review by Powell and colleagues examined strategies which support evidence-based mental health interventions. This review found 11 studies which met inclusion criteria as randomized or controlled design (Powell et al., 2014). Of the eleven studies, four included some measure of personal characteristics and individual stage of change (including openness) (Powell et al., 2014). The results of these studies find a range of successful implementation outcomes with one study showing increases in fidelity to the evidence-based practice and another study citing no statistically significant difference in use of the evidence-based intervention (Powell et al., 2014).

Another recent systematic review examined the degree to which drug and alcohol programs implement evidence-based practices and factors which influence implementation (Louie et al., 2021). The study found that a range of individual characteristics improved implementation outcomes (Louie et al., 2021). This includes 24% of studies which examined individual beliefs and attitudes about the evidence-based intervention (Louie et al., 2021).

At the intersection of the constructs of openness and divergence, a systematic review examined social worker perceptions of evidence-based practices (Scurlock-Evans & Upton, 2015). The review identified 31 articles for inclusion and found that across studies, social workers seem to have overall positive perceptions toward evidence-based practices (Scurlock-

Evans & Upton, 2015). However, also have concerns about their value and applicability in practice (Scurlock-Evans & Upton, 2015). In short, this describes much of the overarching literature on these constructs. While there are descriptive examples of provider perceptions, the direct relationship with implementation is often limited even with a strong theoretical foundation.

A small longitudinal study examined the knowledge and use of cognitive behavioral therapy for anxious youth over a two year period ($n=115$ at baseline, $n=50$ at 2 year follow-up) (Edmunds et al., 2014). The results indicate that over time provider divergence, or perceptions that the intervention was clinically useful, significantly decreased after the consultation intervention so that the intervention was perceived to be less clinically useful (Edmunds et al., 2014). Then significantly increased at the two-year follow-up so that the intervention was perceived as more clinically useful (Edmunds et al., 2014). This corresponded with maintained self-reported use of the evidence-based intervention throughout the follow-up period (Edmunds et al., 2014).

A 2020 longitudinal sub-group analysis report by Coleman and colleagues examined the use of a web-based dissemination tool for evidence-based post-traumatic stress disorder (PTSD) among military, veteran, and community providers. This longitudinal RCT assessed the role of provider attitudes on engagement with the web-based dissemination tool (Coleman et al., 2020). They did not find a statistically significant relationship between attitudes (both openness and divergences) toward evidence-based chronic pain management and the number of pages visited (i.e. the dissemination outcomes of interest) (Coleman et al., 2020). However, qualitative findings from the study showed that barriers such as time and other clinical responsibilities may

have influenced the results more strongly than anticipated; but were not accounted for in the simple regression analyses (Coleman et al., 2020).

A 2021 study by Nielsen and colleagues, examined the use of an evidence-based practice, a routine opioid screening tool among 44 community pharmacists. The study reported provider attitudes and their individual relationship with the target outcome of screen tool use (Nielsen et al., 2021). The study found a relationship on the verge of statistical significance between divergence and other correlates of opioid screening ($\beta=.14$, 95% CI= 0.98, 1.31, $p=.09$). The relationship with the openness was not statistically significant ($\beta=-.004$, 95% CI= 0.83, 1.91, $p=.96$) (Nielsen et al., 2021).

While there is strong theoretical support, the studies that test this relationship demonstrated varied, if not weak, findings. The current study seeks to build on this gap in knowledge by using two of the Evidence-based Practice Attitude Scale (EBPAS) subscales to capture the constructs of openness and divergence. This dissertation will examine the role of EBPAS Openness and EBPAS Divergence in dissemination concordance and implementation concordance. Based on this mixed evidence, the current study anticipated a small, but significant effect of the EBPAS Openness subscale and the EBPAS Divergence subscale with dissemination concordance and implementation concordance respectively. This relationship will be positive for the EBPAS Openness such that as openness increases so does dissemination and implementation concordance. The relationship will also be positive with EBPAS Divergence such that as divergence (or perceived usefulness) increases so does dissemination and implementation concordance.

Knowledge. Existing knowledge of a given clinical topic and/or evidence-based practice is another important factor in understanding dissemination concordance and implementation

concordance. Theoretically, variations in knowledge are important factors in the Innovation-Decision Process and contribute to when an innovation adoption occurs on the “S-curve” (Rogers, 2003) as previously described. The important role of knowledge is well recognized as a factor in implementation (Harvey & Kitson, 2015). This not only includes knowledge from the peer reviewed literature, but also practice-based knowledge that may act as both a barrier and facilitator to implementing evidence-based innovations (Harvey & Kitson, 2015; Rogers, 2003).

A systematic review synthesized information about nurse knowledge, attitudes, and perceived barriers and facilitators to implementing an evidence-based intervention (Li et al., 2019). The study found that little or no knowledge about the evidence-based practice acted as a barrier to implementation (Li et al., 2019). Another systematic review examined knowledge about autism among primary care providers (McCormack et al., 2020). It found 13 studies which included a measure of provider knowledge with most studies (n=9) demonstrating that providers have inadequate knowledge of autism and evidence-based treatments for autism (McCormack et al., 2020).

Limited research exists on the relationship between knowledge of evidence-based chronic pain management and dissemination or implementation. The current study sought to address this gap and anticipated a positive relationship between increased levels of chronic pain knowledge and higher degrees dissemination concordance and implementation concordance.

2.8.2 Contextual Factors

Diffusion of Innovations Theory provides significant theoretical support for the role of contextual factors as it relates to both dissemination and implementation outcomes. Rogers (2003) describes how individuals with high degrees of cosmopolitanism or interconnectedness

and those with greater access to opinion leaders and innovators often have access to earlier knowledge and eventual adoption of novel interventions or innovations. Rogers (2003) describes an example of the critical role of opinion leadership with the spread of Modern Math in Allegheny County, Pennsylvania. In this example, the adoption of Modern Math did not spread in the region until a superintendent who was socially connected with other regional education leaders adopted the innovation. Even as another (more isolated) superintendent had adopted Modern Math several years earlier. While topically distinct, this case study provides a critical example of the powerful role of interconnectedness and access to opinion leaders in the dissemination and implementation of an innovation. Urbanicity or the degree of urban or rural for a given setting and academic affiliation may be used as proxies for understanding the important influence of contextual factors in dissemination and implementation. The following describes existing evidence supporting the connection between implementation and urbanicity and academic affiliation.

Urbanicity. A recent systematic review examined barriers to implementation of medication treatment for opioid use disorder in rural settings (Lister et al., 2020). Of the 18 studies that met inclusion criteria, 7 examined provider experiences or both provider and consumer experiences with the ability to parse out provider responses. The top barriers, specifically for providers in rural settings, included acceptability (5 studies, 27.8% of total), availability (4 studies, 22.4% of total), and accessibility (2 studies, 11.1% of total) (Lister et al., 2020). Provider implementation barriers included factors such as a lack of support from specialists, time to provide the treatment, and negative attitudes about the treatment itself or lack of confidence to provide the treatment (Lister et al., 2020). These findings highlight unique

factors for rural providers and the critical role that urbanicity may play in the dissemination and implementation of evidence-based chronic pain management.

The important role of urbanicity is further supported by a recent examination to implementation barriers of telerehabilitation for veterans in rural settings (Hale-Gallardo et al., 2020). Study themes of cultural factors, infrastructure, and rurality all influenced implementation. The current description will only focus on barriers and facilitators of implementation specifically contributed to the rural context. Hale-Gallardo and colleagues (2020) found that barriers to implementing telerehabilitation in rural settings included access to rehabilitation staff and additional complexities in providing healthcare in rural and often low-resource contexts. These implementation barriers were overcome when there was an urban center within reasonable travelling distance to provide the rehabilitation and when rural communities had community resources such as schools and job opportunities to incentivize potential staff to live in the community (Hale-Gallardo et al., 2020).

Finally, a 2011 survey of 88 clinical staff and providers found several factors which influence the ability of a healthcare system (in this case the VA) to care for patients (Buzza et al., 2011). Top reported implementation barriers included, distance to drive (n=75, 85.2%), limited transportation (n=55; 62.5%), cost or expense (n=46, 52.3%), and the capacity of the VA facility (n=34, 38.6%) (Buzza et al., 2011). The study also conducted interviews and focus groups which further explained how patient-level factors such as overall health can often exacerbate rural-specific barriers, such as distance to the clinic (Buzza et al., 2011).

The preceding studies demonstrate the critical role that urbanicity of the primary care clinic has on dissemination and implementation. Based on this theoretical foundation and existing literature, the current study anticipated that primary care providers in urban settings will

have significantly higher levels of dissemination concordance and implementation concordance than those in rural settings.

Academic Affiliation. Academically affiliated settings, or clinical contexts in which clinicians participate in teaching and research, may have distinct features which support the dissemination and implementation of evidence-based practices. It is widely accepted that one factor contributing to the success of evidence-based interventions during randomized control trials may be the highly controlled research environment which may often be in an academic center or with additional resource support (Breitenstein et al., 2010; Roy-Byrne et al., 2003). Therefore, implementation fidelity may provide some insight into the important influence of the academic setting on dissemination and implementation (Breitenstein et al., 2010). A 2018 systematic review, examined reported barriers and facilitators to the implementation of hospital-based interventions (Geerligs et al., 2018). One barrier described by studies, specifically regarding the sustainability of implementation efforts, included a reliance or at times an overreliance on research staff and resources (Geerligs et al., 2018). Additionally, academic clinical settings are often centers of specialization which can further support implementation of evidence-based interventions (Damanpour, 1991; Greenhalgh et al., 2004; Pugh et al., 1968).

A recent study examined perceptions of organizational capacity among clinical experts in exposure therapy for anxiety disorders and clinicians in provider settings with 38% affiliated with academic centers (Becker-Haimes et al., 2020). The study found that clinical experts emphasized the importance of organizational resources, collaboration within the organization, organizational policies, and support specific to exposure therapy as critical for implementation (Becker-Haimes et al., 2020). However, clinicians in community clinics reported significantly fewer of these resources in community clinics (Becker-Haimes et al., 2020). This study begins to

elucidate factors more likely to be found in academic settings that support dissemination and implementation of evidence-based practices.

For academic affiliation, the current study anticipated that PCPs in academic settings will have significantly higher levels of dissemination concordance and implementation concordance than PCPs in non-academic settings.

2.9 Study Aims and Hypotheses

Based on this theory and evidence, the current study had the following aims and hypotheses.

Aim 1: Identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management.

This aim is descriptive and does not have hypotheses.

Aim 2: Compare existing dissemination and implementation strategies for evidence-based chronic pain management with stated preferences of primary care providers.

Hypothesis 2.1: Primary care providers on average will have dissemination concordance lower than that of chance.

Hypothesis 2.2: Primary care providers on average will have implementation concordance lower than that of chance.

Aim 3: Explore the effect of professional characteristics and clinic context on the concordance of dissemination/implementation strategies and preferences for chronic pain management in primary care providers.

Hypothesis 3.1: Primary care providers in academic primary care settings will have significantly higher levels of dissemination concordance than primary care providers in non-academic settings.

Hypothesis 3.2: Primary care providers in academic primary care settings will have significantly higher levels of implementation concordance than primary care providers in non-academic settings.

Hypothesis 3.3: Primary care providers in urban settings will have significantly higher levels of dissemination concordance than primary care providers in rural settings.

Hypothesis 3.4: Primary care providers in urban settings will have significantly higher levels of implementation concordance than primary care providers in rural settings.

3.0 Research Design and Methodology

3.1 Study Design

The current study employed a cross-sectional survey design. Primary care providers were surveyed about existing and preferred dissemination channels of chronic pain management, existing and preferred implementation strategies, and professional and clinic context factors. These data were used to describe dissemination channels and implementation strategies and preferences, examine their concordance, and explore the moderating role of professional and clinic context factors on concordance.

3.2 Participants

3.2.1 Sample Design

A total of 100 primary care providers in Pennsylvania were surveyed. Data were collected using a non-probability convenience sampling approach. A limitation to convenience sampling is the risk of bias (Etikan et al., 2015). This limitation was addressed by using best practices in survey administration in an attempt to capture a sample which mirrors the population of Pennsylvania primary care providers.

3.2.2 Inclusion/Exclusion

In order to meet the goals of the current dissertation study, data collection focused on clinicians who make care decisions and refer and prescribe treatment for patients living with chronic pain. The current study focused solely on primary care providers, i.e. physicians, physician assistants, and nurse practitioners. These providers have clinical decision-making power and typically make care decisions with patients during primary care appointments.

Primary care providers may have different training backgrounds including family medicine, internal medicine, obstetrics and gynecology, and gerontology and typically treat common illnesses in an outpatient setting (Donaldson et al., 1996). These providers include physicians (medical doctors (MD) and doctors of osteopathy (DO)), nurse practitioners, and physician assistants who, through their scope of practice (defined by state legislatures), are able to provide primary care (Donaldson et al., 1996).

There are differences in training, treatment approach, and scope of practice among primary care providers. The scope of the current study focuses on dissemination and implementation of evidence-based chronic pain management among primary care providers in general who make care decisions with patients. For the purposes of this study, all types of primary care providers (as outlined above) will be included.

Federally Qualified Health Centers (FQHCs) are a distinct primary care setting with additional financial support and the goal to provide care for marginalized populations. FQHCs typically also have highly integrated multi-disciplinary teams who provide care for patients. Because this setting is incredibly unique, primary care providers who work primarily in FQHCs were excluded from the current study.

Social workers who work in primary care were excluded from the current study as they are not designated as primary care providers by the law. Clinical decision-making and prescribing are not within the scope of practice for social workers in Pennsylvania even as many primary care social workers work alongside physicians, nurse practitioners, and physician assistants. Therefore, the inclusion of primary care social workers was beyond the scope of the current study.

Primary care providers were included in the study if they were 1) a physician, physician assistant, or nurse practitioner, 2) practiced in an outpatient primary care setting in Pennsylvania, 3) did not practice more than 50% in a federally qualified health center (FQHC), and 4) did not practice in pediatric primary care.

3.2.3 Recruitment

Primary care providers (PCPs) are challenging to recruit and engage in research activities. The Principal Investigator (PI) used multi-stage approach to recruit primary care providers (PCPs) for the current study. Because this approach used a combination of individual and organizational methods, an overall response rate was not estimated, although response rates for some sources (e.g., UPMC CMI list) were calculable. All approaches of the current study followed guidance provided by Dillman (2014) to increase the number of responses. This approach includes sending a pre-survey announcement, then sending the survey multiple times and at different times of day. The survey was optimized for administration on a computer, tablet, or phone to increase ease of use. These approaches were tailored to each organization and recruitment strategy.

Current estimates for primary care providers in Pennsylvania range from 12,800 (Association of American Medical Colleges, 2019) to about 27,700 (including primary care, obstetrics and gynecology, pediatrics, geriatrics and internal medicine) (United Health Foundation, 2020). These numbers only capture physicians; when including physician assistants and nurse practitioners and anticipating the multi-pronged recruitment approach, a sample of 100 Pennsylvania PCPs was determined to be feasible. The following outlines the detailed procedure to achieve this goal.

First Stage

In the first stage, the PI leveraged existing relationships for targeted recruitment. The first stage of recruitment focused on three main recruitment strategies described below through the UPMC CMI List, academic PCP snowball sampling, and the Mid-Atlantic Region of the Society for General Internal Medicine.

UPMC CMI List

In the first stage of recruitment, the PI leveraged existing relationships within the UPMC provider network to recruit participants. The first strategy was through the UPMC Community Medicine, Inc (CMI) which staffs 57 primary care practices and employs 358 community PCPs throughout western Pennsylvania at the time of the study ([website here](#)). The study team had an existing relationship with the CMI Medical Director and leveraged this relationship to send recruitment information through the CMI email list. Practice locations range from urban centers such as Pittsburgh and McKeesport, to suburban such as Wexford and Allison Park, and more rural areas such as North Huntington and Fishertown (website contains full list of locations).

Academic PCP Snowball Sampling

The PI and study team used existing relationships with academic PCPs within the UPMC network to recruit PCPs through targeted snowball sampling. The study team disseminated recruitment materials through the Division of General Internal Medicine of the University of Pittsburgh. There are approximately 200 faculty within the Division of General Internal Medicine, although not all were primary care providers and/or met inclusion criteria for the current study. This approach leveraged existing relationships with Dr. Jane M. Liebschutz, MD, MPH, FACP, Chief of the Division of General Internal Medicine with additional recruitment from the PI and dissertation committee.

Mid-Atlantic Region of the Society of General Internal Medicine

The PI sent recruitment information for distribution through the Mid-Atlantic Region of the Society for General Internal Medicine (SGIM) Connect Group with permission given by the SGIM Staff via Dr. Thomas Radomski, MD, MS, Assistant Professor of General Internal Medicine and past-President of Mid-Atlantic Region. SGIM is an international organization for academic internal medicine providers with over 3,300 members. The Mid-Atlantic Region includes SGIM members from New York, Delaware, New Jersey, and Pennsylvania. Therefore, not all members who receive the recruitment information were eligible for participation. It is estimated that there were several hundred providers in SGIM from Pennsylvania. The PI and other members of the study team have existing relationships with the leadership of the Mid-Atlantic Region SGIM. The leadership of the Mid-Atlantic Region SGIM agreed to disseminate the survey information through their member list.

Second Stage

The second stage of recruitment focused on professional organizations who serve Pennsylvania primary care providers, and served as a backup to the first stage of recruitment to ensure the successful ascertainment of the proposed sample. The following details the recruitment approach tailored to each professional organization.

Pennsylvania Academy of Family Physicians (PAFP)

The Pennsylvania Academy of Family Physicians (PAFP) is a member organization with over 5,500 physicians, residents, and student members focused on advanced quality healthcare (www.pafp.com). PAFP does not offer specific options for dissemination of research opportunities to its members. However, sponsorships and advertising were available for purchase. The PAFP had a Virtual Spring CME, Annual Business Meeting, and Research Day that the PI targeted for advertising in order to maximize exposure.

Pennsylvania Osteopathic Medical Association (POMA)

The Pennsylvania Osteopathic Medical Association (POMA) is a division of the national American Osteopathic Association and represents over 8,000 osteopathic physicians, residents, and students (www.poma.org). POMA had several opportunities for digital advertising to their members. The PI worked with organization administration to identify the best digital advertising option for the current study.

Pennsylvania Society of Physician Assistants (PSPA)

The Pennsylvania Society of Physician Assistants (PSPA) is a member of the American Academy of Physician Assistants (AAPA) and does not report their Pennsylvania membership numbers online (www.pspa.net). Nationally, the AAPA represents over 140,000 Physician Assistants across the United States. The PSPA had newly developed advertising opportunities for

research dissemination to its members. This included the opportunity to send digital advertising over the course of three months for a nominal fee of \$140. The PI used this strategy to send recruitment information to physician assistants in Pennsylvania.

Pennsylvania Coalition of Nurse Practitioners (PACNP)

The Pennsylvania Coalition of Nurse Practitioners (PACNP) represents over 15,000 Certified Registered Nurse Practitioners in Pennsylvania with the goal to promote the role of CRNPs (www.pacnp.org). The PACNP had a process for disseminating research to its members which includes a form describing the project and a review process by a sub-committee. The PI used this process to disseminate recruitment information to PACNP membership.

Third Stage

Based on the degree of success of the first two recruitment stages, the PI implemented the third stage of recruitment. The third stage included the PI leveraging online searches for Pennsylvania primary care clinics, physician practices, and organizations to disseminate information about the current study. This approach leveraged existing relationships between the PCP and known clinical leaders as well as the relationships between the PI's mentor team and PCPs. The PI also disseminated information about the current study using social media (e.g. Facebook, Twitter, LinkedIn, etc.). The PI used institutional resources at the University of Pittsburgh including Pitt + Me, a repository of research studies, to disseminate information about the current study. This approach continued until the study sample reaches the target for data collection.

3.3 Incorporation of the Dillman Method

The traditional “Dillman Method” for survey development and recruitment approach and strategies is outlined in his predominate text. This approach focuses on probability sampling or sampling where the entire population is known and using mail or telephone methods for reaching potential participants (Dillman et al., 2014). However, many of the approaches (as described above) also support the development and recruitment for digital surveys in a non-probability sample. The current study adapted many of the strategies outlined by Dillman to increase recruitment of Pennsylvania primary care providers.

3.3.1 Survey Development

Development of the survey and piloting followed Dillman’s overall approach for web-based surveys which includes emphasizes simply worded questions presented in a visually appealing way (Dillman et al., 2014). Dillman also recommends obtaining feedback from content experts and pilot testing to ensure flow (2014). The PI sought consultation from chronic pain experts and implementation science experts in developing the questions and order of the survey. Further description of the piloting process is described below.

Dillman recommends the use of both URLs and QR codes for dissemination of web-based surveys and ensure that the survey hosting platform supports various modes of web-based access such as mobile device, computer, or tablet (2014). The current study used the University of Pittsburgh-approved Qualtrics survey platform which automatically adapts to computer, mobile, or tablet access for surveys.

The Dillman method describes additional formatting decisions, such as the number of questions on each page and guiding descriptions for each section of the survey (Dillman et al., 2014). Further, Dillman strongly recommends not requiring responses to questions unless absolutely necessary (Dillman et al., 2014). The current study closely aligned with this guidance as each page of the survey was carefully examined to only include a limited number of questions. The PI made the decision not to require responses to any questions throughout the survey except for the informed consent at the beginning.

Specifically for survey dissemination via email, Dillman recommends sending multiple email requests for participation and to vary the time of contacts to attempt to reach different segments of the target population (Dillman et al., 2014). The method also recommends keeping the survey email short with the URL early in the email (Dillman et al., 2014). The PI attempted to follow this guidance, although most dissemination was sent by third parties (e.g. system administrator, professional organization media personnel, etc.). However, the current study was disseminated on different days of the week and different times for most dissemination sources (e.g. CMI, SGIM, etc.). The survey email included significant text, as required by the University of Pittsburgh Human Protection Office; however, the URL link was toward the beginning of the email.

Not only did survey development adhere to the Dillman method, but recruitment strategies also aligned with best practices as outlined by Dillman.

3.3.2 Survey Recruitment

The PI considered several factors in the development and recruitment of the survey to improve appeal of participation for Pennsylvania PCPs. This included considerations of Cost-

Benefit Theory which seeks to reduce the respondent costs and have benefits outweigh the costs (Dillman et al., 2014). This was implemented in the current study by highlighting the estimated length of time to complete the survey (10 minutes), the opportunity to share PCPs own knowledge, and to enter a sweepstakes to win a \$100 Amazon gift card. Additionally, the PI sought to engage Social Exchange Theory within the context of surveys which seeks to develop trust between the potential participant and survey and to recognize the importance of quick decision-making about whether or not to respond (Dillman et al., 2014). The PI incorporated this by leveraging existing relationships between PCPs and organizational leaders to invite the leaders (who at times acted as survey champions) to disseminate the survey to their colleagues. While at the end of the survey, the PI asked participants if they wished to receive a copy of the final published results as a strategy to promote a social exchange between the PI and participants with the goal to encourage further snowball sampling.

Dillman promotes additional strategies for increasing survey participation including describing how the survey will be used, asking for participant knowledge and expertise, connection with a legitimate organization, describe how others have responded, and the use of cash incentives (Dillman et al., 2014). The PI used many of these strategies (as already discussed) and further sought to increase participation by soliciting buy-in from dissemination organizations such as CMI, SGIM, and other professional organizations. These strategies included leveraging the reputation of the University of Pittsburgh and School of Social Work which was then built upon by having informational phone calls to answer any questions or concerns. This promoted a sense of collaboration and trust between the PI and the organizations and increased the dissemination opportunities for the survey.

The current study leveraged many strategies from the Dillman method to both develop the survey instrument and guide recruitment. The preceding described specific examples of this alignment.

3.4 Measures

Table 1 summarizes each aim and corresponding measures and analyses.

Table 1 Study Aims with corresponding variables, measures, and analyses

| Aim | Independent Variable | Dependent Variable | Analysis |
|--|-----------------------------------|--|----------------------------|
| Aim 1: Identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management. | N/A | Current Dissemination Channels ^a | Descriptive |
| | | Preferred Dissemination Channels ^a | |
| | | Current Implementation Strategies ^a | |
| | | Preferred Implementation Strategies ^a | |
| Aim 2: Compare existing dissemination and implementation strategies for evidence-based chronic pain management with stated preferences of primary care providers. | N/A | Dissemination Concordance | Cohen's Kappa (κ) |
| | | Implementation Concordance | |
| Aim 3: Explore the effect of professional characteristics and clinic context on the concordance of | Professional Factors ^b | Dissemination Concordance | Multiple linear regression |
| | Clinic context | | |

| | | |
|--|--|----------------------------|
| dissemination/implementation strategies and preferences for chronic pain management in primary care providers. | Factors ^b EBPAS Openness subscale ^c EBPAS Divergence subscale ^d | Implementation Concordance |
|--|--|----------------------------|

^a Newly developed survey for this research (see Appendix A)

^b Based on professional background and clinic context information collected during demographics

^c *EBPAS openness sub-scale* (Aarons, 2004)

^d *EBPAS divergence sub-scale* (Aarons, 2004)

3.4.1 Professional Characteristics

The survey collected professional data including personal and professional information which includes age, race, ethnicity, gender, degree(s), number years post-training, number of clinic days, and board certifications. Self-identified race and ethnicity were reported using reported terms and for the purposes of the analysis were dichotomized for 1 indicating white and 0 indicating non-white. Self-identified gender was reported as dichotomous as 1 for female and 0 for male. The survey collected training/profession (i.e. MD, DO, NP, and PA) which was operationalized dichotomously as 1 for MD or DO and 0 for an advanced practice provider (NP or PA). Data were also collected on the number of days per week that the participant worked in the clinic (measured continuously) and the number of years of experience (measured continuously).

3.4.2 Clinic Context Factors

Participants were asked to estimate the percentage of their patients who live with chronic pain. This was reported as a continuous variable. The current study asked participants if their clinic is part of a larger health system or a single clinic in order to assess not only the organizational structure but also potential cosmopolitanism and connectedness of a participant's network. Participants were asked to select all types of insurance that their practice accepts including commercial, Medicare, Medicaid, no insurance, and other. Finally, participants were asked their perception of their own ability to treat their patients living with chronic pain as well during the COVID-19 pandemic as before the pandemic.

3.4.3 Dissemination Preferences

Previous studies examined state legislator perceptions of behavioral health research and dissemination preferences but did not explicitly ask about existing dissemination practices, only asking about where the legislator would go to receive information about behavioral health research (Purtle et al., 2017, 2018). The authors did not compare implicit existing preference with preferred dissemination as this was not the goal of the study. Another study examined teacher dissemination preferences of concussion knowledge, symptoms and management and asked about dissemination channels (i.e. how they received information) and perceived need for concussion information (Dreer et al., 2017). This study did not compare existing dissemination channels with perceived need and only provided descriptive information (Dreer et al., 2017). These studies provide the basis for measuring dissemination preferences, and their measures will be adapted to chronic pain management for the current study.

Based on these existing measures, the author developed a 2-item questionnaire to measure current and preferred dissemination channels for receiving information about chronic pain management. The 21 dissemination channels that represent the items for this questionnaire are based on pilot interviews from the qualitative research preceding this project (Ashcraft et al., *in preparation*). The author also developed a complementary three-item scale which seeks to understand perceptions of adequate knowledge about chronic pain. The scale is based on Diffusion of Innovations Theory and the Model for Dissemination of Research. Reporting for this scale is reported elsewhere and is beyond the scope of the current study.

3.4.4 Implementation Preferences

Numerous scales exist to measure the Consolidated Framework for Implementation Research (CFIR) domains and corresponding constructs (Lewis et al., 2018; Society for Implementation Research Collaboration, 2017). However, none of these instruments examine agreement between existing preferred implementation strategies. The Expert Recommendations for Implementing Change (ERIC) project complements the CFIR by providing a list of 73 implementation strategies which may be used to overcome barriers to implementation (Powell et al., 2015). The implementation strategies were organized using concept mapping into nine clusters of similar strategies (Waltz et al., 2015). The current studies used these nine clusters as a guide to develop a set of 13 chronic pain implementation strategies as a list of 73 was deemed infeasible. The chronic pain implementation strategies were iteratively developed based on feedback from implementation and chronic pain experts and tested during piloting.

3.4.5 Moderators

The Consolidated Framework for Implementation Research (CFIR) has five domains and 39 constructs. In order to best understand dissemination concordance and implementation concordance, it is critical to measure both contextual factors (e.g. geography, clinic type, discussed elsewhere) and individual level factors, specifically perceptions of research (broadly) and perceptions of alignment evidence-based practices and clinical practice. The CFIR captures these constructs and perceptions in the domain of Characteristics of Individuals (discussed earlier). As a meta-theoretical framework, the CFIR was not designed to quantifiably measure these constructs. However, the Evidence-Based Practice Attitude Scale (EBPAS) was developed to understand provider perceptions of evidence-based practices (Aarons, 2004). The development and reliability of this scale was discussed previously. The use of the EBPAS to assess CFIR constructs is acknowledged in various populations and is described next.

Kegler and colleagues (2018) sought to quantify the CFIR constructs to work to increase colorectal screenings in Federally Qualified Health Centers. They adapted the EBPAS Openness and EBPAS Appeal subscales and found strong reliability as part of their testing ($\alpha=.88$ and $\alpha=.75$ respectively) (Kegler et al., 2018). Hall and colleagues (2021) examined the connection between the CFIR and EBPAS using both qualitative and quantitative methods by conducting CFIR-based qualitative interviews and focus groups and also by conducting surveys using an adapted EBPAS to understand the use of an evidence-based practice in a pediatric setting in Guatemala (Hall et al., 2021). They then integrated the qualitative and quantitative results and found overlap between EBPAS Openness subscale and the CFIR domains of Characteristics of

Individuals and Innovation Characteristics (Hall et al., 2021). Overlap between the EBPAS Divergence subscale and CFIR were not reported (Hall et al., 2021).

The following describes the measurement of predicted moderators of dissemination concordance and implementation concordance for the current study.

EBPAS Openness Subscale. The current study employed the Evidence-Based Practice Attitude Scale (EBPAS) Openness subscale by Aarons (2004) and has four items measuring provider openness to trying a novel evidence-based intervention (See Appendix A). Aarons developed this subscale by surveying 322 mental health clinical and case management providers (Aarons, 2004). The scale uses response options from 0 meaning *not at all* to 4 indicating *to a great extent*. The Openness subscale had good internal consistency with $\alpha=.78$ (Aarons, 2004). The Openness construct had good discriminant validity and did not significantly correlate with Divergence or Requirements, but did have a strong positive correlation with the Appeal subscale (not used in this study). The Openness subscale was modified slightly to apply to chronic pain management among primary care providers. For example, the original question stated, “*I like to use new types of therapy/interventions to help my clients.*” and the current question states, “*I like to use new types of chronic pain treatments to help my patients.*”

EBPAS Divergence Subscale. The current study also used the EBPAS Divergence subscale developed by Aarons (2004). The Divergence subscale measures the degree of perceived usefulness of research-based innovations versus clinical experience. The Divergence subscale had moderate internal consistency with $\alpha=.59$ (Aarons, 2004). Divergence had moderate discriminant validity and was negatively correlated with Appeal and Requirements (not used in this study) and no significant correlation with Openness. The Divergence subscale also uses response options ranging from 0=*not at all* to 4=*to a great extent*. The wording of the

Divergence subscale was modified slightly to apply to primary care providers and chronic pain instead of mental health professionals. For example, the original survey question stated, “*I would not use manualized therapy/interventions.*” and the current survey states, “*I would not use manualized chronic pain treatments.*”

Chronic Pain Knowledge. For the purposes of the current study, a novel three-item Chronic Pain Knowledge scale was developed to assess participant knowledge of evidence-based chronic pain management. The scale asks participants to report their degree of agreement with three statements describing different evidence-based chronic pain management strategies. The scale uses a Likert scale for response items in an attempt to reduce social desirability bias ranging from, “strongly agree” to “strongly disagree.” The statements were, 1) “*The treating physician is the most accurate judge of the intensity of the patient’s pain,*” 2) “*Opioids are a first-line therapy for chronic pain,*” and 3) “*Cognitive Behavioral Therapy (CBT) is an evidence-based treatment for chronic pain.*” The Chronic Pain Knowledge scale was scored with 1 for strongly disagree and somewhat disagree for questions one and two and a score of 1 for strongly agree or somewhat agree for question three.

Urbanicity. The current study collected participant clinic zip code which was used to determine urbanicity (i.e. rural, urban). The study used a 2003 zip code-urbanicity crosswalk developed by the University of Michigan Population Studies Center. The 2003 crosswalk included the most recent data available for determining urbanicity of a given zip code. The crosswalk has nine categorizations on the urban-rural continuum. Zip codes were considered urban if they were in categories 1-3 and rural if they were in categories 4-9. Categories 1-3 include counties in metro areas of 1 million people or more and include counties in metro areas of fewer than 250,000 but adjacent to a metro area. Categories 4-9 include rural counties with

less than 2,500 population not adjacent to a metro area and include counties with populations of 20,000 or more adjacent to metro areas. This classification comes from the US Department of Agriculture (USDA) and is commonly used in population studies (US Department of Agriculture, 2020).

Academic Affiliation. Academic affiliation was operationalized into two distinct questions which highlight independent components of academic institutions, teaching and research. The current study asked participants if they were responsible for educating students or trainees and separately asked if the participant conducted research funded by an external entity, excluding internal quality improvement. These questions sought to elucidate differences in institutions which may participate in some type of teaching activities (e.g. residency program) from large research institutions. Academic affiliation was a dichotomous variable indicating participants who both participate in some form of teaching and also conduct research funded by an external entity.

3.5 Study Procedure

Potential participants were recruited through professional organization listservs, through internet searches, and snowball sampling. Primary care providers were emailed the recruitment flyer and link to the survey. Potential participants who chose to complete the survey went through an online informed consent and screening process to identify if they met inclusion criteria (described above).

PCPs who met inclusion criteria were allowed to continue and complete the survey. Upon completion, PCPs had the option to enter their name for a drawing to win one of eight \$100

Amazon gift cards. An anonymous survey link took participants to a form to complete to enter to the sweepstakes. This allowed no connection between participant survey data and identifying information. Participants were also able to indicate if they would like to receive a notification of publication of the completed study. At the end of each month during data collection, the Principal Investigator used a random number generator to select one name per 50 participants for a \$100 Amazon gift cards. At the end of all data collection, the PI used a random number generator to select two more names out of the total number of non-winning participants for two more \$100 Amazon gift cards.

3.5.1 Piloting

The survey instrument was pilot tested over three rounds with iterative feedback given after each round. The instrument was first tested among PhD students and academic faculty with edits made for brevity and to promote comprehension. Additional pilot testing solicited feedback from medical professionals with the goal to promote ease of use and reduce time of completion. The final round of pilot testing concentrated on clarity of language and ordering of questions.

3.6 Data Analysis

The following describes the analysis for the three aims for the current study. The three aims sought to 1) identify existing and preferred dissemination and implementation strategies of primary care providers, 2) compare existing and preferred strategies, and 3) explore the effect of

professional and clinic context factors on dissemination and implementation concordance. All analyses were conducted using *Stata*.

3.6.1 Sample Description

Personal, professional, and clinic context factors were collected from primary care providers. This included personal factors such as self-identified gender, race, and age. Professional factors included profession, number of years practice, sub-specialties, educating trainees, number of days in clinic, and research status. Clinic context factors included urbanicity, academic-affiliation status, and insurance(s) accepted. Professional, and clinic context factors were described using descriptive statistics including frequencies and percentage for categorical variables and mean, standard deviation, and range for continuous variables.

3.6.2 Preliminary Analysis

Preliminary analyses were conducted to assess internal consistency of all scales and identify any outliers. Internal consistency was assessed using Cronbach's alpha. Outliers will be identified by any surveys that take less than two minutes to complete. Outliers with more than 30% missing data and/or missing dissemination or implementation existing practices or preferences will be removed. Within-measure outliers were addressed for parametric analyses using winsorizing of 1.5 standard deviations above and below the sample mean. Multiple imputation will be conducted on independent variables with 5% or more missingness.

3.6.3 Analyses of Specific Aims and Hypotheses

Aim 1: Identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management. The study survey collected data on how primary care providers currently receive information about chronic pain and preferred characteristics of chronic pain dissemination. Data were also collected about current implementation strategies of chronic pain treatment. The survey also asked about preferred implementation of chronic pain treatment. Descriptive statistics were used to describe these data by using frequencies for the categorical variables.

Aim 2: Compare existing dissemination and implementation strategies for evidence-based chronic pain management with stated preferences of primary care providers. The results from Aim 1 were used to generate a dissemination concordance score and an implementation concordance score. This score was generated by using Cohen's kappa (κ). Cohen's kappa (κ) can be used for either two different raters evaluating at the same time or one rater making an evaluation at two different times (Ranganathan et al., 2017). The current study includes one rater (i.e. the primary care provider) rating the same constructs (i.e. dissemination channels and implementation strategies of chronic pain evidence and treatment) at two different times (i.e. currently and in an ideal future). Therefore, Cohen's Kappa (κ) was the appropriate statistical analysis to evaluate dissemination and implementation concordance. The results of Cohen's kappa (κ) range from -1 to 1 with zero indicating agreement equal to that of chance.

Ninety-five percent confidence intervals were calculated using the *ci* command in *Stata* for both dissemination concordance and implementation concordance. The 95% confidence

intervals were then checked to ensure that the average kappa for dissemination concordance and implementation concordance did not cross zero to confirm an average kappa greater (or less) than chance as indicated by the categorical assessment (described below).

Categorical assessments of agreement for Cohen's Kappa (κ) have been thought of as arbitrary (Landis & Koch, 1977); however they are helpful in understanding the magnitude of agreement. Different categorical interpretations vary slightly in terminology. McHugh (2012) interprets Cohen's Kappa (κ) in six categories including 0-.2 indicating none, .21-.39 indicating minimal agreement, .40-.59 indicating weak agreement, .60-.79 indicating moderate agreement, .80-.90 indicating strong agreement, and over .90 indicating almost perfect agreement. An additional interpretation breaks Cohen's Kappa (κ) into seven categories with 0-.09 indicating no different from chance, .10-.20 indicating slight agreement, .21-.40 indicating fair agreement, .41-.60 indicating moderate agreement, .61-0.80 indicating substantial agreement, .81-.99 indicating near perfect agreement, and 1 signifying perfect agreement (Landis & Koch, 1977; Ranganathan et al., 2017).

For the purposes of the current study, the seven-level interpretation was used in order to describe the results in more detail. Cohen's Kappa (κ) was calculated for each respondent to assess the degree of agreement for 1) dissemination channels and 2) implementation strategies of evidence-based chronic pain management. **Table 2.** below shows an example of how data for each respondent were used to calculate a concordance score. For hypothesis testing, the average dissemination concordance score and implementation concordance was compared with the seven-level interpretation of Cohen's kappa to determine if the average concordance scores are above or below that as would be expected by chance.

Table 2 Dissemination Concordance, Cohen's kappa individual data example

| | Current | Preferred |
|---|-------------------------------------|-----------|
| Colleagues | 1 | 0 |
| Your own clinical experience | 1 | 0 |
| Patients | 0 | 0 |
| Professional organizations | 0 | 1 |
| Researchers | 0 | 1 |
| Clinical experts | 1 | 0 |
| Pharmaceutical representatives | 0 | 1 |
| Primary peer-reviewed literature (e.g., PubMed) | 0 | 1 |
| Online peer reviewed clinical resources (e.g., UptoDate) | 0 | 0 |
| Email listserv | 1 | 0 |
| Practice Briefs or Practice Guidelines | 1 | 0 |
| Annual conferences | 0 | 1 |
| Seminars at my clinic/institution (e.g., grand rounds; case conference) | 0 | 0 |
| Web-based continuing education modules | 1 | 0 |
| Workshops on specific intervention (e.g. CBT, Yoga) | 1 | 1 |
| Main-stream media (e.g. NPR, CNN, FoxNews) | 0 | 0 |
| Blogs (e.g. Tumblr, Wordpress) | 1 | 0 |
| Social media (e.g. Facebook, Twitter, Reddit) | 1 | 1 |
| Podcasts | 1 | 0 |
| Other | 0 | 1 |
| None of these | 0 | 0 |
| | Agreement, n (%) | 7 (33) |
| | Disagreement, n (%) | 14 (66) |
| | Expected agreement by chance, n (%) | 11.5 (50) |
| | Kappa | -.33 |

Aim 3: Explore the effect of professional characteristics and clinic context on the concordance of dissemination/implementation strategies and preferences for chronic pain management in primary care providers. The dissemination concordance score and implementation concordance score were used in conjunction with collected professional characteristics and clinic context factors to understand the effect of these factors on concordance between existing and preferred dissemination channels and implementation strategies. Multiple linear regression was used to assess the effect of these factors on dissemination and implementation concordance. Covariates were only included in the model if the bivariate correlation between the variable and the given outcome is statistically significant at $p < .05$. Additionally, predicted moderators (independent variables) including urbanicity, academic affiliation, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge will be included in both models.

$$\hat{\gamma}_1 = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \varepsilon_1 \quad (1)$$

Where, $\hat{\gamma}_1$ is dissemination concordance (Aim 2), x_1 is professional factors, and x_2 is clinic context factors, and x_3 is predicted moderators. Each factor will be individually added to the model, keeping factors that significantly predict dissemination concordance. Factors influencing implementation concordance mirrored this process using the following approach:

$$\hat{\gamma}_2 = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \varepsilon_2 \quad (2)$$

Where, $\hat{\gamma}_2$ is implementation concordance (Aim 2), x_1 is professional factors, and x_2 is clinic context factors, and x_3 is predicted moderators. Again, each factor was added individually and retained when reaching significance. Independent t -tests were used for hypothesis testing.

3.6.4 Power Analysis

Aim 1 was descriptive and therefore did not require a power analysis. Aim 2 used Cohen's Kappa (κ) and compared current dissemination channels and implementation strategies with preferred dissemination and implementation strategies at the individual level and therefore did not require a power analysis. Aim 3 used multiple linear regression and regressed concordance on professional characteristics, clinic context factors, EBPAS Openness, and EBPAS Divergence (total of 7 predictors). With a sample size of 101 primary care providers and a power of 88%, this study was able to detect an effect size of $f^2=.10$ which is a small to medium effect. Therefore, this study was adequately powered to investigate the effect of professional and clinic context factors on dissemination and implementation concordance.

3.7 COVID-19

The COVID-19 pandemic has had a significant effect on the ability of all health care providers to care for their patients. Therefore, the current study also collected information on the degree to which primary care providers perceive a change in their current practice. A secondary analysis of the influence of COVID-19 on dissemination and implementation of chronic pain will be assessed but is beyond the scope of the current study.

Few provider-focused existed at the time of development of the current survey to understand the effects of the COVID-19 pandemic on primary care. Zhang and colleagues (2020) developed a questionnaire to test knowledge, attitudes, and practices of providers during the COVID-19 pandemic. To ensure feasibility, the current study used one question to gain limited

insight into how well participants perceive to manage chronic pain among their patients during the COVID-19 pandemic. The COVID-19 item was the statement, *“During the COVID-19 pandemic, I have managed patients with chronic pain as well as before the pandemic”* and had five response options from strongly disagree to strongly agree. For analysis, the COVID-19 item was scored -2 to 2 with -2 aligning with strongly disagree and 2 aligning with strongly agree.

4.0 Results

Data collection occurred between January and May 2021. The Principal Investigator (PI) made 380 documented contacts with professional practice organizations, provider groups, on social media, and to available resources at the University of Pittsburgh (e.g. Pitt + Me, PaTH Network, etc.). In total, 252 people attempted to take the survey and 136 (54%) met inclusion criteria. Sixty-nine people who attempted to take the survey reported learning about the study from CMI. The estimated response rate for CMI is 51%. In order to meet inclusion criteria, potential participants needed to 1) be a physician, physician assistant, or nurse practitioner, 2) practice in an outpatient primary care setting in Pennsylvania, 3) not practice more than 50% in a federally qualified health center (FQHC), and 4) not practice in pediatric primary care. Of the 136 who met inclusion criteria, 115 (85%) people completed the full survey.

Fourteen people were excluded due to a survey development error which was identified and remedied in late January 2021. Originally, the dissemination and implementation concordance questions were structured using a matrix format. There was participant confusion about selecting different response options for each of the dissemination channels and implementation strategies. Therefore, the PI excluded participants from the early phase of the study who had no active (selected) overlap in current and preferred dissemination channels/implementation strategies. In late January, the survey was changed to clarify the selection of current and ideal dissemination channels and implementation strategies. With the exclusion of the 14 participants, the final sample for this study was 101.

4.1 Sample Characteristics

Full participant characteristics can be found in Table 3. For personal characteristic factors, study participants self-identified as mostly white (n=85; 85.15%), female (n=67; 66.34%), physicians (n=71; 70.30%), from urban settings (n=95; 94.06%). Participants worked on average 3.36 days per week in outpatient primary care clinics (SD=1.41), had on average 12.29 (SD=10.70) years of experience post-residency. For clinic context factors, participants treated on average 31.35 (SD=18.52) percent of patients with chronic pain. Most participants were part of a larger health system (n=93; 92.08%). Most participants provided some form of teaching or education (n=77; 76.24%) and few conducted research funded by an external source excluding quality improvement (n=12; 11.88%). Positive responses to both teaching or educational responsibility and research were combined to determine the number of participants who worked in academic settings. Most participants worked in non-academic settings (n=91; 90.10%). Most participants accepted commercial insurance, Medicare, and Medicaid (n=92; 91.09%). Many participants did not perceive a negative impact of COVID-19 on their ability to treat patients with chronic pain. Thirty-two participants (31.68%) responded with somewhat agree and 17 (16.83%) responded with strongly agree to the following statement, “*During the COVID-19 pandemic, I have managed patients with chronic pain as well as before the pandemic.*”

Table 3 Participant Characteristics

| Variable Name | Missing | N | % | M | SD | Min | Max | Skew | N= outliers |
|------------------------------------|---------|-----|--------|-------|-------|-----|-----|-------|----------------|
| Race | 2 | 99 | | | | | | | |
| White | | 86 | 85.15% | | | | | | |
| Black/African American | | 1 | 1.01% | | | | | | |
| East Asian | | 4 | 3.96% | | | | | | |
| Southeast Asian | | 3 | 2.97% | | | | | | |
| Indian | | 4 | 3.96% | | | | | | |
| Multiracial (non-white) | | 2 | 2.02% | | | | | | |
| Ethnicity ¹ | 0 | 101 | | | | | | | |
| Hispanic | | 5 | 4.95% | | | | | | |
| Latino | | 1 | 0.99% | | | | | | |
| Gender (Female) | 3 | 67 | 66.34% | | | | | | |
| Profession (Physician) | 1 | 71 | 70.30% | | | | | | |
| MD | | 63 | 62.38% | | | | | | |
| DO | | 8 | 7.92% | | | | | | |
| CRNP | | 15 | 14.85% | | | | | | |
| PA-C | | 14 | 13.86% | | | | | | |
| Days per week in clinic | 3 | 98 | | 3.36 | 1.41 | 0.5 | 6 | -0.32 | 12 |
| Years of experience | 3 | 98 | | 12.29 | 10.70 | 0 | 42 | 0.90 | 10 |
| Percent patients with chronic pain | 0 | 101 | | 31.35 | 18.52 | 5 | 82 | 0.77 | 12 |
| Urban | 2 | 95 | 94.06% | | | | | | |
| Part of health system | 1 | 93 | 92.08% | | | | | | |
| Non-Academic Setting | 0 | 91 | 90.10% | | | | | | |
| Teaching | | 77 | 76.24% | | | | | | |
| Research | | 12 | 11.88% | | | | | | |
| Accept all insurance | 1 | 92 | 91.09% | | | | | | |
| Commercial | 1 | 95 | 94.06% | | | | | | |
| Medicare | 1 | 95 | 94.06% | | | | | | |
| Medicaid | 1 | 96 | 95.05% | | | | | | |
| None | | 0 | 0% | | | | | | |
| Other | 1 | 4 | 3.96% | | | | | | |
| COVID-19* | | | | | | | | | |
| Strongly disagree | | 5 | 4.95% | | | | | | |
| Somewhat disagree | | 14 | 13.68% | | | | | | |
| Neither agree nor disagree | | 33 | 32.67% | | | | | | |
| Somewhat agree | | 32 | 31.68% | | | | | | |
| Strongly agree | | 17 | 16.83% | | | | | | |
| COVID-19 score | 0 | 101 | | 0.42 | 1.08 | -2 | 2 | -0.31 | 5 |

Sample size: 101;

**“During the COVID-19 pandemic, I have managed patients with chronic pain as well as before the pandemic.”*

¹ The term *Hispanic* refers to people from Spanish-speaking Latin American countries. The term *Latino* refers to people who live in Latin America in countries colonized by Spain or Portugal and is inclusive of non-Spanish speaking countries (e.g. Brazil) (Ramirez, 1993).

Urbanicity was assessed using self-reported clinic zip codes and a 2003 crosswalk from the University of Michigan Population Studies Center which leverages rurality data from the US Department of Agriculture (USDA) to create a Rural Urban continuum (<https://www.psc.isr.umich.edu/dis/data/kb/answer/1102>). Table 4 shows a complete list of Pennsylvania counties represented by participant practice locations. Allegheny County, which includes Pittsburgh and the Pittsburgh metro area, had the most participant practices represented (n=45; 44.55%) and Philadelphia County had the second largest proportion of participant practices (n=23; 22.77%).

Table 4 Urban Rural Counties

| County Name | n (%) |
|-----------------------|------------|
| Urban Counties (n=95) | |
| Allegheny | 45 (44.55) |
| Butler | 2 (1.98) |
| Centre | 2 (1.98) |
| Chester | 1 (0.99) |
| Cumberland | 1 (0.99) |
| Dauphin | 3 (2.97) |
| Delaware | 1 (0.99) |
| Erie | 4 (3.96) |
| Lackawanna | 2 (1.98) |
| Lehigh | 2 (1.98) |
| Lycoming | 5 (4.95) |
| Mercer | 1 (0.99) |
| Perry | 1 (0.99) |
| Philadelphia | 23 (22.77) |
| Washington | 1 (0.99) |
| Westmoreland | 1 (0.99) |
| Rural Counties (n=4) | |
| Bedford | 2 (1.98) |
| Lawrence | 1 (0.99) |
| Venango | 1 (0.99) |
| 2 missing | |

4.2 Preliminary Analyses

Several strategies were used to understand internal consistency, parametric assumptions, and to assess potential bias in the sample before completing Aim 3. The following describes this process and actions taken to address these issues and prepare for primary analyses.

4.2.1 Internal Consistency

The current study used three scales, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge. The following describes preliminary analyses of internal consistency of each scale in the current sample (see Table 5). As described above, each item in the EBPAS Openness subscale is scored from 0 to 4 with higher scores indicating more willingness to try new interventions and total potential scores ranging from 0 to 16. The EBPAS Openness scale had no missingness and strong internal consistency with a standardized alpha of .87.

Internal consistency for the EBPAS Divergence subscale was assessed prior to imputation (see below). Each item within the EBPAS Divergence subscale was scored from 0 to 4 for a total score range from 0 to 16 and was reverse coded with higher scores indicating higher degrees of perceiving research-based interventions as congruent with clinical practice. Five participants did not answer at least one of the EBPAS Divergence questions. Item four or “no perceived use for manualized treatment in clinical practice” had the most item-level missingness with three participants choosing not to respond. *Of note, a total score was not calculated if there was any missingness among the four items, as missing data imputation was handled at the scale level rather than item level.* Internal consistency of the EBPAS Divergence subscale was low with a standardized alpha for .49.

The Chronic Pain Knowledge scale is a novel scale created to assess the degree of knowledge of evidence-based chronic pain management among participants. The scale had three statements which examined 1) patients as experts in their own pain, 2) the use of opioids as a first-line treatment for chronic pain, and 3) cognitive behavioral therapy (CBT) as an evidence-based treatment. Participants were given five response options ranging from strongly agree to strongly disagree in an effort to promote response rates and decrease social desirability bias.

Each item was scored with a one for the strongly agree or somewhat agree response corresponding with the answer supported by current chronic pain management best practices. The Chronic Pain Knowledge scale had possible score range of 0 to 3. Participants scored the highest on item two which solicited agreement with the statement “*Opioids are a first-line therapy for chronic pain*” with 97 (96%) of participants responding correctly. Eighty-seven (86%) of participants provided the correct response to the statement, “*Cognitive Behavioral Therapy (CBT) is an evidence-based treatment for chronic pain.*” Finally, 66 (65%) of participants correctly responded to, “*The treating physician is the most accurate judge of the intensity of the patient’s pain.*” The standardized alpha for the Chronic Pain Knowledge scale is very low at .26.

Table 5 Internal Consistency for Study Scales

| | n | M (SD) | Min | Max | Outliers | Skew | Skew post transform | Average interitem covariance | Alpha if item deleted | Alpha |
|---|-----|-----------------|-----|-----|----------|-------|------------------------|---------------------------------|--------------------------|-------|
| EBPAS Openness | 101 | 8.56 (3.40) | 1 | 16 | 15 | -0.20 | | | | .87 |
| New treatment | 101 | 1.87 (0.95) | 0 | 4 | | 0.04 | | .65 | .85 | |
| New manualized therapy | 101 | 2.09 (1.02) | 0 | 4 | | -0.24 | | .58 | .80 | |
| Willingness | 101 | 2.35 (1.00) | 0 | 4 | | -0.14 | | .56 | .80 | |
| New different | 101 | 2.26 (1.05) | 0 | 4 | | 0.21 | | .69 | .87 | |
| EBPAS Divergence * | 96 | 12.85 (2.12) | 7 | 16 | 12 | -0.63 | | | | .49 |
| Know better than researchers | 100 | 3.17 (0.90) | 1 | 4 | | -0.76 | | .24 | .48 | |
| Research-based tx not useful | 100 | 3.47 (0.85) | 0 | 4 | | -1.87 | | .26 | .51 | |
| Clinical expertise more beneficial than research-based | 99 | 2.90 (0.79) | 1 | 4 | | -0.20 | | .10 | .24 | |
| No use manualized treatment | 98 | 3.36 (0.84) | 0 | 4 | | -1.27 | | .18 | .40 | |
| Chronic Pain Knowledge | 101 | 2.47 (0.69) | 0 | 3 | 9 | -1.12 | -0.59 [^] | | | .26 |
| Pain Intensity | 101 | 0.65 (0.48) | 0 | 1 | | -0.64 | | .07 | .12 | |
| Opioids | 101 | 0.96 (0.20) | 0 | 1 | | -4.72 | | .19 | .32 | |
| CBT | 101 | 0.86 (0.35) | 0 | 1 | | -2.09 | | .07 | .12 | |

*Internal consistency standardized for each measure; * reverse coded*

4.2.2 Parametric Assumptions

All continuous variables were assessed for potential skew of responses. Chronic Pain Knowledge was the only variable with a skew greater than one or less than negative one. To address this violation of assumptions of parametric testing, the variable was transformed using a square transformation with the resulting skew within acceptable levels (skewness = -.59) (see Table 5).

Multiple imputation was employed to address missingness of 5% in the EBPAS Divergence subscale, which was the only scale measure with missingness. The *mvn* command in *Stata* was used to impute using multivariate normal regression. One round of imputation (seed 1234) was completed due to the small number of missingness (n=5) and included covariates with no missingness which included Dissemination Concordance, Dissemination Concordance, percent of patients with chronic pain, COVID-19 score, EBPAS Openness subscale, non-academic clinical setting, and Chronic Pain Knowledge. Using expectation maximization optimization, the minimum log likelihood of -470.61 was observed at iteration eight.

All variables were assessed for outliers. Outliers were defined as values above or below 1.5 standard deviations from the mean. All outliers were visually assessed and were determined to be true values and not data entry or respondent errors. Because these data were not in error, winsorized variables were only used in Aim 3 for parametric tests and not in any descriptive analyses (Aims 1 and 2). All variables with outliers were winsorized by making all values above and below 1.5 standard deviations from the mean equal to 1.5 standard deviation from the mean. Throughout the results section, variables are labeled as winsorized to increase clarity. The variables that were winsorized included, days per week, years of experience, the effect of

COVID-19, percent of chronic pain patients, EBPAS Openness EBPAS Divergence, Chronic Pain Knowledge, Dissemination Concordance, and Implementation Concordance.

4.2.3 Assessment of Bias in Sample

Several tests were undertaken to assess potential bias in the included sample. As previously reported, 21 people met inclusion criteria and agreed to participate but did not complete the entire survey. None of these 21 people completed any participant characteristic questions and it is therefore not possible to tell if there are specific characteristics unique to this group of people.

Of the 14 who were excluded due to the survey development error, there were some significant differences between the included sample and those who were excluded (see Table 6). Of note, excluded participants tended work more days per week in the clinic, have more years of experience, and practice in more rural settings. Additionally, excluded participants had less teaching responsibilities and fewer accepted Medicaid insurance. Finally, on average they had significantly lower levels of Chronic Pain Knowledge.

Table 6 Preliminary Analysis: Included and Excluded Sample

| Variable Name | Included Sample (N=101) M (SD) | Excluded (N=14) M (SD) | Sig. Difference from zero |
|------------------------------------|--------------------------------------|---------------------------|---------------------------------|
| Race (white) | 0.87 (0.34) | 0.93 (0.27) | |
| Gender (Female) | 0.68 (0.47) | 0.43 (0.51) | |
| Profession (Physician) | 0.71 (0.46) | 0.57 (0.51) | |
| Days per week in clinic | 3.36 (1.41) | 4.85 (0.92) | <i>p</i> <.001 |
| Years of experience | 12.29 (10.70) | 21.73 (13.83) | <i>p</i> <.01 |
| Percent patients with chronic pain | 31.35 (18.52) | 25.62 (14.75) | |
| Urban | 0.96 (0.20) | 0.57 (0.29) | <i>p</i> <.001 |
| Part of health system | 0.93 (0.26) | 1 (0) | |
| Non-Academic Setting | 0.90 (0.30) | 1 (0) | |
| Teaching | 0.76 (0.43) | 0.29 (0.47) | <i>p</i> <.001 |
| Research | 0.12 (0.33) | 0 (0) | |
| Accept all insurance | 0.92 (0.27) | 0.79 (0.43) | |
| Commercial | 0.95 (0.22) | 1 (0) | |
| Medicare | 0.95 (0.22) | 0.93 (0.27) | |
| Medicaid | 0.96 (0.20) | 0.79 (0.43) | <i>p</i> <.05 |
| COVID-19 score | 0.42 (1.08) | 0.64 (1.28) | |
| EBPAS Openness | 8.56 (3.40) | 6.93 (3.60) | |
| EBPAS Divergence | 12.85 (2.12) | 12.69 (1.65) | |
| Chronic Pain Knowledge | 2.48 (0.69) | 1.86 (0.53) | <i>p</i> <.01 |

4.3 Aim 1: Identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management.

Aim 1 for the current study was to identify the existing and preferred dissemination and implementation strategies of primary care providers for learning about and using evidence-based chronic pain management. Aim 1 was descriptive and therefore totals and percentages are reported for each dissemination channel and implementation strategy.

Each participant was asked to select all ways in which they currently learn about managing chronic pain and also asked how they would prefer to learn about managing chronic pain in an ideal world. Table 7 lists the provided dissemination channels, along with frequencies and percentages for each response “currently” and “in an ideal world.” Finally, the table shows the percentage point difference between the Current and Ideal, and indicates if the percentage difference is significantly different from zero using *prtest* in *Stata* which assesses the equality of proportions (Acock, 2008). Positive differences indicated participants currently experience this dissemination channel more than they would in an ideal world and negative differences indicated a gap in how they would prefer to learn about chronic pain management but are not experiencing that channel currently.

This approach showed that gaps in dissemination channels of workshops (-23.76, $p<.001$), clinical experts (-16.84, $p<.05$), seminars (-14.85, $p<.05$), and researchers (-11.88, $p<.05$) are most salient as expressed by participants. In contrast, both experience (29.70, $p<.001$) and colleagues (17.82, $p<.01$) were the most overused dissemination channels experienced and reported by this group of Pennsylvania primary care providers.

Table 7 Description of Dissemination Channels

| Category | Current N (%) | Ideal N (%) | Percentage point difference |
|----------------------------|--------------------------|------------------------|--|
| Colleagues | 80 (79.21) | 62 (61.39) | 17.82** |
| Experience | 86 (85.15) | 56 (55.45) | 29.70*** |
| Patients | 46 (45.54) | 39 (38.61) | 6.93 |
| Professional Organizations | 56 (55.45) | 55 (54.46) | 0.99 |
| Researchers | 18 (17.82) | 30 (29.70) | -11.88* |
| Clinical Experts | 49 (48.51) | 66 (65.35) | -16.84* |
| Pharma | 5 (4.95) | 8 (7.92) | -2.97 |
| Peer Reviewed | 56 (55.45) | 62 (61.39) | -5.94 |
| Online Clinical Resources | 77 (76.24) | 68 (67.33) | 8.91 |
| Email Listserv | 4 (3.96) | 8 (7.92) | -3.96 |
| Briefs/Guidelines | 52 (51.49) | 62 (61.39) | -9.9 |
| Conferences | 50 (49.50) | 60 (59.41) | -9.90 |
| Seminars | 51 (50.50) | 66 (65.35) | -14.85* |
| Web CMEs | 49 (48.51) | 52 (51.49) | -2.97 |
| Workshops | 14 (13.86) | 38 (37.62) | -23.76*** |
| Mainstream Media | 7 (6.93) | 1 (0.99) | 5.94* |
| Blogs | 0 (0) | 1 (0.99) | -0.99 |
| Social Media | 6 (5.94) | 5 (4.95) | 0.99 |
| Podcasts | 32 (20.79) | 18 (17.82) | 2.97 |
| Other | 0 (0) | 0 (0) | 0 |
| None | 1 (0.99) | 2 (1.98) | -0.10 |

*Test of equality of proportions; * $p < .05$, ** $p < .01$, *** $p < .001$*

The same approach was used for implementation strategies. Participants were asked about what chronic pain management strategies they use currently and would use in an ideal world. Table 8 shows the frequencies in the number of responses and the corresponding percentages. Table 8 also shows the percentage point difference between the expressed current and ideal implementation strategies with positive numbers indicating participants are currently using the strategies more than in an ideal world and negative numbers indicating a gap in what implementation strategies they would prefer to use. The same test of equality of proportions was taken for each implementation strategy to assess the difference between current and ideal is statistically significantly different from zero.

In contrast with dissemination channels, participants identified many significant gaps in implementation needs for chronic pain management in primary care. The greatest need was expressed as workgroups or “*Develop an interdisciplinary workgroup to address chronic pain*” with a percentage point difference of -64.36 ($p < .001$). Other significant gaps in implementation strategies included targeted support or “*Provide targeted support for clinicians treating chronic pain (e.g., clinical supervision, technical assistance)*” (-44.55, $p < .001$), champion or “*Develop a chronic pain champion in clinic (a local clinic member who is passionate about improving chronic pain management)*” (-43.57, $p < .001$), use data or “*Use data to inform care (e.g., track quality indicators, provide clinical data to providers)*” (-41.58, $p < .001$), and engagement of patients and families or “*Directly engage patients or families in the process of quality improvement around chronic pain management*” (-40.59, $p < .001$). Even with this list, all proposed implementation strategies except consult experts (15.84, $p < .01$) and none (-0.99) had statistically significant gaps identified by participants between their current experience and their ideal experience.

Table 8 Description of Implementation Strategies

| Category | Current n (%) | Ideal n (%) | Percentage point difference |
|------------------------------|--------------------------|------------------------|--|
| Needs Assessment | 37 (36.63) | 77 (76.24) | -39.61*** |
| Targeted Support | 17 (16.83) | 62 (61.39) | -44.55*** |
| Tailor Treatments | 60 (59.41) | 76 (75.25) | -15.84* |
| Champion | 10 (9.90) | 54 (53.47) | -43.57*** |
| Consult Experts | 84 (83.17) | 68 (67.33) | 15.84** |
| Workgroup | 15 (14.85) | 80 (79.21) | -64.36*** |
| Chronic Pain Education | 39 (38.61) | 78 (77.23) | -38.61*** |
| Engage Patients and Families | 23 (22.77) | 64 (63.37) | -40.59*** |
| Change payments | 2 (1.98) | 35 (34.65) | -32.67*** |
| Change medical records | 1 (13.86) | 43 (42.57) | -28.71*** |
| Use data | 18 (17.82) | 60 (59.41) | -41.58*** |
| Mandate Change | 12 (11.88) | 27 (26.73) | -14.85** |
| None | 0 (0) | 1 (0.99) | -0.99 |

*Test of equality of proportions; * p<.05, ** p<.01, ***p<.001*

The goal of Aim 1 was to identify current and existing dissemination channels and implementation strategies of Pennsylvania primary care providers. For each dissemination channel and implementation strategy, frequencies and percentages were shown along with the percentage point difference and test of equality of proportions. These descriptions show the range of current and ideal dissemination channels and implementation strategies reported by participants and indicate multiple gaps in both dissemination channels and implementation strategies about how PCPs receive information about evidence-based chronic pain management and the strategies they prefer to use to put it into practice. For Dissemination Concordance, workshops, clinical experts, seminars, and researchers were identified the largest statistically

significant gaps by participations. Participants identified many Implementation Concordance gaps with the greatest being interdisciplinary workgroups but also included targeted support for clinicians, developing a champion, using data, and engaging with patients and families in quality improvement.

4.4 Aim 2: Compare existing dissemination and implementation strategies for evidence-based chronic pain management with stated preferences of primary care providers.

The goal of Aim 2 was to compare existing dissemination channels with ideal world preferences and current implementation strategies with ideal strategies regarding evidence-based chronic pain management among primary care providers. The two primary hypotheses for this aim are first, that primary care providers will have dissemination concordance that is lower than that anticipated by chance. The second hypothesis is that PCPs would have on average, lower implementation concordance than that expected by chance. These hypotheses are descriptive and therefore measures of variability, totals, and frequencies are reported.

Dissemination and implementation concordance were measured by calculating Cohen's kappa (κ) at an individual level which can range from -1 or perfect disagreement to 1 or perfect agreement (see Methods for full description; see Table 9). Participants were considered to have agreement in one of two ways: 1) active agreement by selecting both a dissemination channel or implementation strategy currently and in ideal world or 2) passive agreement by not selecting both current and ideal world for given dissemination channel or implementation strategy. Cohen's kappa (κ) is not a raw percentage (i.e. the percent agreement), rather kappa (κ) is a coefficient of agreement such that a kappa score equal to that of chance is 0 whereas a percent

agreement due to chance is 50% (Cohen, 1960). The current study reports the kappa coefficient to describe dissemination concordance and implementation concordance.

Using this method, Pennsylvania PCPs in this study had an average dissemination concordance of $\kappa = 0.45$ (SD=0.33) which is considered moderate agreement (Landis & Koch, 1977; Ranganathan et al., 2017). The 95% confidence interval of dissemination concordance for the sample was .38 to .52. This indicates that at the sample level, the average degree of concordance was greater than that expected by chance. Participants had on average an implementation concordance of 0.18 (SD=0.26) which is considered slight agreement (Landis & Koch, 1977; Ranganathan et al., 2017) (See Table 9). The 95% confidence interval of implementation concordance across the sample was .13 to .23, indicating that on average the degree of concordance was greater than that expected by chance. These findings lead us to reject both hypotheses for Aim 2 as participants had higher levels of concordance than that expected by chance.

Table 9 Description of Dissemination and Implementation Concordance

| | n | M (SD) | Min | Max | 95% CI | Skew | Outliers |
|----------------------------|----------|-------------------|------------|------------|---------------|-------------|-----------------|
| Dissemination Concordance | 101 | 0.45 (0.33) | -0.5 | 1 | .38-.52 | -0.60 | 10 |
| Implementation Concordance | 101 | 0.18 (0.26) | -0.41 | 1 | .13-.23 | 0.60 | 14 |

Categorical and graphical representations of these data help to further explore the spread of dissemination concordance and implementation concordance. Table 10 shows the categorical interpretation of dissemination concordance results for the current study. This shows that most participants had fair agreement or higher. This is further represented in Figure 7 which shows the

spread of dissemination concordance in a scatter plot. This again demonstrates that, overall, participants had moderate to high levels of dissemination concordance which leads us to reject hypothesis 2.1.

Table 10 Categorical Dissemination Concordance

| Cohen's kappa (κ) | Categorical Interpretation | Dissemination Concordance n (%) |
|-------------------------------|----------------------------|------------------------------------|
| -1 | Perfect disagreement | |
| -.81- .99 | Near perfect disagreement | |
| -.61- .80 | Substantial disagreement | |
| -.41-.60 | Moderate disagreement | 2 (1.98) |
| -.21-.40 | Fair disagreement | 3 (2.97) |
| -.10-.20 | Slight disagreement | 2 (1.98) |
| -.09-.09 | No different from chance | 5 (4.95) |
| .10-.20 | Slight agreement | 10 (9.90) |
| .21-.40 | Fair agreement | 20 (19.80) |
| .41-.60 | Moderate agreement | 24 (23.76) |
| .61-.80 | Substantial agreement | 19 (18.81) |
| .81-.99 | Near perfect agreement | 14 (13.86) |
| 1 | Perfect agreement | 2 (1.98) |

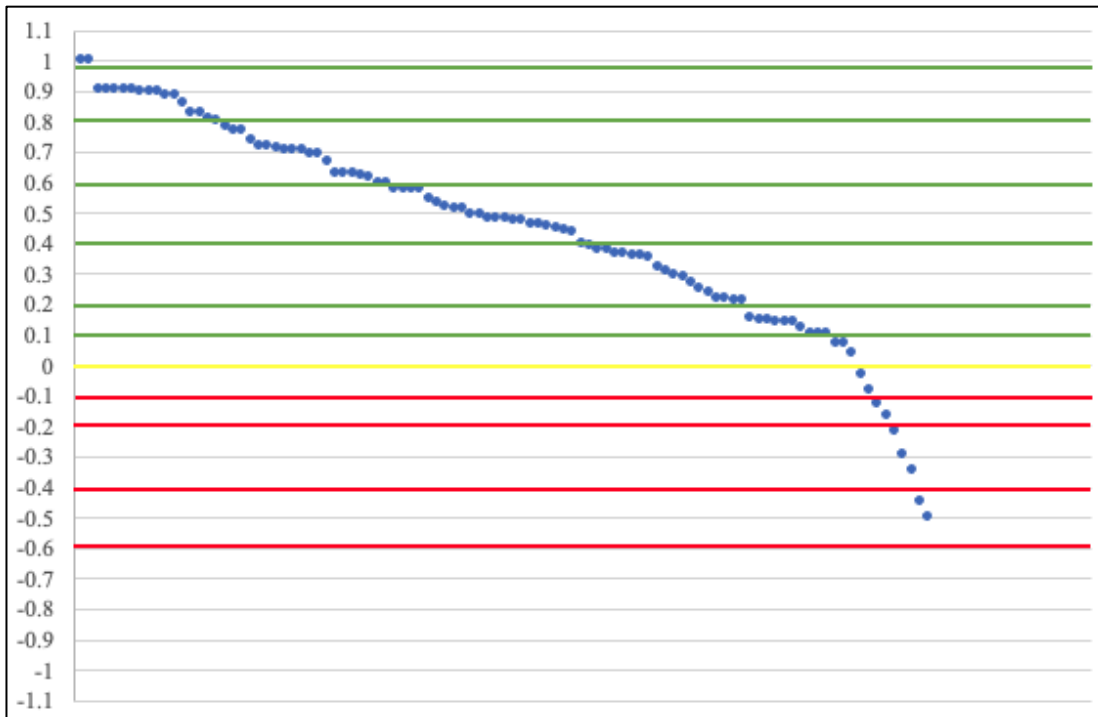


Figure 7 Dissemination Concordance

Implementation concordance was calculated at the individual level (i.e., Cohen’s kappa for within person). For implementation concordance, participants had relatively lower levels of concordance when compared with dissemination concordance but, overall, still had on average higher concordance than would be expected by chance or a kappa equal or close to zero. Table 10 displays the categorical interpretation of implementation concordance for this sample of Pennsylvania PCPs which shows the highest concentrations of agreement at the levels of no different from chance, slight agreement, and fair agreement. Figure 8 shows this using a scatter plot of participant kappa scores. Compared to the dissemination concordance score, the implementation concordance score is flatter with more participants experiencing lower levels of implementation concordance.

Table 11 Categorical Implementation Concordance

| Cohen's kappa (κ) | Categorical Interpretation | Implementation Concordance n (%) |
|-------------------------------|----------------------------|--|
| -1 | Perfect disagreement | |
| -.81- .99 | Near perfect disagreement | |
| -.61- .80 | Substantial disagreement | |
| -.41- .60 | Moderate disagreement | |
| -.21- .40 | Fair disagreement | 6 (5.94) |
| -.10- .20 | Slight disagreement | 8 (7.92) |
| -.09-.09 | No different from chance | 24 (23.76) |
| .10-.20 | Slight agreement | 23 (22.77) |
| .21-.40 | Fair agreement | 25 (24.75) |
| .41-.60 | Moderate agreement | 9 (8.91) |
| .61-.80 | Substantial agreement | 3 (2.97) |
| .81-.99 | Near perfect agreement | 1 (0.99) |
| 1 | Perfect agreement | 2 (1.98) |



Figure 8 Implementation Concordance

Aim 2 compared existing dissemination channels and implementation strategies with ideal or preferred dissemination channels and implementation strategies for each participant. This aim used analyses of variability, frequencies, and totals to test *Hypotheses 2.1* and *2.2* which predicted the average dissemination concordance score and average implementation concordance score to be lower than that anticipated by chance. The current findings result in rejecting *Hypotheses 2.1* and *2.2* which show higher average dissemination and implementation concordance scores than those anticipated by chance. The rejection of *Hypothesis 2.1* and *2.2* is further supported by examining the spread of Dissemination Concordance and Implementation Concordance in categorical tables as well as scatter plots. The scatter plots demonstrate different shapes to the curve of Dissemination Concordance and Implementation Concordance. However,

both Figure 7 and Figure 8 visually show that most participants had congruence (kappa) scores higher than would be expected by chance.

4.5 Aim 3: Explore the effect of professional characteristics and clinic context on the concordance of dissemination/implementation strategies and preferences for chronic pain management in primary care providers.

The goal of Aim 3 was to understand the effect that professional characteristics and clinic context may have on dissemination concordance and implementation concordance. There were four hypotheses for this aim. The first two hypotheses predicted that primary care providers in academic settings would have significantly higher levels of both dissemination concordance and implementation concordance. The second two hypotheses predicted that primary care providers in urban settings would have higher levels of dissemination concordance and implementation concordance than PCPs in rural settings.

To address the larger aim, the correlation for each independent variable including urbanicity, academic affiliation, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge along with covariates were assessed with the two dependent variables, Dissemination Concordance and Implementation Concordance using pairwise correlation (*pwcorr* in *Stata*) in order to preserve cases with some missing data (See Table 12). For Dissemination Concordance, the EBPAS Openness subscale was the only independent variable that had a statistically significant correlation. EBPAS Openness had weak positive correlation with dissemination concordance (.21, $p < .05$). Independent variables with significant bivariate correlations with Dissemination Concordance included self-identifying as female which had weak negative

correlation with dissemination concordance ($-.30, p<.05$), being a physician ($.21, p<.01$) and the number of days per week in the clinic ($-0.25, p<.05$).

For implementation concordance, no independent variables had statistically significant correlation. However, three covariates were statistically significantly correlated with Implementation Concordance including self-identifying as female ($-.21, p<.05$), the number of days per week in the clinic ($-0.28, p<.05$) which had a weak negative correlation with the outcome, and the number of years of experience had a moderate positive correlation with implementation concordance ($0.39, p<.001$).

Table 12 Bivariate Correlation with Dissemination and Implementation Concordance

| | Dissemination Concordance ⁺ | Implementation Concordance ⁺ |
|--------------------------------------|--|---|
| Covariates | | |
| Race (White) | .01 | .11 |
| Gender (Female) | -.30* | -.21* |
| Profession (Physician) | .21** | .15 |
| Days per week in clinic ⁺ | -.25* | -.28* |
| Years of experience ⁺ | .15 | .39*** |
| Chronic Pain Patients ⁺ | -.08 | -.10 |
| Health system | .04 | -.06 |
| Accept all insurance | -.00 | .03 |
| COVID-19 ⁺ | -.04 | .12 |
| Independent Variables | | |
| Urban | -.00 | .12 |
| Non-Academic Setting | -.05 | -.19 |
| EBPAS Openness ⁺ | .21* | -.03 |
| EBPAS Divergence ^{^+} | .11 | .14 |
| Chronic Pain Knowledge ⁺ | .05 | .03 |

* $p<0.05$, ** $p<0.01$, $p<0.001$, ^ imputed + Winsorized

Covariates with statistically significant bivariate correlations were included in the final multiple linear regression model. Additionally, all the independent variables of urbanicity, academic setting, EBPAS Openness subscale, EBPAS Divergence subscale, and Chronic Pain

Knowledge scale were included in the final model as they reflect theoretical constructs expected to be related to dissemination and implementation concordance (as previously described). Table 13 displays the results of the corresponding regression models. The multiple linear regression model shows that raw dissemination concordance (Kappa) is significantly lower for self-identified female PCPs than for males by .15 ($\beta=-.24$, $p<.05$), when controlling for being a physician and days per week in the clinic, urbanicity, academic setting, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge. No other covariates are statistically significant in this model. For implementation concordance, multiple linear regression results indicated that for every year increase in experience, implementation concordance had a raw increase in the Cohen's κ coefficient by .01 ($\beta=.34$, $p<.01$) when controlled for self-identifying as female, days per week in the clinic, urbanicity, academic setting EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge. No other covariates reached statistical significance.

Table 13 Multiple Linear Regression Results

| | Dissemination Concordance ⁺ | Implementation Concordance ⁺ |
|--------------------------------------|--|---|
| | B (SE) [β] | B (SE) [β] |
| Gender (Female) | -.15 (.07)* [-.24] | -.01 (.05) [-.01] |
| Profession (Physician) | .06 (.07) [.09] | |
| Days per week in clinic ⁺ | -.04 (.03) [-.19] | -.04 (.02) [-.21] |
| Years of experience ⁺ | | .01 (.00)** [.34] |
| Urban | -.20 (.15) [-.14] | .06 (.11) [.05] |
| Non-Academic Setting | .09 (.11) [.09] | -.01 (.08) [.02] |
| EBPAS Openness ⁺ | .02 (.01) [.17] | -.00 (.01) [-.07] |
| EBPAS Divergence ⁺ | .01 (.02) [.03] | .01 (.01) [.10] |
| Chronic Pain Knowledge ⁺ | .00 (.01) [.03] | .01 (.01) [.11] |
| <i>n</i> | 93 | 90 |
| <i>F</i> -Statistic | 2.11* | 3.24** |
| <i>R</i> ² | .17 | .24 |

* $p<.05$ ** $p<.01$ *** $p<.001$ ^ imputed + Winsorized

Next, each hypothesis was tested using independent *t*-tests. *Hypothesis 3.1* and *3.2* examining differences between PCPs in academic and non-academic settings were tested using independent *t*-tests for both dissemination concordance and implementation concordance (see Table 14). For dissemination concordance, there was a small difference in the mean dissemination concordance score with PCPs in academic settings having higher dissemination concordance than PCPs in non-academic settings. However, this difference was not statistically significant ($d=.16, p=.32$). The raw concordance (Kappa) difference between PCPs in academic settings and PCPs in non-academic settings was .14 for implementation concordance which approaches significance ($d=.52, p=.06$). It is therefore appropriate to reject *Hypothesis 3.1* and *Hypothesis 3.2*.

Table 14 Differences between PCPs in Academic and Non-Academic Settings

| | N | Non-Academic M (SD) | Academic M (SD) | <i>d</i> | Std Error | t value | p value |
|-------------------------------|-----|------------------------|--------------------|----------|-----------|---------|---------|
| Dissemination Concordance | 101 | .44 (.33) | .49 (.38) | .16 | .11 | 0.48 | .32 |
| Implementation Concordance | 101 | .16 (.27) | .30 (.14) | .52 | .09 | 1.57 | .06 |

Hypothesis 3.3 and *Hypothesis 3.4* both examine differences for PCPs in urban settings and PCPs in rural settings (see Table 15). Again, independent *t*-tests were used to assess the differences in means between these two groups for both dissemination concordance and implementation concordance (see Table 14). There was a slight non-significant difference in average dissemination concordance between PCPs in urban settings and those in rural settings ($d=0.07, p=0.45$). PCPs in urban settings had higher levels of implementation concordance

(0.18) on average than PCPs in rural settings (0.04). However, this difference (-0.14) approached but did not reach statistical significance ($d=-0.54, p=0.15$).

Table 15 Differences between PCPs in Urban and Rural Settings

| | N | Urban M (SD) | Rural M (SD) | <i>d</i> | Std Error | t value | p value |
|-------------------------------|----|-----------------|-----------------|----------|-----------|---------|---------|
| Dissemination Concordance | 99 | .45 (0.34) | .47 (.19) | .07 | .17 | 0.13 | .45 |
| Implementation Concordance | 99 | .18 (0.26) | .04 (.14) | .54 | .13 | -1.05 | .15 |

Aim 3 used multiple linear regression to understand the potential moderating relationship of independent variables on Dissemination Concordance and Implementation Concordance. Based on theory and previous research, it was predicted that urbanicity, academic setting, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge would affect the concordance relationship. At the bivariate correlation level, self-identifying as female, days per week in the clinic, and EBPAS Openness were the only covariates and independent variables, respectively, that had a significant relationship with Dissemination Concordance. For Implementation Concordance, only the covariates of days per week in the clinic and years of experience had statistically significant correlations.

The multiple regression results of Aim 3 show the small negative influence of gender on Dissemination Concordance and positive effect of years of experience on Implementation Concordance. This is surprising given the relatively similar strength at the bivariate correlation-level of days per week in the clinic with both Dissemination Concordance and Implementation Concordance. No predicted independent variables had a statistically significant relationship with either Dissemination Concordance or Implementation Concordance.

Independent *t*-tests were used to assess the four Aim 3 hypotheses. These analyses show that while there are raw mean differences in Dissemination Concordance between PCPs in

academic settings and those in non-academic settings, this difference is not statistically significant. This leads us to reject *Hypothesis 3.1*. For Implementation Concordance, there is a larger raw mean difference in Kappa score that does approach statistical significance ($p=.06$). Therefore, *Hypothesis 3.2* is also rejected.

Independent *t*-tests were also used to assess *Hypothesis 3.3* and *Hypothesis 3.4* which sought to understand differences in Dissemination Concordance and Implementation Concordance between PCPs who practice in rural and urban settings. For PCPs who practice in rural settings, there was a small raw difference in Dissemination Concordance, but this difference was not statistically significant. There was a larger raw difference between PCPs who practice in urban settings and those who practice in rural settings regarding Implementation Concordance. While this difference approach statistical significance with higher raw levels of Concordance for PCPS in urban settings, the difference was not statistically significant. This again leads us to reject both *Hypotheses 3.3*, and *3.4* predicted that PCPs who practice in urban settings would have significantly higher levels of Dissemination Concordance and Implementation Concordance than PCPs who practice in rural settings.

5.0 Discussion

5.1 Summary of Findings

The overarching goal of this dissertation study was to move the field of implementation science forward by employing a novel approach to quantify the potential gap between preferences and lived experiences of primary care providers for learning about and using strategies to manage chronic pain. More specifically, the purpose of this specific study was to learn more about the existing and preferred dissemination channels and implementation strategies of Pennsylvania primary care providers in the evidence-based management of chronic pain. This goal was accomplished by first describing current and preferred dissemination channels and implementation strategies, then second by assessing the degree of concordance between current and preferred dissemination channels and implementation strategies, and third by examining the roles of potential modifiers in the dissemination concordance and implementation concordance relationship.

The study included 101 participants for the final analysis. Participants were mostly white (85.15%), female (66.34%), and medical doctors (62.38%). Participants spent on average 3.36 days per week in the clinic and had about 12 years of clinical experience post-training. On average about 31% of participants' patients live with chronic pain. Most participants practice in urban settings (94.06%), are part of a larger health system (92.08%), work in a non-academic setting (90.10%), and accept all insurances (91.09%). About half of participants thought they could manage the chronic pain during the COVID-19 pandemic as well as before the pandemic (48.51%).

The descriptive results from Aim 1 of this study show that there are many significant gaps between current and preferred dissemination channels and implementation strategies and highlighted the magnitude of those gaps. The current study asked for participants to identify currently used dissemination channels for learning about evidence-based chronic pain management and what dissemination channels they would prefer in an ideal world. The greatest gaps between the current experience and an ideal scenario include the dissemination channels of workshops, clinical experts, seminars, and researchers.

Future dissemination research should use this methodology to quantify and benchmark dissemination channels. For example, this approach can help dissemination scholars to first prioritize and target channels for interventions. This approach essentially provides a to-do list of sorts for the expressed needs of a group of providers (or patients or consumers). Further, this methodological approach can be then used for benchmarking to measure ongoing success—i.e. did the given intervention reduce gaps in dissemination channels.

For the specific case of chronic pain management in primary care, these identified channels act as the foundation for improving dissemination of evidence-based chronic pain management among primary care providers. For example, content experts could develop treatment-specific workshops or lectures in an on-demand format to allow PCPs to receive information a specific evidence-based treatment that may work for their patients. These workshops should be tailored to the local context and provide insights about how to leverage existing community resources to meet the needs of people living with chronic pain. The identified gaps align with existing knowledge about ongoing success of Project ECHO (described previously) which uses a tele-education model to connect primary care providers with content experts (Zhou et al., 2016). A final example could include developing strategies to

incentive researchers to target their own dissemination strategies to better meet the needs of PCPs.

Participants identified many more gaps between Current and Ideal implementation strategies as ways to manage chronic pain with their patients. The greatest needs were in the areas of workgroups or *“Develop an interdisciplinary workgroup to address chronic pain,”* targeted support or *“Provide targeted support for clinicians treating chronic pain (e.g., clinical supervision, technical assistance),”* champion or *“Develop a chronic pain champion in clinic (a local clinic member who is passionate about improving chronic pain management),”* use data or *“Use data to inform care (e.g., track quality indicators, provide clinical data to providers),”* and engagement of patients and families or *“Directly engage patients or families in the process of quality improvement around chronic pain management.”*

The descriptive gaps give future implementation researchers targeted approaches to improve the implementation of evidence-based chronic pain management in primary care. Implementation scientists can apply this methodological approach in many clinical settings, especially where the evidence-practice gap is widely acknowledged. By testing the equality of proportions across a sample, this approach recognizes that there are often factors which are difficult (or impossible) to measure and instead quantifies the magnitude and significance of implementation strategy gaps.

Future chronic pain research should examine systemic factors to incentive the development of an interdisciplinary workgroup to support chronic pain management in primary care clinics as this was the strategy with the largest implementation gap in this sample. A chronic pain workgroup could also support the implementation of several other highlighted strategies including providing support for clinicians and developing a champion. For the use of data, future

research should examine developing chronic pain dashboards for both PCPs as well as patients to empower patients to engage in their own chronic pain management. For implementation scientists, the research of these strategies should go beyond effectiveness and efficacy and should also include an examination of what factors supported the implementation of evidence-based chronic pain management strategies. This confirms and builds on existing work in implementation research in chronic pain which has often leveraged facilitation and system consultation (Jacobson et al., 2019; Quanbeck et al., 2018) as implementation strategies for working to improve implementation of evidence-based chronic pain management.

Importantly, PCPs in the current study acknowledged the important role of engaging patients and family in improving chronic pain management. This identified gap in implementation strategies must be a key aspect of future research and clinical care as the benefits of including patients and families in care and quality improvement efforts are well known (Baker et al., 2016; Cené et al., 2016). See below for additional discussion on the engagement of patients and families.

The second aim of the current study was to compare current dissemination channels and preferred dissemination channels and current implementation strategies with preferred implementation strategies within each individual in order to create concordance scores for both dissemination and implementation. The current study hypothesized that both dissemination concordance and implementation concordance would be, on average, lower than concordance by chance. However, both dissemination concordance and implementation concordance had on average higher levels of concordance than that expected by chance (Cohen's $\kappa = .45$ and $.18$, respectively).

This finding is slightly surprising in the context of chronic pain in that there is little existing evidence to suggest that primary care providers are receiving information about chronic pain management (dissemination) or using it (implementation) in a way that aligns with their preferences (Slade et al., 2016). Further, it may be expected that with the known challenges in getting research into practice (Morris et al., 2011) concordance levels would be lower for a traditionally hard to reach sample, in this case primary care providers. Future research should replicate this approach to confirm this phenomenon in larger and more diverse sample (see Limitations). That said, this replication should not act as a barrier to using these findings to improve the dissemination or implementation of evidence-based chronic pain management in primary care settings.

This dissertation is the first known study to quantify dissemination and implementation gaps not only across channel or strategy (Aim 1), but also within person (Aim 2). In the same way as methodological advances allowed for sample-level gaps in dissemination channel and implementation strategy in Aim 1, Aim 2 explored the degree of agreement within participant, in this case primary care providers in using Cohen's Kappa. This methodological advance provides an example for strategies to identify which characteristics may contribute to increases in agreement between experience and preferred dissemination channels and implementation strategies. This again allows for quantifying gaps in dissemination channels and implementation strategies in a way that gives overarching perspective on what providers (or other populations) may be experiencing.

The purpose of Aim 3 of this study was to understand the effect of potential professional or clinic context characteristics may influence dissemination concordance and implementation concordance, specifically examining the role of urbanicity, academic setting, EBPAS Openness,

EBPAS Divergence, and Chronic Pain Knowledge. Aim 3 employed multiple linear regression to understand what factors may affect the dissemination concordance relationship and the implementation concordance relationship. For dissemination concordance, only self-identifying as female was statistically significantly related to dissemination concordance and resulted in having, on average, a .15 decrease in dissemination concordance (or Kappa) than for participants who self-identified as male after controlling for days per week worked in the clinic, urbanicity, academic setting, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge.

For implementation concordance, only the number of years of experience had a statistically significant relationship such that with every year increase in experience there was a .01 point increase in Implementation Concordance (or Kappa) after controlling for days per week in the clinic, urbanicity, academic setting, EBPAS Openness, EBPAS Divergence, and Chronic Pain Knowledge.

The multiple linear regression findings provide some insights into what moderate the degree of agreement for PCPs for both dissemination and implementation of evidence-based chronic pain management. Future research should seek to better understand what factors self-identified women experience that may make their dissemination experience less concordance than that of self-identified male PCPs. An -.19 average decrease in Cohen's Kappa (κ) is not insignificant in practice ($\beta=-.26$). Further investigation into this relationship may lead to future tailoring for dissemination interventions to improve the experience of female PCPs.

Further, additional implementation science should seek to understand what factors contribute to increases in Implementation Concordance for PCPs with more years of experience. This may indicate the PCPs with more experience have more understanding of systems and are able to navigate chronic pain management treatment systems in a more satisfactory way.

Based on theory and previous literature, the current study hypothesized that PCPs in academic settings would have statistically significantly higher levels of dissemination concordance and implementation concordance and that PCPS in urban settings would also have statistically significantly higher levels of dissemination concordance and implementation concordance. While the results did not find any statistically significant difference between PCPs in academic and non-academic settings and PCPs in rural or urban settings, the results are trending in the direction predicted and supported by the theory and the previous literature.

Future work should seek to further explore this relationship by seeking to recruit a more well-balanced sample of PCPs in academic and non-academic settings (as this sample was predominately in non-academic settings). There may be factors in academic versus non-academic settings which support dissemination congruence, but especially implementation congruence. Further, defining an “academic setting” is challenging in that many large academic centers have centralized robust research activities but not all clinicians within the system may benefit from those additional resources. Future work may explore a more nuanced perspective on academic setting which may describe levels of academic settings and incorporate rigorous quality improvement efforts which may be of benefit to PCPs in a similar way as formalized research activities.

Regarding urbanicity (i.e. the degree of rural or urban of the clinic), again the direction of the average dissemination concordance and implementation concordance was trending in the predicted direction; however, it did not reach statistical significance. Future research should begin to further explore the potential effect of the clinic’s geographic location on the ability of PCPs to receive and implement evidence-based chronic pain management in the way that works best for their patients. To do this, scholars may need to build additional relationships with more

rural-based PCPs. Additional next steps may also build on existing work which seeks to bridge the rural-urban divide by providing interventions supplemented by technology (e.g. tele-education such as Project ECHO previously discussed).

While not significant at the bivariate level, future research should explore the role of provider types in dissemination concordance and implementation concordance as various types of providers (i.e. MD, DO, NP, PA-C) may experience differences in how they prefer to receive information about chronic pain management and what strategies they prefer to use to implement chronic pain management with their patients. Further, there may be within group differences among NPs and PA-Cs which may result in better targeting and tailoring of dissemination channels and implementation strategies.

5.2 Limitations

The current study has several limitations. First, these data were collected using non-probability, snowball sampling which relied on the willingness of individuals, groups, and organizations to disseminate information about the study survey. This resulted in a disproportionate sample of participants practiced in Allegheny County (44.55%) which over-represents the experiences of PCPs in Southwestern Pennsylvania and does not represent the overall distribution of primary care providers in Pennsylvania. Therefore, future research should seek to understand the current experiences and preferences of PCPs from a more geographically diverse region.

Additionally, survey respondents may have unique characteristics from the overall population of Pennsylvania PCPs. Future research should work to identify opportunities for

probability sampling of primary care providers in order to gain a representative understanding of dissemination concordance and implementation concordance of evidence-based chronic pain management.

The first limitation is closely connected with the second limitation of this study which is the small sample size. As this study employed a snowball, convenience sample of Pennsylvania PCPs and with the small number of respondents, the results of this study should not be considered generalizable to all Pennsylvania PCPs or PCPs in general. The COVID-19 pandemic may have also influenced the response rate as several organizations declined participation due to PCPs feeling overwhelmed by COVID-related research recruitment and increased clinical responsibilities. Future research should identify strategies to increase sample size by developing additional relationships with individuals and organizations for dissemination of additional research.

As noted, a survey development error resulted in the exclusion of 14 participants. Unfortunately, there were unique characteristics of this group of 14 that may have changed the overall results of the study. For example, this group, on average, worked significantly more days per week in the clinic and had significantly more years of experience than the included sample. Further, the excluded group practiced in significantly more rural areas and conducted significantly less teaching. Additionally, this group accepted significantly less Medicaid and had significantly lower levels of Chronic Pain Knowledge. While predictions may be made, it would be irresponsible to attempt to predict how the dissemination concordance and implementation concordance results of the excluded group may have affected the study results. Future research should make more diligent efforts to pilot test survey instruments with as diverse a group as possible prior to survey deployment in order to avoid survey development errors.

Another limitation of this study is that most respondents self-identify as white. While significant efforts were made to recruit non-white PCPs, only 11% of respondents self-identified as non-white. Some of these efforts included collaboration with organizations who work non-white PCPs, such as the National Hispanic Medical Association and the National Society of Black Physician Assistants. Future work should use additional strategies to learn from the experiences of primary care providers who identify as Black, Latinx, and other people of color. These efforts will allow for a more holistic understanding of how to best target dissemination efforts and implementation strategies. Future research should also work to recruit a more diverse sample of participants across the domains of profession (MD, DO, NP, PA-C), urbanicity, health system status, academic setting, and accepted insurances.

The low reliability of some of the moderator variables was another limitation to the current study. The EBPAS Divergence subscale and the Chronic Pain Knowledge measure both had unacceptable levels of internal consistency (Chronbach's alpha= .49 and .26 respectively). In other populations, the EBPAS Divergence subscale often has higher levels of reliability; however, in this sample that was not the case. The novel Chronic Pain Knowledge measure requires additional testing to gain a better understanding of how this may function in other populations. Future research should conduct additional analysis in similar samples of PCPs to learn more about the validity and reliability of these two measures.

Finally, surveys as a method for data collection are limited in their ability to collect highly detailed or nuanced information about each participant. Qualitative research is more suited to understanding additional factors not included in the survey. As such, there may have been some data lost during the data collection process as participants may not have seen or found a response that best aligned with their experience. The results of this study are descriptive and

more research is needed to build and understand what factors may influence dissemination concordance and implementation concordance among primary care providers.

5.3 Implications for Social Work

Social work practitioners and scholars are well-positioned to address the dissemination and implementation gaps in evidence-based chronic pain management as identified by the results of this study. The following describes first, the role of social work practitioners and then the role for social work scholars.

5.3.1 Role for Primary Care Social Workers

Social workers who work in primary care settings provide an invaluable contribution to interdisciplinary care teams, especially in primary care settings (Lombardi et al., 2019). It is therefore imperative that primary care social workers continue to use their skills and expertise in the care of people with chronic pain. The results of this study provide another step for primary care-based social workers to target their efforts.

The results from Aim 1 of this study provide specific approaches for primary care social workers to support the efforts of PCPs. For example, when it comes to the dissemination of evidence-based chronic pain management, primary care social workers can provide use foundational resource identification and acquisition skills to identify workshops and colleagues who may be able to provide additional information about evidence-based chronic pain management.

Specifically, when it comes to CBT and other evidence-based behavioral treatments for chronic pain management, primary care social workers who are also licensed clinical social workers (LCSWs) can provide clinic-based treatments for patients living with chronic pain. Primary care based LCSWs are well-suited to provide holistic support to patients living with chronic pain and can therefore be a resource to primary care providers who often lead the management of chronic pain. This approach aligns well with previous research in which PCPs used clinic-based chronic pain groups and therapy as a strategy to overcome barriers to treating chronic pain with their patients (Ashcraft et al., *in preparation*).

When it comes to the implementation of evidence-based chronic pain management in primary care settings, primary care social workers are ideally situated to work alongside both PCPs and patients to manage chronic pain. Much of social work is based in ecological theory and person-in-environment perspectives (Meyer & W, 1988; Wakefield, 1996) which is invaluable when incorporating the results of this study.

Identified implementation gaps as identified by participants, highlight the need to develop interdisciplinary workgroups to address the management of chronic pain. As previously stated, social workers are well equipped to make significant contributions to these groups, if employed. A recent scoping review supports primary care social workers' ability to conduct this work in demonstrating that primary care social workers are already providing referral services for transportation, education, housing, and career supports for patients experiencing chronic pain and other chronic conditions (King et al., 2021).

The current study identifies another gap that is well-suited to the skills of primary care social workers—the expressed need by participants to engage with patients and families in the quality improvement of chronic pain management services. Social work, broadly, understands

the critical role that the social support from family (loosely defined) can provide. Therefore, primary care social workers should come alongside primary care providers to together engage with patients and their families with the goal of improving the quality of chronic pain management.

The results from the current study have several ways for primary care social workers to contribute to the improved evidence-based management of chronic pain. Primary care social work practitioners should also help to address some of the identified gaps in the dissemination and implementation of evidence-based chronic pain management. Social workers are well-equipped and positioned to address dissemination by leveraging resource identification and acquisition skills and clinical skills (LCSWs) to address gaps in knowledge and also support the management of chronic pain.

Primary care social workers can also contribute to interdisciplinary workgroups in primary care settings to support the evidence-based management of primary care settings and lead the patient and family engagement in quality improvement efforts. These significant gaps in chronic pain management in primary care align with skills and expertise already existing within primary care social workers.

5.3.2 Role for Social Work Scholars

Social work researchers, specifically social work implementation scientists, should leverage the results of this study to promote holistic and person-centered scholarship. Specifically, social work implementation scientists should focus their efforts on the implementation of CBT to manage chronic pain within the results of this study, investigate and

test how to best engage with patients and families, and employ systems strategies to address dissemination needs.

While not the specific focus of the current study, primary care social workers are well-equipped to provide behavioral interventions in primary care settings (Lombardi et al., 2019). However, there are ongoing implementation barriers to utilizing evidence-based chronic pain management in primary care settings as demonstrated by the results of the current study. Therefore, social work scholars should examine what implementation strategies would best support this intersection of need.

For example, one implementation gap identified by participants is the need for targeted support for clinicians which may look like clinical supervision or technical assistance. Social work implementation scientists should investigate the structure that would best meet this goal. Scholars, especially those with clinical expertise, may be able to develop novel implementation strategies to meet the needs of people living with chronic pain and providers, which may also intersect with the roles of primary care social workers.

As defined by the ERIC strategies, clinical supervision gives ongoing support for clinicians specifically targeted for the innovation (e.g. CBT or peer support) (Powell et al., 2015). Technical assistance is similar but is often provided on an as needed basis, such as a phone line or website (Powell et al., 2015). Corresponding findings from the current study show a dissemination gap by clinical experts and researchers. This may indicate that primary care providers (or at least some in the current sample) want to hear from chronic pain experts about evidence-based management strategies. For implementation science, this readiness for change (see Rogers' Innovation-Decision Process and CFIR Characteristics of Individual) may be the catalyst to successful implementation of an innovation. Social Work implementation scientists

should work alongside PCPs to solicit honest thoughts on readiness for change and gauge what implementation strategy is best suited for that particular provider—ongoing support or as-needed assistance.

One important finding from the current study is the identified gap of engaging with patients and families in efforts to improve chronic pain management. Social workers and social work scholarship has a long history of engaging with and supporting individuals and families (Early & GlenMaye, 2000). *Of note:* these efforts should not ignore the harm caused by the field of social work, specifically when it comes to racist and anti-Black practice, as is still seen today in the child welfare system (Hill, 2004; Merritt, 2021)

Social work implementation scientists should leverage the intersection of implementation science with the strong history of social work to best work alongside people living with chronic pain and their families to improve chronic pain management in primary care settings. For example, social work scholars may work alongside patients and families to develop patient-centered implementation strategies to improve access to evidence-based chronic pain management such as peer supports or building a chronic pain coalition of evidence-based chronic pain management providers alongside primary care providers, and people who live with chronic pain.

This work is critical and builds on the current project by using identified gaps and currently successful dissemination strategies, such as professional organizations. The goals of future research should be to further explore what strategies work best is spreading information about evidence-based chronic pain management. Additional goals should focus on the implementation of evidence-based chronic pain management. Social work implementation

scientists may use the results of this study along with the expressed needs of primary care providers and people living with chronic pain to determine what strategies to use first.

A final proposed target for social work implementation scientists is to use the ecological and systems perspective to address the expressed dissemination need. The current study is the first known study of its kind to quantitatively assess current practice with expressed preferences. However, the results of this study only examine the surface of needed knowledge to improve dissemination practices. Social work scholars may be uniquely skilled and situated to provide additional and implementation interventions in this area.

Social work has a long history as an allied health professional (Cannon, 1913). This, in conjunction with the systems and ecological perspective (often used in social work [(Meyer & W, 1988; Wakefield, 1996)]) may provide additional benefit, specifically in implementation science scholarship. Social work implementation scientists could leverage their existing knowledge of the healthcare and social service systems alongside critical insights into human behavior to work to address the reported dissemination need from study participants.

For social workers, this may mean finding ways to develop or replicate existing workshops or seminars for free or low costs for primary care providers to attend. Social workers have training in leveraging existing resources from a variety of sources and should use this knowledge to tailor dissemination opportunities to the needs of primary care providers.

Both social work practitioners in primary care settings and social work scholars have an important role taking the findings of the current research to the next step. Primary care social workers have the first-hand knowledge of the experiences of primary care providers who often struggle to manage chronic pain with their patients. These social work practitioners should leverage their clinical expertise to support PCPs in connecting people living with chronic pain

with existing resources. When applicable, primary care social workers should also seek to provide additional behavioral supports for people living with chronic pain. These services should always be provided with cultural humility and recognize that all patients with chronic pain are experts in their own pain experience.

Social work implementation scientists also have an important role in moving the current research forward. This includes investigating implementation strategies to support behavioral chronic pain management within the primary care settings. Additionally, social work scholars should lead culturally humble engagement of people living with chronic pain and their families in efforts to improve the quality of existing chronic pain management. Investigation into these implementation strategies should take an anti-racist lens and ensure a person-centered approach.

Scholars should also use a systems perspective to address dissemination gaps as identified by the current study. This approach should leverage existing knowledge at the intersection of social work, implementation science, and chronic pain to meet the needs of primary care providers who care for people living with chronic pain.

5.3.3 Role for Macro Social Workers

The results of this study also have implications for social workers in macro and policy practice. Social workers who work in administrative roles, specifically as leaders in healthcare systems and practices, should leverage the results of this study to implement macro-level interventions to improve the dissemination and implementation of evidence-based chronic pain management in primary care. These changes should have the goal to address the dissemination and implementation gaps identified by this sample of primary care providers.

The results of Aim 1 are particularly important for macro-practicing social workers. For a given healthcare system or clinic, social work administrators should first use the novel data analysis strategy to identify the dissemination and implementation gaps for their specific group of primary care providers. If that is not possible, social work administrators can use the results of the current study as a framework to develop and employ interventions to improve the dissemination and implementation of evidence-based chronic pain management.

For example, social work administrators may develop infrastructure and financial resources to develop interdisciplinary chronic pain workgroups to support PCPs. Infrastructure interventions may include developing a space to host these meetings or administrative titles and designations for leaders. Financially, social work administrators should look for ways to pay for clinician time to participate in workgroups (or other dissemination channels and implementation strategies). This will communicate the organizational importance of ensuring patients receive evidence-based chronic pain management and will compensate clinicians for their time.

At the organizational level, social work administrators may also develop systems to improve access to evidence-based chronic pain management for clinicians. This may include social workers themselves organizing workshops or seminars on specific chronic pain management treatment or empowering others to develop “lunch and learn” events, as one example. Social work administrators may also engage with local chronic pain experts to develop one-time or ongoing relationships for PCPs to see consultation from experts to discuss specific cases of chronic pain management.

Social work administrators and healthcare leaders should also develop a series of incentives for engaging in ongoing education, training, or collaborations to address dissemination and implementation gaps of chronic pain management in primary care. For some

clinicians, specifically physicians, nurse practitioners, and physician assistants, incentive should be developed which provide financial or professional benefit. For example, a financial incentive may work for some PCPs. However, for others, it may be more beneficial to provide additional support for administrative tasks or responsibilities.

State-level policymakers can also leverage preferences about dissemination channels in promoting the use of the Pennsylvania Prescription Drug Monitoring Program (PDMP). The PDMP is often used by PCPs when treating patients with chronic pain (Ashcraft, *in preparation*). While most PCPs may already be aware of its existence, Pennsylvania administrative policymakers may be able to increase the reach and appropriate utilization of the PDMP by holding workshops or seminars. Additional supports may include increasing access to experts and researchers about the benefits of prescription confirmation when using pharmacologic approaches to manage chronic pain.

The methods used in Aim 2 can provide a gauge for social work administrators to understand how well a given health care system or clinic is meeting the needs of PCPs when managing chronic pain with their patients. These results, in combination with the results of Aim 3, can provide some insights into whether specific groups of PCPs need additional support. For example, the results of the current study showed that female PCPs were more likely to have lower levels of dissemination concordance. Social work administrators can leverage this information to solicit additional feedback from female PCPs to learn about unique dissemination barriers.

The results of this study have implications for social work primary care clinicians, social work scholars, and social worker in macro practice settings—specifically healthcare managers and administrators. It is critically important for social workers to utilize the results of this study

to not only move the field of implementation science forward, but also to support the critical role of primary care providers in managing the treatment of people living with chronic pain.

5.4 Conclusions

Chronic pain is a serious issue in the United States. Primary care providers are on the front lines of managing this complex condition and often need to synthesize often overwhelming information about evidence-based treatment options. For many people living with chronic pain this may lead to the mismanagement of their symptoms. Implementation science which includes both dissemination research and implementation research provides a theoretic framework and approach for addressing this problem. This study uses the foundation of the profession of social work leverage advances in implementation science to address the dissemination and implementation gap of evidence-based chronic pain management in primary care settings. The current dissertation identified existing and preferred dissemination channels and implementation strategies of 101 Pennsylvania primary care providers with the goal to understand preferences, the degree of concordance, and finally to explore potential moderators of the concordance relationship.

The results of the current study show that gaps existing in both dissemination and implementation of evidence-based chronic pain management. Most notably, PCPs expressed an unmet need to learn about evidence-based chronic pain management from workshops, clinical experts, and seminars. Further, PCPs have many unmet implementation strategy needs for employing evidence-based chronic pain management including developing workgroups, targeted

support, developing a chronic pain champion, using data to inform care, and engaging patients and families in quality improvement efforts.

The study also found that on average PCPs had moderate levels of dissemination concordance and slight implementation concordance, which is higher than that expected by chance. This indicates that while there are gaps in dissemination and implementation of evidence-based chronic pain management, PCPs are still experiencing ways to learn about chronic pain management in ways that they prefer. In a similar way, PCPs are finding ways to utilize chronic pain management strategies in ways that work for them, but to a lesser degree.

Finally, the results of this study found that anticipated moderators of the concordance relationship of urbanicity, academic setting, openness to new treatments, perceptions of differences between currently clinical practice and research, and chronic pain knowledge were not significantly associated with dissemination concordance or implementation concordance. However, self-identifying as female did significantly affect dissemination concordance and the number of years of experience did significantly affect implementation concordance.

Social work primary care practitioners and social work implementation scientists both have roles in the next steps from the results of the current study. Primary care social workers should work to leverage their existing relationships in the clinical settings as a framework for addressing expressed gaps in dissemination and implementation of evidence-based chronic pain management. In a similar way, social work implementation scientists have a unique skillset to address the complex dissemination and implementation context in filling gaps.

The current dissertation moves uses the dissemination and implementation of evidence-based chronic pain management to move the field of implementation science forward by

developing and employing a quantitative method to assess the degree of agreement between existing and preferred dissemination channels and implementation strategies.

Appendix A Study Survey

Dissertation Survey

Start of Block: Screening Questions

1.1 Thank you for your interest in participating in the Dissemination and Implementation of Chronic Pain Management in Primary Care Study.

Please answer the following four questions to see if you're eligible to participate.

If you have any questions, comments, or concerns, please email the Principal Investigator, LauraEllen Ashcraft at lauraellenashcraft@pitt.edu.

1.2 Are you a physician, physician assistant, or nurse practitioner?

- Yes (1)
 No (2)
-

1.3 Do you practice in an outpatient primary care setting in Pennsylvania?

- Yes (1)
 No (2)
-

1.4 Do you primarily practice (over 50%) in a Federally Qualified Health Center (FQHC)?

- Yes (1)
 - No (2)
-

1.5 Do you work in a pediatric primary care clinic?

- Yes (1)
 - No (2)
-

1.6 Where did you learn about this study? *Select all that apply.*

- Pennsylvania Academy of Family Physicians (1)
- Pennsylvania Osteopathic Medical Association (4)
- Pennsylvania Society of Physician Assistants (5)
- Pennsylvania Coalition of Nurse Practitioners (6)
- Society of General Internal Medicine (7)
- UPMC CMI (8)
- Penn Medicine
- Social Media
- Pitt+Me
- A friend/colleague (3)
- I'm not sure (2)
- Other (9) _____

End of Block: Screening Questions

Message if Ineligible:

Thank you for your interest in our study. Unfortunately, you do not meet our eligibility criteria.

If you think you received this message in error, please contact the Principal Investigator, LauraEllen Ashcraft at lauraellenashcraft@pitt.edu.

Start of Block: Informed Consent

2.1 Thank you for your interest in participating in the Dissemination and Implementation of Chronic Pain Management in Primary Care Study. The goal of this research study is to learn more about how you receive information about chronic pain and how you manage chronic pain with your patients.

There are no right or wrong answers.
You care for patients every day—you are the expert.

We want to learn from you!

The survey has five sections:

1. Learning about Chronic Pain
2. Managing Chronic Pain
3. Trying New Treatments
4. Best Practices in Chronic Pain
5. Personal Characteristics

Before you decide if you would like to participate, here are a few things you should know:

- Participation in this study is voluntary.
- You may end your participation at any time.
- Your answers are confidential.
- Your participation may help to expand knowledge in this area.
- We do not anticipate any direct benefit to you as a result of your participation.
- Some questions may make you feel uncomfortable.
- You may choose not to answer any question.
- As with all research studies, there is a risk of breach of confidentiality.
- To protect against this risk, all study data is being stored on a password-protected computer and behind the University of Pittsburgh firewalls.
- You may choose to enter into a sweepstakes to win a \$100 Amazon Gift Card.
- The chance of winning the prize is approximately 1 in 50.
- A drawing will take place on the last day of every month between January and May 2021.

- The survey will take about 15 minutes to complete.

If you have any questions, comments, or concerns about this research study, please contact the Principal Investigator, LauraEllen Ashcraft, MSW at lauraellenashcraft@pitt.edu. You may also contact the University of Pittsburgh Human Research Protection Office at (412) 383-1480

2.2 Do you agree to participate in this research study?

Yes (1)

No (2)

End of Block: Informed Consent

Start of Block: Section 1: Learning about Chronic Pain Management (Diss. Congruence)

3.1 Section 1: Learning about Chronic Pain Management

There are many ways you may learn about chronic pain management and treatment options. Sometimes, you may not be able to find information in a way that works best for you. We want to know more about how you learn about chronic pain and how you wish you could learn about chronic pain.

3.2 **Currently**, how do you learn about managing chronic pain? *Select all that apply.*

- Colleagues (35)
- Your own clinical experience (59)
- Patients (60)
- Professional organizations (61)
- Researchers (62)
- Clinical experts (63)
- Pharmaceutical representatives (64)
- Primary peer-reviewed literature (e.g., PubMed) (66)
- Online peer reviewed clinical resources (e.g., UptoDate) (67)
- Email listserv (68)
- Practice Briefs or Practice Guidelines (69)
- Annual conferences (86)
- Seminars at my clinic/institution (e.g., grand rounds; case conference) (70)
- Web-based continuing education modules (71)
- Workshops on specific intervention (e.g. CBT, Yoga) (72)
- Main-stream media (e.g. NPR, CNN, FoxNews) (73)
- Blogs (e.g. Tumblr, Wordpress) (74)
- Social media (e.g. Facebook, Twitter, Reddit) (75)
- Podcasts (76)
- Other (36) _____
- None of these (58)

3.3 **In an ideal world**, how would you learn about managing chronic pain? *Select all that apply.*

- Colleagues (35)
- Your own clinical experience (59)
- Patients (60)
- Professional organizations (61)
- Researchers (62)
- Clinical experts (63)
- Pharmaceutical representatives (64)
- Primary peer-reviewed literature (e.g., PubMed) (66)
- Online peer reviewed clinical resources (e.g., UptoDate) (67)
- Email listserv (68)
- Practice Briefs or Practice Guidelines (69)
- Annual conferences (86)
- Seminars at my clinic/institution (e.g., grand rounds; case conference) (70)
- Web-based continuing education modules (71)
- Workshops on specific intervention (e.g. CBT, Yoga) (72)
- Main-stream media (e.g. NPR, CNN, FoxNews) (73)
- Blogs (e.g. Tumblr, Wordpress) (74)
- Social media (e.g. Facebook, Twitter, Reddit) (75)
- Podcasts (76)
- Other (36) _____
- None of these (58)

Page
Break

3.4 Which (if any) chronic pain management strategies would you like to learn more about? *Select all that apply.*

- Acupuncture (1)
- Cognitive Behavioral Therapy (2)
- Self-Management (10)
- Mindfulness (3)
- Multidisciplinary Treatment (4)
- Peer Support (5)
- Physical Therapy (6)
- Safe opioid prescribing (7)
- Yoga (11)
- None of these (9)
- Other: (8) _____

Page _____

Break

3.5 Now, we would like you to tell us the extent to which you agree/disagree with the following statements.

3.6 I have adequate knowledge about chronic pain to help my patients.

- Strongly agree (8)
 - Somewhat agree (9)
 - Neither agree nor disagree (10)
 - Somewhat disagree (11)
 - Strongly disagree (12)
-

3.7 I want to learn more about chronic pain management.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

3.8 How I learn about chronic pain helps me select evidence-based treatments with patients.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

End of Block: Section 1: Learning about Chronic Pain Management (Diss. Congruence)

Start of Block: Section 2: Managing Chronic Pain (Impl. Congruence)

4.1 Section 2: Managing Chronic Pain

You will be presented with several chronic pain management strategies.

4.2 **Currently**, what chronic pain management strategies do you use? *Select all that apply.*

- Conduct a chronic pain needs assessment (i.e., assess barriers to treatment in your clinic) (1)
 - Provide targeted support for clinicians treating chronic pain (e.g., clinical supervision, technical assistance) (4)
 - Tailor treatments to meet the needs of your patient population (e.g., provide telehealth for rural patients with chronic pain) (5)
 - Develop a chronic pain champion in clinic (a local clinic member who is passionate about improving chronic pain management). (6)
 - Seek consultation from chronic pain experts (7)
 - Develop an interdisciplinary workgroup to address chronic pain (8)
 - Provide chronic pain education for patients or caregivers (9)
 - Directly engage patients or families in the process of quality improvement around chronic pain management (10)
 - Change payment or reimbursement structures for chronic pain management (11)
 - Change medical records (e.g., develop new note templates, clinical reminders) (12)
 - Use data to inform care (e.g., track quality indicators, provide clinical data to providers) (13)
 - Mandate change (change the rules about prescribing) (14)
 - None of these (15)
-

4.3 **In an ideal world**, what chronic pain management strategies would you use? *Select all that apply.*

- Conduct a chronic pain needs assessment (i.e., assess barriers to treatment in your clinic) (1)
- Provide targeted support for clinicians treating chronic pain (e.g., clinical supervision, technical assistance) (4)
- Tailor treatments to meet the needs of your patient population (e.g., provide telehealth for rural patients with chronic pain) (5)
- Develop a chronic pain champion in clinic (a local clinic member who is passionate about improving chronic pain management). (6)
- Seek consultation from chronic pain experts (7)
- Develop an interdisciplinary workgroup to address chronic pain (8)
- Provide chronic pain education for patients or caregivers (9)
- Directly engage patients or families in the process of quality improvement around chronic pain management (10)
- Change payment or reimbursement structures for chronic pain management (11)
- Change medical records (e.g., develop new note templates, clinical reminders) (12)
- Use data to inform care (e.g., track quality indicators, provide clinical data to providers) (13)
- Mandate change (change the rules about prescribing) (14)
- None of these (15)

Page _____
Break

End of Block: Section 2: Managing Chronic Pain (Impl. Congruence)

Start of Block: Section 3: EPBAS

5.1 Section 3: Trying New Treatments

You are half-way finished!
Primary care providers are sometimes asked to try new treatments. This section asks you about your experience with new treatments.

5.2 I like to use new types of chronic pain treatments to help my patients.

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.3 I am willing to try new types of chronic pain treatments even if I have to follow a treatment manual

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.4 I know better than academic researchers how to care for my patients.

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.5 I am willing to use new and different types of chronic pain treatments developed by researchers.

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.6 Research based chronic pain treatments are not clinically useful.

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.7 Clinical experience is more important than using manualized chronic pain treatments.

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.8 I would not use manualized chronic pain treatments.

- Not at All (1)
 - To a Slight Extent (2)
 - To a Moderate Extent (3)
 - To a Great Extent (4)
 - To a Very Great Extent (5)
-

5.9 I would try a new chronic pain treatment even if it were very different from what I'm used to doing.

- Not at All (1)
- To a Slight Extent (2)
- To a Moderate Extent (3)
- To a Great Extent (4)
- To a Very Great Extent (5)

End of Block: Section 3: EPBAS

Start of Block: Section 4: Chronic Pain Knowledge

6.1 Section 4: Best Practices in Chronic Pain We have a few general questions about chronic pain. Please rate the extent to which you agree with the following statements.

6.2 The treating physician is the most accurate judge of the intensity of the patient's pain.

- Strongly agree (15)
 - Somewhat agree (16)
 - Neither agree nor disagree (17)
 - Somewhat disagree (18)
 - Strongly disagree (19)
-

6.3 Opioids are a first-line therapy for chronic pain.

- Strongly agree (18)
 - Somewhat agree (19)
 - Neither agree nor disagree (20)
 - Somewhat disagree (21)
 - Strongly disagree (22)
-

6.4 Cognitive Behavioral Therapy (CBT) is an evidence-based treatment for chronic pain.

- Strongly agree (14)
- Somewhat agree (15)
- Neither agree nor disagree (16)
- Somewhat disagree (17)
- Strongly disagree (18)

End of Block: Section 4: Chronic Pain Knowledge

Start of Block: Section 5: Personal Characteristics

7.1 Section 5: Personal Characteristics
This is the last section of questions.

We want to know more about you, your training, and your practice.

7.2 What is your profession?

- Medical Doctor (MD) (1)
 - Doctor of Osteopathy (DO) (2)
 - Physician Assistant-Certified (PA-C) (3)
 - Nurse Practitioner (CRNP) (4)
 - Doctorate of Nursing Practice (DNP) (6)
-

7.3 What board certifications do you have? *Select all that apply.*

- Internal Medicine (4)
 - Family Medicine (5)
 - Other (10) _____
-

7.4 What sub-specialty board certification(s) do you have? *Select all that apply.*

- Addiction (1)
 - Pain (2)
 - Palliative Care (7)
 - OB/GYN (3)
 - Gerontology (4)
 - I do not have a sub-specialty (5)
 - Other (6) _____
-

7.5 How many years since you finished your last-post graduate training (e.g. residency or fellowship) or terminal degree (e.g. NP, PA)? (Please round to the closest year e.g. 3.75 would be 4)

7.6 How many days per week do you see patients in outpatient primary care? *Please use half-day increments. (e.g. 0.5 or 4.5)*

| | |
|------|--|
| 7 () |  |
|------|--|

7.7 Are you responsible for educating students or trainees?

- Yes (1)
- No (2)
- I'm not sure. (3)

7.8 Do you conduct research funded by an external entity (e.g. NIH, foundation, etc) **excluding** internal quality improvement initiatives?

- Yes (1)
- No (2)
- I'm not sure. (3)

7.9 What is your age? (Please enter a whole number, e.g. 45.5 round to 45)

7.10 How do you identify your race and ethnicity? *Select all that apply.*

- White/Caucasian (1)
 - Black/African American (2)
 - Black/Afro-Caribbean (3)
 - Black/African (4)
 - Hispanic (5)
 - Latino (6)
 - American Indian or Alaska Native (7)
 - East Asian (8)
 - Southeast Asian (9)
 - Indian (10)
 - Native Hawaiian or Other Pacific Islander (11)
 - Other (12) _____
-

7.11 How do you identify your gender?

- Male (1)
 - Female (2)
 - Select for more options (3)
-

Display This Question:

If How do you identify your gender? = Select for more options

7.12 Please select the gender which best reflects how you identify.

- Agender (1)
- Androgyne (2)
- Androgynous (3)
- Bigender (4)
- Cis (5)
- Cisgender (6)
- Cis Female (7)
- Cis Male (8)
- Cis Man (9)
- Cis Woman (10)
- Cisgender Female (11)
- Cisgender Male (12)
- Cisgender Man (13)
- Cisgender Woman (14)
- Female to Male (15)
- FTM (16)
- Gender Fluid (17)
- Gender Nonconforming (18)
- Gender Questioning (19)
- Gender Variant (20)
- Genderqueer (21)

- Intersex (22)
- Male to Female (23)
- MTF (24)
- Neither (25)
- Neutrois (26)
- Non-binary (27)
- Other (28)
- Pangender (29)
- Trans (30)
- Trans* (31)
- Trans Female (32)
- Trans* Female (33)
- Trans Male (34)
- Trans* Male (35)
- Trans Man (36)
- Trans* Man (37)
- Trans Person (38)
- Trans* Person (39)
- Trans Woman (40)
- Trans* Woman (41)
- Transfeminine (42)
- Transgender (43)

Transgender Female (44)

Transgender Male (45)

Transgender Man (46)

Transgender Person (47)

Transgender Woman (48)

Transmasculine (49)

Transsexual (50)

Transsexual Female (51)

Transsexual Male (52)

Transsexual Man (53)

Transsexual Person (54)

Transsexual Woman (55)

Two-Spirit (56)

7.13 What is the zip code of your outpatient primary care clinic?

7.14 What best describes your outpatient clinic? *Select all that apply.*

Independent Clinic (8)

Part of a larger health system (2)

Other (3) _____

7.15 What insurance providers do you accept in your primary care clinic? *Select all that apply.*

- Commercial (1)
- Medicare (generally, older adults) (2)
- Medicaid (generally, people with disabilities; people with low incomes) (3)
- I do not take insurance. (4)
- Other (5) _____

7.16 About what percentage of your patients have chronic pain?

0 0 0 0 0 0 0 0 0 00

4 ()



7.17 **COVID-19:** *Please respond with the degree to which you agree with the following statement.*

During the COVID-19 pandemic, I have managed patients with chronic pain as well as before the pandemic.

- Strongly agree (16)
- Somewhat agree (17)
- Neither agree nor disagree (18)
- Somewhat disagree (19)
- Strongly disagree (20)

Page
Break

End of Survey Message

Thank you for completing this research study.

If you would like to enter your name into the sweepstakes for a \$100 Amazon gift card and/or would like to receive a copy of the main results paper when it is published. [Please click link here.](#)

Please note: This link will not connect your name to your responses.

If you would like to send this survey to a friend, please share this link: https://pitt.co1.qualtrics.com/jfe/form/SV_e8Qlm79wz9X93IV

Please contact LauraEllen Ashcraft, MSW Principal Investigator with any comments, questions, or concerns at lauraellenashcraft@pitt.edu.

Dissertation Compensation

Start of Block: Default Question Block

Q1 Would you like to enter your name into the sweepstakes for a \$100 Amazon gift card?

- Yes (1)
- No (2)

Q2 Would you like to receive a copy of the main results paper from this research?

- Yes (1)
- No (2)

Q4 Are you willing to participate in future research on chronic pain in primary care?

*Your response to this question **does not increase or decrease** your chances of winning the sweepstakes.*

- Yes (1)
 - No (2)
-

Q3 Please enter your name and email address:

Name (1) _____

Email Address (2) _____

End of Block: Default Question Block

Page

Break

End of Survey Message

Thank you for completing this research study.

If you would like to send this survey to a friend, please share this link: https://pitt.co1.qualtrics.com/jfe/form/SV_e8Qlm79wz9X93IV

Please contact LauraEllen Ashcraft, MSW Principal Investigator with any comments, questions, or concerns at lauraellenashcraft@pitt.edu.

Bibliography

- Aarons, G. A. (2004). Mental health provider attitudes toward adoption of evidence-based practice: The Evidence-Based Practice Attitude Scale (EBPAS). *Mental Health Services Research, 6*(2), 61–74. <https://doi.org/10.1023/b:mhsr.0000024351.12294.65>
- Acock, A. C. (2008). *A gentle introduction to Stata*. Stata press.
- Allegrì, N., Mennuni, S., Rulli, E., Vanacore, N., Corli, O., Floriani, I., Simone, I. D., Allegrì, M., Govoni, S., Vecchi, T., Sandrini, G., Liccione, D., & Biagioli, E. (2019). Systematic Review and Meta-Analysis on Neuropsychological Effects of Long-Term Use of Opioids in Patients With Chronic Noncancer Pain. *Pain Practice, 19*(3), 328–343. <https://doi.org/10.1111/papr.12741>
- American Academy of Social Work & Social Welfare. (2016). *Close the health gap*. Grand Challenges For Social Work. <http://grandchallengesforsocialwork.org/grand-challenges-initiative/12-challenges/close-the-health-gap/>
- American Physical Therapy Association. (2019). *What physical therapists do*. Becoming a PT. <https://www.apta.org/your-career/careers-in-physical-therapy/becoming-a-pt>
- Assendelft, W. J., Morton, S. C., Yu, E. I., Suttorp, M. J., & Shekelle, P. G. (2004). Spinal manipulative therapy for low-back pain. *Cochrane Database of Systematic Reviews, 1*. <https://doi.org/10.1002/14651858.CD000447.pub2>
- Association of American Medical Colleges. (2019). *Pennsylvania Physician Workforce Profile*. <https://www.aamc.org/system/files/2019-12/state-physician-Pennsylvania-2019%5B1%5D.pdf>

- Baker, G. R., Fancott, C., Judd, M., & O'Connor, P. (2016). *Expanding patient engagement in quality improvement and health system redesign: Three Canadian case studies*. 29(5), 176–182.
- Becker, W. C., Mattocks, K. M., Frank, J. W., Bair, M. J., Jankowski, R. L., Kerns, R. D., Painter, J. T., Fenton, B. T., Midboe, A. M., & Martino, S. (2018). Mixed methods formative evaluation of a collaborative care program to decrease risky opioid prescribing and increase non-pharmacologic approaches to pain management. *Addictive Behaviors*, 86, 138–145. Scopus. <https://doi.org/10.1016/j.addbeh.2018.03.009>
- Becker-Haimes, E. M., Byeon, Y. V., Frank, H. E., Williams, N. J., Kratz, H. E., & Beidas, R. S. (2020). Identifying the organizational innovation-specific capacity needed for exposure therapy. *Depression and Anxiety*, 37(10), 1007–1016. <https://doi.org/10.1002/da.23035>
- Benmarhnia, T., Huang, J. Y., & Jones, C. M. (2017). Lost in translation: Piloting a novel framework to assess the challenges in translating scientific uncertainty from empirical findings to WHO policy statements. *International Journal of Health Policy and Management*, 6(11), 649.
- Breitenstein, S. M., Gross, D., Garvey, C. A., Hill, C., Fogg, L., & Resnick, B. (2010). Implementation fidelity in community-based interventions. *Research in Nursing & Health*, 33(2), 164–173.
- Brennan, F., Carr, D. B., & Cousins, M. (2007). Pain Management: A Fundamental Human Right. *Anesthesia & Analgesia*, 105(1), 205. <https://doi.org/10.1213/01.ane.0000268145.52345.55>
- Breuer, B., Cruciani, R., & Portenoy, R. K. (2010). Pain Management by Primary Care Physicians, Pain Physicians, Chiropractors, and Acupuncturists: A National Survey.

Southern Medical Journal, 103(8), 738–747.
<https://doi.org/10.1097/SMJ.0b013e3181e74ede>

Brothers, B. M., Carpenter, K. M., Shelby, R. A., Thornton, L. M., Frierson, G. M., Patterson, K. L., & Andersen, B. L. (2014). Dissemination of an evidence-based treatment for cancer patients: Training is the necessary first step. *Translational Behavioral Medicine*, 5(1), 103–112.

Brownson, R. C., Ballew, P., Brown, K. L., Elliott, M. B., Haire-Joshu, D., Heath, G. W., & Kreuter, M. W. (2007). The Effect of Disseminating Evidence-Based Interventions That Promote Physical Activity to Health Departments. *American Journal of Public Health*, 97(10), 1900–1907. aph.

Brownson, R. C., Eyler, A. A., Harris, J. K., Moore, J. B., & Tabak, R. G. (2018). Getting the Word Out: New Approaches for Disseminating Public Health Science. *Journal of Public Health Management and Practice: JPHMP*, 24(2), 102–111.
<https://doi.org/10.1097/PHH.0000000000000673>

Burke, J., Lich, K., Neal, J., Meissner, H., Yonas, M., & Mabry, P. (2015). Enhancing Dissemination and Implementation Research Using Systems Science Methods. *International Journal of Behavioral Medicine*, 22(3), 283–291. aph.

Buzza, C., Ono, S. S., Turvey, C., Wittrock, S., Noble, M., Reddy, G., Kaboli, P. J., & Reisinger, H. S. (2011). Distance is relative: Unpacking a principal barrier in rural healthcare. *Journal of General Internal Medicine*, 26(2), 648.

Cannon, I. M. (1913). *Social work in hospitals: A contribution to progressive medicine*. Russell Sage Foundation.

- Cardarelli, R., Workman, C. S., Weatherford, S., Whanger, S., & King, D. E. (2017). Dissemination Approaches to Participating Primary Care Providers in a Quality Improvement Program Addressing Opioid Use in Central Appalachia. *Southern Medical Journal*, *110*(6), 421–424. aph.
- Cené, C. W., Johnson, B. H., Wells, N., Baker, B., Davis, R., & Turchi, R. (2016). A narrative review of patient and family engagement: The “foundation” of the medical home. *Medical Care*, *54*(7), 697.
- Chang, H.-C. (2010). A new perspective on Twitter hashtag use: Diffusion of innovation theory. *Proceedings of the American Society for Information Science and Technology*, *47*(1), 1–4. <https://doi.org/10.1002/meet.14504701295>
- Chen, L. M., Farwell, W. R., & Jha, A. K. (2009). Primary care visit duration and quality: Does good care take longer? *Archives of Internal Medicine*, *169*(20), 1866–1872.
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*(1), 37–46.
- Coleman, J. L., Marceau, L., Zincavage, R., Magnavita, A. M., Ambrosoli, J., Shi, L., Simon, E., Ortigo, K., Clarke-Walper, K., & Penix, E. (2020). Understanding how clinicians use a new web-based tool for disseminating evidence-based practices for the treatment of PTSD: The PTSD Clinicians Exchange. *Military Medicine*, *185*(Supplement_1), 286–295.
- Cornell, P. Y., Halladay, C. W., Ader, J., Halaszynski, J., Hogue, M., McClain, C. E., Silva, J. W., Taylor, L. D., & Rudolph, J. L. (2020). Embedding Social Workers In Veterans Health Administration Primary Care Teams Reduces Emergency Department Visits. *Health Affairs*, *39*(4), 603–612. <https://doi.org/10.1377/hlthaff.2019.01589>

- Dahlhamer, J. (2018). Prevalence of Chronic Pain and High-Impact Chronic Pain Among Adults—United States, 2016. *MMWR. Morbidity and Mortality Weekly Report*, 67. <https://doi.org/10.15585/mmwr.mm6736a2>
- Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis Of Effects Of Determinants and Moderators. *Academy of Management Journal*, 34(3), 555–590. <https://doi.org/10.5465/256406>
- Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science*, 4(1), 50. <https://doi.org/10.1186/1748-5908-4-50>
- Dansie, E. J., & Turk, D. C. (2013). Assessment of patients with chronic pain. *BJA: British Journal of Anaesthesia*, 111(1), 19–25. <https://doi.org/10.1093/bja/aet124>
- Dearing, J. W. (2009). Applying Diffusion of Innovation Theory to Intervention Development. *Research on Social Work Practice*, 19(5), 503–518. <https://doi.org/10.1177/1049731509335569>
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method, 4th Edition* (John Wiley & Sons, Inc. 10475 Crosspoint Boulevard, Indianapolis, IN 46256. Tel: 800-956-7739; Fax: 800-605-2665; e-mail: consumers@wiley.com; Web site: <http://www.wiley.com>). John Wiley & Sons, Inc.
- Donaldson, M. S., Yordy, K. D., Lohr, K. N., & Vanselow, N. A. (1996). *Primary care: America's health in a new era*. National Academies Press.

- Dreer, L. E., Crowley, M. T., Cash, A., O'Neill, J. A., & Cox, M. K. (2017). Examination of teacher knowledge, dissemination preferences, and classroom management of student concussions: Implications for return-to-learn protocols. *Health Promotion Practice, 18*(3), 428–436.
- Early, T. J., & GlenMaye, L. F. (2000). Valuing families: Social work practice with families from a strengths perspective. *Social Work, 45*(2), 118–130.
- Edmunds, J. M., Read, K. L., Ringle, V. A., Brodman, D. M., Kendall, P. C., & Beidas, R. S. (2014). Sustaining clinician penetration, attitudes and knowledge in cognitive-behavioral therapy for youth anxiety. *Implementation Science, 9*(1), 89. <https://doi.org/10.1186/s13012-014-0089-9>
- Ellis, P., Robinson, P., Ciliska, D., Armour, T., Brouwers, M., O'Brien, M. A., Sussman, J., & Raina, P. (2005). A systematic review of studies evaluating diffusion and dissemination of selected cancer control interventions. *Health Psychology, 24*(5), 488.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2015). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Federman, D. G., Gunderson, C. G., & medicine, integrative. (2017). Battlefield Acupuncture: Is It Ready for Widespread Dissemination? *Southern Medical Journal, 110*(1), 55–57. aph.
- Fernandez, M. E., Walker, T. J., Weiner, B. J., Calo, W. A., Liang, S., Risendal, B., Friedman, D. B., Tu, S. P., Williams, R. S., & Jacobs, S. (2018). Developing measures to assess constructs from the inner setting domain of the consolidated framework for implementation research. *Implementation Science, 13*(1), 52.

- Ferreira, G. E., McLachlan, A. J., Lin, C.-W. C., Zadro, J. R., Abdel-Shaheed, C., O’Keeffe, M., & Maher, C. G. (2021). Efficacy and safety of antidepressants for the treatment of back pain and osteoarthritis: Systematic review and meta-analysis. *BMJ*, *372*, m4825. <https://doi.org/10.1136/bmj.m4825>
- Flor, H., Fydrich, T., & Turk, D. C. (1992). Efficacy of multidisciplinary pain treatment centers: A meta-analytic review. *Pain*, *49*(2), 221–230. [https://doi.org/10.1016/0304-3959\(92\)90145-2](https://doi.org/10.1016/0304-3959(92)90145-2)
- Furlan, A. D., Sandoval, J. A., Mailis-Gagnon, A., & Tunks, E. (2006). Opioids for chronic noncancer pain: A meta-analysis of effectiveness and side effects. *CMAJ: Canadian Medical Association Journal = Journal de l’Association Medicale Canadienne*, *174*(11), 1589–1594. <https://doi.org/10.1503/cmaj.051528>
- Geerligs, L., Rankin, N. M., Shepherd, H. L., & Butow, P. (2018). Hospital-based interventions: A systematic review of staff-reported barriers and facilitators to implementation processes. *Implementation Science*, *13*(1), 1–17. aph.
- Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of Innovations in Service Organizations: Systematic Review and Recommendations. *The Milbank Quarterly*, *82*(4), 581–629. <https://doi.org/10.1111/j.0887-378X.2004.00325.x>
- Grimshaw, J., Eccles, M., Thomas, R., MacLennan, G., Ramsay, C., Fraser, C., & Vale, L. (2006). Toward Evidence-Based Quality Improvement: Evidence (and its Limitations) of the Effectiveness of Guideline Dissemination and Implementation Strategies 1966-1998. *JGIM: Journal of General Internal Medicine*, *21*, S14–S20. aph.
- Grol, R. P. T. M., Bosch, M. C., Hulscher, M. E. J. L., Eccles, M. P., & Wensing, M. (2007). Planning and Studying Improvement in Patient Care: The Use of Theoretical

- Perspectives. *The Milbank Quarterly*, 85(1), 93–138. <https://doi.org/10.1111/j.1468-0009.2007.00478.x>
- Guy, G. P., Zhang, K., Bohm, M. K., Losby, J., Lewis, B., Young, R., Murphy, L. B., & Dowell, D. (2017). Vital Signs: Changes in Opioid Prescribing in the United States, 2006–2015. *MMWR. Morbidity and Mortality Weekly Report*, 66(26), 697–704. <https://doi.org/10.15585/mmwr.mm6626a4>
- Haefeli, M., & Elfering, A. (2006). Pain assessment. *European Spine Journal*, 15(Suppl 1), S17–S24. <https://doi.org/10.1007/s00586-005-1044-x>
- Hale-Gallardo, J. L., Kreider, C. M., Jia, H., Castaneda, G., Freytes, I. M., Ripley, D. C. C., Ahonle, Z. J., Findley, K., & Romero, S. (2020). Telerehabilitation for rural veterans: A qualitative assessment of barriers and facilitators to implementation. *Journal of Multidisciplinary Healthcare*, 13, 559.
- Hall, B. J., Puente, M., Aguilar, A., Sico, I., Barrios, M. O., Mendez, S., Baumgartner, J. N., Boyd, D., Calgua, E., Lou-Meda, R., Ramirez, C. C., Diez, A., Tello, A., Sexton, J. B., & Rice, H. (2021). Implementation challenges to patient safety in Guatemala: A mixed methods evaluation. *BMJ Quality & Safety*. <https://doi.org/10.1136/bmjqs-2020-012552>
- Hammond, M. M., Neff, N. L., Farr, J. L., Schwall, A. R., & Zhao, X. (2011). Predictors of individual-level innovation at work: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, 5(1), 90–105. <https://doi.org/10.1037/a0018556>
- Hardt, J., Jacobsen, C., Goldberg, J., Nickel, R., & Buchwald, D. (2008). Prevalence of Chronic Pain in a Representative Sample in the United States. *Pain Medicine*, 9(7), 803–812. <https://doi.org/10.1111/j.1526-4637.2008.00425.x>

- Harvey, G., & Kitson, A. (2015). PARIHS revisited: From heuristic to integrated framework for the successful implementation of knowledge into practice. *Implementation Science, 11*(1), 1–13.
- Hayden, J. A., Van Tulder, M. W., Malmivaara, A. V., & Koes, B. W. (2005). Meta-analysis: Exercise therapy for nonspecific low back pain. *Annals of Internal Medicine, 142*(9), 765.
- Hill, R. B. (2004). Institutional racism in child welfare. *Race and Society, 7*(1), 17–33.
- Hilton, L., Hempel, S., Ewing, B. A., Apaydin, E., Xenakis, L., Newberry, S., Colaiaco, B., Maher, A. R., Shanman, R. M., Sorbero, M. E., & Maglione, M. A. (2017). Mindfulness Meditation for Chronic Pain: Systematic Review and Meta-analysis. *Annals of Behavioral Medicine, 51*(2), 199–213. <https://doi.org/10.1007/s12160-016-9844-2>
- Hoffman, B. M., Papas, R. K., Chatkoff, D. K., & Kerns, R. D. (2007). Meta-analysis of psychological interventions for chronic low back pain. *Health Psychology, 26*(1), 1–9. <https://doi.org/10.1037/0278-6133.26.1.1>
- Institute of Medicine of the National Academies. (2012). Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. *Institute of Medicine of the National Academies*. <http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=115064741&site=ehost-live>
- Jacobson, N., Johnson, R., Deyo, B., Alagoz, E., & Quanbeck, A. (2019). Systems consultation for opioid prescribing in primary care: A qualitative study of adaptation. *BMJ Quality and Safety, 28*(5), 397–404. Scopus. <https://doi.org/10.1136/bmjqs-2018-008160>
- Jamieson, M., & Bodonyi, J. M. (1999). Data-Driven Child Welfare Policy and Practice in the Next Century. *Child Welfare, 78*(1), 15–30. aph.

- Jamison, R. N., Gintner, L., Rogers, J. F., & Fairchild, D. G. (2002). Disease Management for Chronic Pain: Barriers of Program Implementation With Primary Care Physicians. *Pain Medicine*, 3(2), 92–101. <https://doi.org/10.1046/j.1526-4637.2002.02022.x>
- Jamison, R. N., Sheehan, K. A., Scanlan, E., Matthews, M., & Ross, E. L. (2014). Beliefs and attitudes about opioid prescribing and chronic pain management: Survey of primary care providers. *Journal of Opioid Management*, 10(6), 375–382. <https://doi.org/10.5055/jom.2014.0234>
- Johannes, C. B., Le, T. K., Zhou, X., Johnston, J. A., & Dworkin, R. H. (2010). The Prevalence of Chronic Pain in United States Adults: Results of an Internet-Based Survey. *The Journal of Pain*, 11(11), 1230–1239. <https://doi.org/10.1016/j.jpain.2010.07.002>
- Katon, W. J., Lin, E. H., Von Korff, M., Ciechanowski, P., Ludman, E. J., Young, B., Peterson, D., Rutter, C. M., McGregor, M., & McCulloch, D. (2010). Collaborative care for patients with depression and chronic illnesses. *New England Journal of Medicine*, 363(27), 2611–2620.
- Kegler, M. C., Liang, S., Weiner, B. J., Tu, S. P., Friedman, D. B., Glenn, B. A., Herrmann, A. K., Risendal, B., & Fernandez, M. E. (2018). Measuring constructs of the consolidated framework for implementation research in the context of increasing colorectal cancer screening in federally qualified health center. *Health Services Research*, 53(6), 4178–4203.
- King, J., Tupper, S., Fletcher, K., Brose, K., & Goodridge, D. (2021). The current practice of social work in pain management: A scoping review on chronic disease. *Social Work in Health Care*, 0(0), 1–16. <https://doi.org/10.1080/00981389.2021.1878318>

- Kinney, M., Seider, J., Beaty, A. F., Coughlin, K., Dyal, M., & Clewley, D. (2018). The impact of therapeutic alliance in physical therapy for chronic musculoskeletal pain: A systematic review of the literature. *Physiotherapy Theory and Practice*, 0(0), 1–13. <https://doi.org/10.1080/09593985.2018.1516015>
- Kirk, M. A., Kelley, C., Yankey, N., Birken, S. A., Abadie, B., & Damschroder, L. (2016). A systematic review of the use of the Consolidated Framework for Implementation Research. *Implementation Science*, 11(1), 72. <https://doi.org/10.1186/s13012-016-0437-z>
- Krebs, E. E., Gravely, A., Nugent, S., Jensen, A. C., DeRonne, B., Goldsmith, E. S., Kroenke, K., Bair, M. J., & Noorbaloochi, S. (2018). Effect of Opioid vs Nonopioid Medications on Pain-Related Function in Patients With Chronic Back Pain or Hip or Knee Osteoarthritis Pain: The SPACE Randomized Clinical Trial. *JAMA*, 319(9), 872–882. <https://doi.org/10.1001/jama.2018.0899>
- Landis, J. R., & Koch, G. G. (1977). The Measurement of Observer Agreement for Categorical Data. *Biometrics*, 33(1), 159–174. <https://doi.org/10.2307/2529310>
- Lewis, C. C., Mettert, K. D., Dorsey, C. N., Martinez, R. G., Weiner, B. J., Nolen, E., Stanick, C., Halko, H., & Powell, B. J. (2018). An updated protocol for a systematic review of implementation-related measures. *Systematic Reviews*, 7(1), N.PAG-N.PAG. aph.
- Li, S., Cao, M., & Zhu, X. (2019). Evidence-based practice: Knowledge, attitudes, implementation, facilitators, and barriers among community nurses—Systematic review. *Medicine*, 98(39).
- Lister, J. J., Weaver, A., Ellis, J. D., Himle, J. A., & Ledgerwood, D. M. (2020). A systematic review of rural-specific barriers to medication treatment for opioid use disorder in the United States. *American Journal of Drug & Alcohol Abuse*, 46(3), 273–288. aph.

- Lombardi, B. M., Zerden, L. de S., & Richman, E. L. (2019). Where are social workers co-located with primary care physicians? *Social Work in Health Care*, 58(9), 885–898. <https://doi.org/10.1080/00981389.2019.1659907>
- Louie, E., Barrett, E. L., Baillie, A., Haber, P., & Morley, K. C. (2021). A systematic review of evidence-based practice implementation in drug and alcohol settings: Applying the consolidated framework for implementation research framework. *Implementation Science*, 16(1), 22. <https://doi.org/10.1186/s13012-021-01090-7>
- Lyytinen, K., & Damsgaard, J. (2001). What's Wrong with the Diffusion of Innovation Theory? *Diffusing Software Product and Process Innovations*, 173–190. https://doi.org/10.1007/978-0-387-35404-0_11
- MacDonald, J. E. (2000). A Deconstructive Turn in Chronic Pain Treatment: A Redefined Role for Social Work. *Health & Social Work*, 25(1), 51–58. <https://doi.org/10.1093/hsw/25.1.51>
- McCormack, G., Dillon, A. C., Healy, O., Walsh, C., & Lydon, S. (2020). Primary care physicians' knowledge of autism and evidence-based interventions for autism: A systematic review. *Review Journal of Autism and Developmental Disorders*, 7(3), 226–241.
- McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, 22(3), 276–282.
- Medves, J., Godfrey, C., Turner, C., Paterson, M., Harrison, M., MacKenzie, L., & Durando, P. (2010). Systematic review of practice guideline dissemination and implementation strategies for healthcare teams and team-based practice. *International Journal of Evidence-Based Healthcare*, 8(2), 79–89. aph.

- Merritt, D. H. (2021). Lived Experiences of Racism Among Child Welfare-Involved Parents. *Race and Social Problems*, 13(1), 63–72.
- Meyer, C. H., & W, D. S. (1988). The Eco-Systems Perspective. In *Paradigms of Clinical Social Work*. Routledge.
- Midboe, A. M., Wu, J., Erhardt, T., Carmichael, J. M., Bounthavong, M., Christopher, M. L. D., & Gale, R. C. (2018). Academic detailing to improve opioid safety: Implementation lessons from a qualitative evaluation. *Pain Medicine (United States)*, 19, S46–S53. Scopus. <https://doi.org/10.1093/pm/pny085>
- Mitchell, S. A., & Chambers, D. A. (2017). Leveraging implementation science to improve cancer care delivery and patient outcomes. *Journal of Oncology Practice*, 13(8), 523.
- Morley, S., Eccleston, C., & Williams, A. (1999). Systematic review and meta-analysis of randomized controlled trials of cognitive behaviour therapy and behaviour therapy for chronic pain in adults, excluding headache. *Pain*, 80(1), 1–13. [https://doi.org/10.1016/S0304-3959\(98\)00255-3](https://doi.org/10.1016/S0304-3959(98)00255-3)
- Morris, Z. S., Wooding, S., & Grant, J. (2011). The answer is 17 years, what is the question: Understanding time lags in translational research. *Journal of the Royal Society of Medicine*, 104(12), 510–520. <https://doi.org/10.1258/jrsm.2011.110180>
- National Center on Complementary and Integrative Health. (2015, August 4). *NIH Analysis Shows Americans Are In Pain*. NCCIH. <https://nccih.nih.gov/news/press/08112015>
- National Institutes of Health. (2019, May 6). *PAR-19-276: Dissemination and Implementation Research in Health (R03 Clinical Trial Not Allowed)*. <https://grants.nih.gov/grants/guide/pa-files/PAR-19-276.html>

- Nguyen, M., Ugarte, C., Fuller, I., Haas, G., & Portenoy, R. K. (2005). Access to Care for Chronic Pain: Racial and Ethnic Differences. *The Journal of Pain*, 6(5), 301–314. <https://doi.org/10.1016/j.jpain.2004.12.008>
- Nielsen, S., Sanfilippo, P., Picco, L., Bruno, R., Kowalski, M., Wood, P., & Larney, S. (2021). What predicts pharmacists' engagement with opioid-outcome screening? Secondary analysis from an implementation study in community pharmacy. *International Journal of Clinical Pharmacy*, 43(2), 420–429. <https://doi.org/10.1007/s11096-020-01074-5>
- Niesen, C. R., Olson, D. M., Nowdesha, K. D., Tynsky, D. A., Loftus, C. G., & Meiers, S. J. (2018). Enhancing Self-management for Adults with Functional Abdominal Pain: A Registered Nurse-Led Cognitive-Behavioral Therapy Approach. *Gastroenterology Nursing*, 41(4), 321–332. Scopus. <https://doi.org/10.1097/SGA.0000000000000322>
- Pizzo, P. A., & Clark, N. M. (2012). Alleviating Suffering 101—Pain Relief in the United States. *New England Journal of Medicine*, 366(3), 197–199. <https://doi.org/10.1056/NEJMp1109084>
- Powell, B. J., Proctor, E. K., & Glass, J. E. (2014). A Systematic Review of Strategies for Implementing Empirically Supported Mental Health Interventions. *Research on Social Work Practice*, 24(2), 192–212. aph.
- Powell, B. J., Waltz, T. J., Chinman, M. J., Damschroder, L. J., Smith, J. L., Matthieu, M. M., Proctor, E. K., & Kirchner, J. E. (2015). A refined compilation of implementation strategies: Results from the Expert Recommendations for Implementing Change (ERIC) project. *Implementation Science*, 10(1), 21. <https://doi.org/10.1186/s13012-015-0209-1>

- Proctor, E. (2017). The pursuit of quality for social work practice: Three generations and counting. *Journal of the Society for Social Work and Research*, 8(3), 335–353. Scopus. <https://doi.org/10.1086/693431>
- Proctor, & Rosen, A. (2008). From knowledge production to implementation: Research challenges and imperatives. *Research on Social Work Practice*, 18(4), 285–291.
- Pugh, D. S., Hickson, D. J., Hinings, C. R., & Turner, C. (1968). Dimensions of Organization Structure. *Administrative Science Quarterly*, 13(1), 65–105. <https://doi.org/10.2307/2391262>
- Purtle, J., Dodson, E. A., Nelson, K., Meisel, Z. F., & Brownson, R. C. (2018). Legislators' Sources of Behavioral Health Research and Preferences for Dissemination: Variations by Political Party. *Psychiatric Services*, appi.ps.201800153. <https://doi.org/10.1176/appi.ps.201800153>
- Purtle, J., Lê-Scherban, F., Shattuck, P., Proctor, E. K., & Brownson, R. C. (2017). An audience research study to disseminate evidence about comprehensive state mental health parity legislation to US State policymakers: Protocol. *Implementation Science*, 12, 1–13. aph.
- Quanbeck, A., Brown, R. T., Zgierska, A. E., Jacobson, N., Robinson, J. M., Johnson, R. A., Deyo, B. M., Madden, L., Tuan, W.-J., & Alagoz, E. (2018). A randomized matched-pairs study of feasibility, acceptability, and effectiveness of systems consultation: A novel implementation strategy for adopting clinical guidelines for Opioid prescribing in primary care. *Implementation Science*, 13(1). Scopus. <https://doi.org/10.1186/s13012-018-0713-1>
- Rabin, B. A., Brownson, R. C., Haire-Joshu, D., Kreuter, M. W., & Weaver, N. L. (2008). A Glossary for Dissemination and Implementation Research in Health. *Journal of Public*

- Health Management and Practice*, 14(2), 117–123.
<https://doi.org/10.1097/01.PHH.0000311888.06252.bb>
- Rabin, B. A., Glasgow, R. E., Kerner, J. F., Klump, M. P., & Brownson, R. C. (2010). Dissemination and Implementation Research on Community-Based Cancer Prevention: A Systematic Review. *American Journal of Preventive Medicine*, 38(4), 443–456. aph.
- Raffoul, M., Moore, M., Kamerow, D., & Bazemore, A. (2016). A Primary Care Panel Size of 2500 Is neither Accurate nor Reasonable. *The Journal of the American Board of Family Medicine*, 29(4), 496–499. <https://doi.org/10.3122/jabfm.2016.04.150317>
- Ramirez, D. A. (1993). Excluded Voices: The Disenfranchisement of Ethnic Groups from Jury Service. *Wisconsin Law Review*, 1993(3), 761–810.
- Ranganathan, P., Pramesh, C. S., & Aggarwal, R. (2017). Common pitfalls in statistical analysis: Measures of agreement. *Perspectives in Clinical Research*, 8(4), 187–191.
https://doi.org/10.4103/picr.PICR_123_17
- Reinecke, H., Weber, C., Lange, K., Simon, M., Stein, C., & Sorgatz, H. (2015). Analgesic efficacy of opioids in chronic pain: Recent meta-analyses. *British Journal of Pharmacology*, 172(2), 324–333.
- Reiss-Brennan, B., Brunisholz, K. D., Dredge, C., Briot, P., Grazier, K., Wilcox, A., Savitz, L., & James, B. (2016). Association of Integrated Team-Based Care With Health Care Quality, Utilization, and Cost. *JAMA*, 316(8), 826.
<https://doi.org/10.1001/jama.2016.11232>
- Rogers, E. M. (2003). *Diffusion of Innovations, 5th Edition*. Simon and Schuster.
- Roy, R. (1981). Social work and chronic pain. *Health & Social Work*, 6(3), 54–62.

- Roy-Byrne, P. P., Sherbourne, C. D., Craske, M. G., Stein, M. B., Katon, W., Sullivan, G., Means-Christensen, A., & Bystritsky, A. (2003). Moving treatment research from clinical trials to the real world. *Psychiatric Services, 54*(3), 327–332.
- Salerno, S. M., Browning, R., & Jackson, J. L. (2002). The effect of antidepressant treatment on chronic back pain: A meta-analysis. *Archives of Internal Medicine, 162*(1), 19–24.
- Scascighini, L., Toma, V., Dober-Spielmann, S., & Sprott, H. (2008). Multidisciplinary treatment for chronic pain: A systematic review of interventions and outcomes. *Rheumatology, 47*(5), 670–678.
- Scurlock-Evans, L., & Upton, D. (2015). The Role and Nature of Evidence: A Systematic Review of Social Workers' Evidence-Based Practice Orientation, Attitudes, and Implementation. *Journal of Evidence-Informed Social Work, 12*(4), 369–399. aph.
- Seaberg, J. R. (1982). Getting there from here: Revitalizing child welfare training. *Social Work, 27*(5), 441–447. aph.
- Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal, 27*(3), 379–423.
- Shannon, & Weaver. (1975). *The mathematical theory of communication* (Sixth). University of Illinois press.
- Shea, C. M., Gertner, A. K., & Green, S. L. (2019). Barriers and perceived usefulness of an ECHO intervention for office-based buprenorphine treatment for opioid use disorder in North Carolina: A qualitative study. *Substance Abuse. Scopus*.
<https://doi.org/10.1080/08897077.2019.1694617>
- Sholomskas, D. E., Syracuse-Siewert, G., Rounsaville, B. J., Ball, S. A., Nuro, K. F., & Carroll, K. M. (2005). We don't train in vain: A dissemination trial of three strategies of training

- clinicians in cognitive-behavioral therapy. *Journal of Consulting and Clinical Psychology*, 73(1), 106.
- Shue, S. A., McGuire, A. B., & Matthias, M. S. (2018). Facilitators and Barriers to Implementation of a Peer Support Intervention for Patients with Chronic Pain: A Qualitative Study. *Pain Medicine*. <https://doi.org/10.1093/pm/pny229>
- Slade, S. C., Kent, P., Patel, S., Bucknall, T., & Buchbinder, R. (2016). Barriers to Primary Care Clinician Adherence to Clinical Guidelines for the Management of Low Back Pain: A Systematic Review and Metasynthesis of Qualitative Studies. *The Clinical Journal of Pain*, 32(9), 800–816. <https://doi.org/10.1097/AJP.0000000000000324>
- Society for Implementation Research Collaboration. (2017). *Instrument Review Project*. SIRC. <https://societyforimplementationresearchcollaboration.org/sirc-instrument-project/>
- Stanhope, V., Videka, L., Thorning, H., & McKay, M. (2015). Moving toward integrated health: An opportunity for social work. *Social Work in Health Care*, 54(5), 383–407. <https://doi.org/10.1080/00981389.2015.1025122>
- Subramanian, K., & Rose, S. D. (1988). Social Work and the Treatment of Chronic Pain. *Health & Social Work*, 13(1), 49–60. <https://doi.org/10.1093/hsw/13.1.49>
- Sullivan, M. D., Turner, J. A., & Romano, J. (1991). Chronic pain in primary care. *J Fam Pract*, 32, 193–199.
- Treede, R.-D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., Cohen, M., Evers, S., Finnerup, N. B., First, M. B., Giamberardino, M. A., Kaasa, S., Kosek, E., Lavand'homme, P., Nicholas, M., Perrot, S., Scholz, J., Schug, S., Smith, B. H., ... Wang, S.-J. (2015). A classification of chronic pain for ICD-11. *Pain*, 156(6), 1003–1007. <https://doi.org/10.1097/j.pain.0000000000000160>

- Turk, D. C., Dansie, E. J., Wilson, H. D., Moskovitz, B., & Kim, M. (2014). Physicians' Beliefs and Likelihood of Prescribing Opioid Tamper-Resistant Formulations for Chronic Noncancer Pain Patients. *Pain Medicine*, *15*(4), 625–636. aph.
- United Health Foundation. (2020). *Explore Primary Care Physicians in Pennsylvania | 2019 Annual Report. America's Health Rankings*.
<https://www.americashealthrankings.org/explore/annual/measure/PCP/state/PA>
- US Department of Agriculture. (2020, December 10). *Rural-Urban Continuum Codes*. Rural-Urban Continuum Codes. <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx>
- US Department of Health and Human Services. (2017, December 4). *What Are Opioids?* [Text]. HHS.Gov; <https://plus.google.com/+HHS>.
<https://www.hhs.gov/opioids/prevention/index.html>
- Varley, A. L., Lappan, S., Jackson, J., Goodin, B. R., Cherrington, A. L., Copes, H., & Hendricks, P. S. (2020). Understanding Barriers and Facilitators to the Uptake of Best Practices for the Treatment of Co-Occurring Chronic Pain and Opioid Use Disorder. *Journal of Dual Diagnosis*, *16*(2), 239–249. Scopus.
<https://doi.org/10.1080/15504263.2019.1675920>
- Veehof, M. M., Oskam, M.-J., Schreurs, K. M. G., & Bohlmeijer, E. T. (2011). Acceptance-based interventions for the treatment of chronic pain: A systematic review and meta-analysis. *PAIN®*, *152*(3), 533–542. <https://doi.org/10.1016/j.pain.2010.11.002>
- Vickers, A. J., Cronin, A. M., Maschino, A. C., Lewith, G., MacPherson, H., Foster, N. E., Sherman, K. J., Witt, C. M., Linde, K., & Acupuncture Trialists' Collaboration. (2012).

- Acupuncture for chronic pain: Individual patient data meta-analysis. *Archives of Internal Medicine*, 172(19), 1444–1453. <https://doi.org/10.1001/archinternmed.2012.3654>
- Vickers, A. J., Vertosick, E. A., Lewith, G., MacPherson, H., Foster, N. E., Sherman, K. J., Irnich, D., Witt, C. M., & Linde, K. (2018). Acupuncture for Chronic Pain: Update of an Individual Patient Data Meta-Analysis. *The Journal of Pain*, 19(5), 455–474. <https://doi.org/10.1016/j.jpain.2017.11.005>
- Wakefield, J. C. (1996). Does social work need the eco-systems perspective? Part 1. Is the perspective clinically useful? *Social Service Review*, 70(1), 1–32.
- Walters, K. L., Spencer, M. S., Smukler, M., Allen, H. L., Andrews, C., Browne, T., Maramaldi, P., Wheeler, D. P., Zebrack, B., & Uehara, E. (2016). Health Equity: Eradicating Health Inequalities for Future Generations. *American Academy of Social Work and Social Welfare*, 32.
- Waltz, T. J., Powell, B. J., Matthieu, M. M., Damschroder, L. J., Chinman, M. J., Smith, J. L., Proctor, E. K., & Kirchner, J. E. (2015). Use of concept mapping to characterize relationships among implementation strategies and assess their feasibility and importance: Results from the Expert Recommendations for Implementing Change (ERIC) study. *Implementation Science*, 10(1), 109. <https://doi.org/10.1186/s13012-015-0295-0>
- Webster, L. R. (2013). Pills, Polices, and Predicaments: The Unintended Consequences of a Health Care System's Policy toward Opioids. *Pain Medicine*, 14(10), 1439–1440. aph.
- Wright, E. R., Carnes, N. A., Smelser, W. G., & Kail, B. L. (2017). Professional Status and Physicians' Views of Expanding Governmental Oversight of Prescribing Drugs. *Socius*, 3, 2378023117707647. <https://doi.org/10.1177/2378023117707647>

- Zhang, M., Zhou, M., Tang, F., Wang, Y., Nie, H., Zhang, L., & You, G. (2020). Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. *Journal of Hospital Infection*, *105*(2), 183–187. <https://doi.org/10.1016/j.jhin.2020.04.012>
- Zhou, C., Crawford, A., Serhal, E., Kurdyak, P., & Sockalingam, S. (2016). The Impact of Project ECHO on Participant and Patient Outcomes: A Systematic Review. *Academic Medicine*, *91*(10), 1439–1461. <https://doi.org/10.1097/ACM.0000000000001328>
- Zisblatt, L., Hayes, S. M., Lazure, P., Hardesty, I., White, J. L., & Alford, D. P. (2017). Safe and competent opioid prescribing education: Increasing dissemination with a train-the-trainer program. *Substance Abuse*, *38*(2), 168–176.