Addressing the Practice Context in Evidence-Based Practice Implementation: Leadership and Climate

by

Clayton John Shuman

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Nursing)
in The University of Michigan
2017

Doctoral Committee:

Professor Marita G. Titler, Chair
Clinical Associate Professor Michelle L. Aebersold
Associate Professor Jane Banaszak-Holl
Associate Professor Xuefeng Liu
Clinical Associate Professor Dana Tschannen

Clayton J. Shuman

clayshu@umich.edu

ORCID iD: 0000-0002-6072-9739

DEDICATION

This dissertation is dedicated to

My wife,

Marissa

My children,

Meryl and Clark

and

My parents,

William and Linda Shuman

ACKNOWLEDGEMENTS

Completion of this dissertation was only made possible with the mentoring and encouragement of faculty and family.

I am forever indebted to the mentorship and guidance of my advisor and committee chair, Dr. Marita Titler, PhD, RN, FAAN. Your encouragement, expectation of "nothing but excellence," expertise, and willingness to afford me tremendous professional and scholarly opportunities were pivotal to my development and success.

To the members of my committee, I am grateful for your encouragement, feedback, criticism, and guidance. Thank you for your interest and investment in my doctoral studies and dissertation research. I believe that no other committee could boast such great accolades and expertise.

Finally, a tremendous amount of gratitude is owed to my wife, Marissa. You willingly sacrificed so much to help me complete this dissertation. Most importantly, while I worked on my doctorate, you brought our two precious children into the world – a feat larger than anything I could ever imagine.

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE

LIST OF TABLES

TABLE

LIST OF APPENDICES

APPENDIX

ABSTRACT

Implementation of evidence-based practices (EBP) is complicated with barriers, many of which are associated with the context of care. However, little is known regarding social dynamic context factors (e.g., leadership and climate) that affect implementation. As leaders of patient care units, nurse managers have a pivotal role in fostering unit climates supportive of implementation of EBPs into care delivery; however, nurse managerial leadership and unit climate are widely overlooked in this area of science. The purposes of this study were to: 1) describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and unit climates for EBP implementation; 2) examine the unique contributions of nurse manager EBP leadership behaviors and nurse manager EBP competencies in explaining unit climate for EBP implementation; and 3) examine the unique contributions of these social dynamic context factors in explaining patient outcomes.

A multi-site, multi-unit cross sectional design was used in this study. Institutional review board approvals at the investigator's site and at each participating hospital were obtained prior to collecting data from a sample of 287 staff nurses and 23 nurse managers from 24 medical-surgical units in 7 acute care hospitals, geographically dispersed across the Northeast and Midwest United States.

While controlling for key confounding variables and nested effects of units in hospitals, nurse manager EBP leadership behaviors (b= 0.64, p < .0001) and EBP competency (b=-0.22, p= .003) explained 50.2% of variance in unit climate for EBP

implementation. In models explaining unit fall rates, unit climates for EBP implementation demonstrated the largest effect (b=-0.86, p<.01). Post hoc mediation analyses provided preliminary evidence suggesting the relationship between nurse manager EBP leadership behaviors and fall rates is mediated by unit climate for EBP implementation. The study identified a need for future work to address nurse manager EBP competency, nurse manager EBP leadership behaviors, and unit climates for EBP implementation in acute care medical-surgical units.

This study is the first to describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and nursing unit climate for EBP implementation. Equipped with EBP leadership behaviors and competencies, nurse managers likely foster practice climates more conducive for EBP implementation resulting in patient receipt of evidence-based care and improved patient outcomes. Future work to develop interventions addressing these social dynamic context factors are needed as well as studies to test the effect of these context factors on implementation processes and outcomes.

CHAPTER 1

INTRODUCTION

Introduction and Research Problem

Since the early 1990s, evidence-based practice (EBP) has been gaining widespread acceptance in health services. Over time, increased attention has been applied to developing an evidence-base that informs care delivery. Findings from clinical trials and effectiveness studies provide evidence that can be summarized and packaged for use in clinical decision-making and care provision (IOM, 2009; Titler, 2008). Examples of EBP resources developed over the last two decades and made available to clinicians and healthcare organizations include: numerous evidence-based clinical practice guidelines and practice recommendations, systematic reviews, evidence-summary reports, and EBP education offerings (e.g., workshops, in-services, webinars). Clinicians engage in EBP by using these resources along with their clinical expertise and their patients' values to guide the delivery of care (Titler, 2014).

Despite the availability of EBP recommendations and resources, the 2014 National Healthcare Quality and Disparities Report, released by the Agency for Healthcare Research and Quality (AHRQ), demonstrated that evidence-based care is delivered only 70% of the time, an improvement of just 4% since 2005 (AHRQ, 2015). This problem demonstrates the gap between the availability of EBP recommendations and the use of these practices at the point of care delivery (Herr et al., 2012; IOM, 2001;

Titler, Shever, Kanak, Picone, & Qin, 2011; Titler, Wilson, Resnick, & Shever, 2013). The lack of routine evidence-based care can lead to adverse patient outcomes, such as healthcare-acquired infections, injurious falls, and pressure injuries (Conway, Pogorzelska, Larson, & Stone, 2012; Shever, Titler, Mackin, & Kueny, 2010; Sving, Gunningberg, Högman, & Mamhidir, 2012).

To improve care delivery, quality, and patient outcomes, it is crucial to address the essential role of implementation science in connecting research findings to optimal health outcomes for all people. This is important because interventions developed in the context of efficacy and effectiveness trials are rarely transferrable without adaptations to specific settings and additional tools and guidance to support uptake, implementation, and sustainability (Newhouse, Bobay, Dykes, Stevens, & Titler, 2013; Titler, 2004; Titler, 2010). Therefore, research is needed to examine the process of transferring interventions into local settings, which may be similar to but also somewhat different from the ones in which the intervention was developed and tested (Titler, 2010).

In hospitals, registered nurses (RN) have the primary responsibility for monitoring and managing care delivery to optimize patient outcomes. RNs are responsible for prevention, early detection and treatment of patient complications, and are optimally positioned to minimize adverse events (Moorhead, 2013). Therefore, RNs play a pivotal role in the implementation of EBPs that improve care quality and patient outcomes (Kiss, O'Malley, & Hendrix, 2010; Melnyk, Fineout-Overholt, & Mays, 2008; White-Williams et al., 2013). However, findings from studies investigating factors contributing to nurses' use of EBPs are equivocal and do not account for the practice context in which nurses provide care (Titler, 2010). A comprehensive understanding is needed of the practice context influencing the application of evidence to improve patient outcomes (AHRQ, 2015; Titler, 2010). The Promoting Action on Research Implementation in Health Services (PARIHS) model defines context as “the environment or setting in which the proposed change is to be implemented” (Kitson, Harvey, & McCormack, 1998, p. 150) and includes leadership and climate, with climate bearing significant influence on implementation success or failure (Harvey & Kitson, 2015a; Kitson et al., 2008; Klein & Sorra, 1996).

As the “linkers” between executive leadership strategic development and clinician delivery of care, nurse managers are ideally situated within an organization to influence patient outcomes by means of leading EBP implementation efforts and fostering an EBP climate (Birken, Lee, & Weiner, 2012; Steinberg, Greenfield, Mancher, Wolman, & Graham, 2011). Nurse managers are responsible for supervision of their unit(s), including staffing, maintaining budgets, ensuring excellent nursing practice, facilitating quality improvement, and promoting patient safety. In light of these responsibilities, the task of facilitating EBP integration, as well as, fostering an EBP unit climate is highly influenced by the leadership of nurse managers. But there is a paucity of research regarding the influence of nurse managers on EBP implementation (Birken et al., 2012; Carney, 2006; Gifford, Davies, Edwards, Griffin, & Lybanon, 2007; Sandström, Borglin, Nilsson, & Willman, 2011; Wilkinson, Nutley, & Davies, 2011; Wong, Cummings, & Ducharme, 2013). Some evidence supporting the relationship between nurse leaders and patient outcomes, safety, and satisfaction has been demonstrated (Wong et al., 2013; Cummings, Midodzi, Wong, & Estabrooks, 2010), however, there are few well-designed studies to support this relationship (Wong et al., 2013). Despite EBP competency being one of five core competencies espoused by the Institute of Medicine (Greiner & Knebel, 2003), nurse managers report a lack of confidence in EBP knowledge and skills (Gifford, Lefebre, & Davies, 2014; Hutchinson & Johnston, 2006).

Implementation of EBP occurs within widely diversified practice environments, or contexts. For the purposes of this dissertation, context is comprised of two major categories: 1) structural context factors, and 2) social dynamic context factors. Structural context factors are defined as characteristics of the setting, such as, staffing, unit size, and types of patients cared for in the unit. Social dynamic context factors pertain to the roles, relationships, and dynamics of the individuals and groups within a setting and are defined in this dissertation as unit climate for implementation, nurse manager leadership behaviors for EBP, and nurse manager competency for EBP.

Previous research has identified structural context factors (e.g., staffing; unit/hospital size; characteristics of patients cared for in unit) which influence EBP implementation and patient outcomes (3M, 2015; Dunton, Gajewski, Taunton, & Moore, 2004; Halm, Lee, & Chassin, 2002; Herr et al., 2012; Howell, Bessman, Marshall, & Wright, 2010; Kerr et al., 2010; Lang, Hodge, Olson, Romano, & Kravitz, 2004; Shever & Titler, 2012; Titler et al., 2016; Titler, Dochterman, et al., 2007; Titler, Dochterman, Picone, & Everett, 2005; Titler et al., 2009; Titler et al., 2008; Titler et al., 2011; Twigg, Duffield, Bremner, Rapley, & Finn, 2012). However, little is known about social dynamic context factors, such as, nurse manager EBP competencies and EBP leadership behaviors, and how these factors foster nursing unit climates that are evidence-based, promote implementation of EBPs by staff, and improve patient outcomes.

Statement of Purpose and Specific Aims

The purpose of the this multisite, multiunit cross-sectional study is to describe the EBP competencies of nurse managers, nurse manager EBP leadership behaviors, and the unit climate for EBP implementation in acute care hospitals, and to examine the unique contributions of these variables on the patient outcomes of falls, catheter associated urinary tract infection, and nosocomial pressure injuries.

Nurse managers are believed to play an important role in promoting EBP on clinical units (Birken et al., 2012; Gifford et al., 2007; Sandstrom et al., 2011). There is, however, a dearth of research focused on EBP competencies and EBP leadership behaviors of nurse managers and the effect on unit climate for EBP implementation. There are no multi-site studies that have demonstrated the effect of these context factors on patient outcomes; there is a need for studies to explicate these relationships. The proposed study addresses this gap in the science with a long-term goal of testing implementation interventions targeted to social dynamic context factors to improve evidence-based care delivery and patient outcomes.

To address the study purpose, the following specific aims were set forth:

Aim 1: To describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and unit climates for EBP implementation in hospital settings.

a. To describe the EBP competencies of nurse managers in hospital settings as perceived by nurse managers.
b. To describe the EBP leadership behaviors of nurse managers in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

c. To describe the unit climates for EBP implementation in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

d. To test for differences among staff nurse and manager perceptions of 1) EBP implementation leadership behaviors (subscale and total scores) and 2) unit climates for EBP implementation (subscale and total scores).

Aim 2: To examine the unique contributions of nurse manager EBP competencies and nurse manager EBP leadership behaviors (staff nurse reported) in explaining unit climates of EBP implementation (staff nurse reported) after controlling for staff nurse level of nursing education and years of experience as a registered nurse on current unit.

Aim 3: To explore the relationships among nurse manager EBP competencies (nurse manager reported), nurse manager EBP leadership behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and selected patient outcomes (inpatient fall rates, catheter-associated urinary tract infection rates, and nosocomial stage III and IV pressure injury rates) in hospital settings.

a. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining inpatient fall rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

b. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining catheter-associated urinary tract infection rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.
c. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining nosocomial stage III and IV pressure injury rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

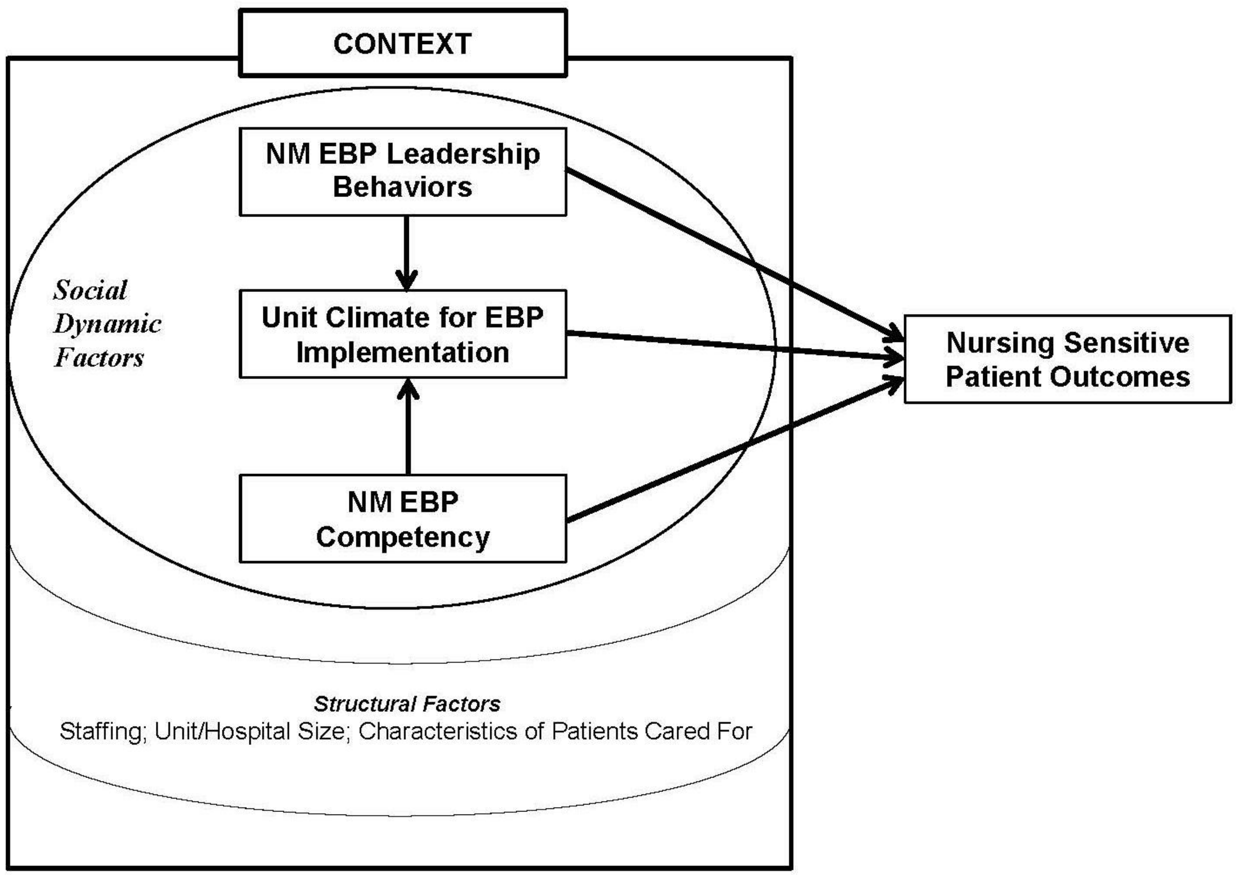
Research Design

A multi-site, multiunit cross-sectional design was used to address the specific aims. Since no studies were found that investigated the competencies and leadership behaviors of nurse managers regarding EBP, unit climates for EBP implementation, and the impact of these context variables on patient outcomes, this study helps to identify the social dynamic context factors that contribute to EBP implementation and patient outcomes, as well as, provides the foundation needed to inform future implementation intervention development and testing.

Conceptual Model

A conceptual model developed for this study was derived from the Promoting Action on Research Implementation in Health Services (PARIHS) framework (Kitson et al., 1998). According to the PARIHS model successful implementation is a function of the interrelations between three key elements: evidence, context, and facilitation (Kitson et al., 2008). As stated in the aims, this study describes context factors influencing implementation (Aim 1). In the PARIHS model, context is defined as “the environment or setting in which the proposed change is to be implemented” (Kitson et al., 1998, p. 150) and includes leadership and climate with climate bearing significant influence on implementation success or failure (Harvey & Kitson, 2015a; Kitson et al., 2008; Klein & Sorra, 1996; McCormack et al., 2002). The conceptual model of this dissertation study explores the relationships (1) among social dynamic context factors (nurse manager leadership behaviors, nurse manager EBP competencies, and unit climates for EBP implementation), and (2) the influence of these social dynamic variables on patient outcomes. Structural context variables that describe additional setting characteristics of context affecting patient outcomes (e.g., staffing; unit/hospital size; characteristics of patients cared for in the unit) are included as confounding effects. Specifically, the model (Figure 1.1) is composed of four main concepts: (1) nurse manager EBP leadership behaviors; (2) nurse manager EBP competencies; (3) unit climate for EBP implementation; and (4) nursing sensitive patient outcomes. According to the model, nurse manager EBP competencies, and nurse manager EBP leadership behaviors have a unique effect on the unit climate for EBP implementation (Aim 2), with each of these three social dynamic context variables uniquely explaining variations in nursing sensitive patient outcomes (Aim 3). In Figure 1.1, social dynamics and structural factors are found within the context. This dissertation examines the social dynamic context factors while controlling for structural context factors.

Figure 1.1. Conceptual Model for Dissertation Study



CHAPTER 2

DEFINITIONS, THEORY, AND LITERATURE REVIEW

As noted in the National Institute of Nursing Research's (NINR) strategic plan, the knowledge advanced from implementation science coupled with health care environments that promote the use of evidence-based practices will help close the evidence practice gap (NINR, 2016). Advancements in implementation science can expedite and sustain the successful integration of evidence in practice to improve care delivery and patient outcomes (Henly, McCarthy, Wyman, Heitkemper, et al., 2015; Henly, McCarthy, Wyman, Stone, et al., 2015). However, progress has been inhibited by a lack of a common taxonomy in implementation science; failure of current implementation conceptual frameworks and models to fully explain the context factors influencing implementation efforts, interventions, and outcomes; and lack of attention regarding the effect of acute care context factors on implementation in published implementation studies (Eccles et al., 2009; Proctor et al., 2011; Titler, Everrett, & Adams, 2007; Titler, 2010).

The purposes of this chapter are twofold: (1) to describe the current state of the science in implementation research, particularly in nursing and context, and (2) to identify significant gaps within implementation science that this dissertation addresses. To accomplish these purposes, the first section of this chapter discusses taxonomical shortcomings and incongruences affecting implementation science. Next, common implementation conceptual frameworks and models to guide implementation research are presented, with an emphasis on the PARIHS framework, which provides the theoretical underpinnings of this dissertation study. Next, the state of science on implementation in nursing and regarding context is reviewed. Finally, I discuss measurement issues and challenges in implementation science (e.g., implementation outcomes and patient outcomes) while elucidating specific connections to this dissertation study.

What is Implementation Science?

The field of implementation science is a relatively new area of investigation that aims to speed the translation of scientific evidence into practice to improve patient outcomes and public health. For centuries, scientists have amassed a wealth of knowledge regarding health promotion, illness prevention, and treatment of disease. Additionally, with the advent of modern healthcare systems (e.g. acute care hospitals, patient-centered medical homes), significant work has been done to improve care delivery and quality. As the evidence-based practice (EBP) approach to health care delivery gained increased attention in the 1990s, investigators and clinicians discovered that translating the evidence base into clinical settings proved difficult. This problem is partially attributed to a lack of understanding of the facilitators and barriers to successful implementation, as well as, effective strategies for implementing evidence into routine practice (Titler, 2004; Titler, 2010). Therefore, to address these shortcomings, translation sciences (e.g. effectiveness, dissemination, implementation) emerged in an effort to understand these factors and increase the adoption and use of EBP recommendations in care delivery (Bero et al., 1998).

Implementation science is a relatively newer field with demonstrated success in speeding the translation of scientific knowledge to clinical practice. In its early stages, this new field of scientific inquiry emerged empirically rather than theoretically (Eccles, Grimshaw, Walker, Johnston, & Pitts, 2005). However, over the past decade, various conceptual models and frameworks have been developed and adopted to guide implementation research in (1) describing barriers and facilitators to successful implementation; (2) developing and testing implementation interventions to promote adoption of EBPs; and (3) addressing the methodological issues and instrumentation in implementation science (Newhouse et al., 2013; Nilsen, 2015).

As an emerging science, this field of inquiry has been referred to by numerous related, although not synonymous, terms including: translational science, effectiveness science, dissemination science, implementation science, and knowledge translation (McKibbon et al., 2010; Newhouse et al., 2013). Despite varying terminology, there is international agreement regarding the overall goal: to address the challenges associated with integration and use of research findings and EBP recommendations in care delivery and decision-making. This collective objective has led to the formation of academic journals, like *Implementation Science* and *Translational Behavioral Medicine*, which are specifically interested in advancing the body of science in this field. However, the inconsistent terminology and lack of a common taxonomy impedes theoretical formulation and scientific progress (Proctor, 2014). The following section discusses and defines a selected group of terms commonly attributed to this field.

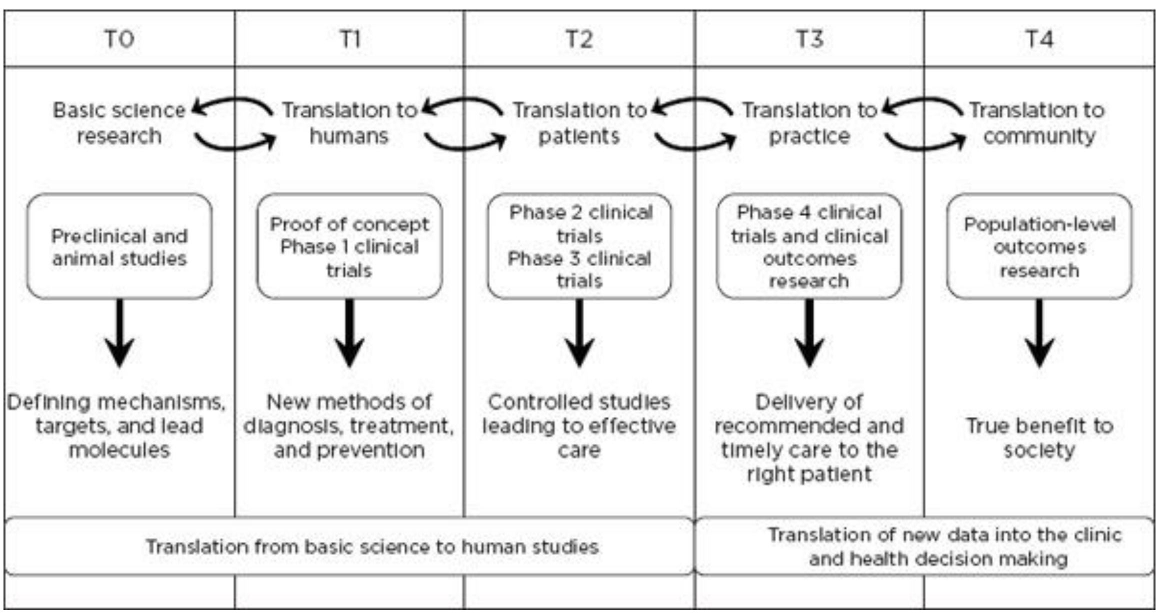
Definitions

The most frequently used terms to describe the scientific study of methods to promote the systematic translation of research findings into care delivery include: translational science, effectiveness science, dissemination science, implementation science, and knowledge translation. Clear and accepted conceptual definitions of these terms are needed to advance theory building in this field of inquiry (Graham et al., 2006; Mitchell, Fisher, Hastings, Silverman, & Wallen, 2010).

Translational science. Translational science has received widespread attention following the publication of the National Institutes of Health (NIH) Roadmap in 2003, along with the development of Clinical and Translational Science Awards (CTSA) in 2006 (Zerhouni, 2005; Zerhouni & Alving, 2006). NIH defines translational research within two broad categories: (1) the translation of basic science and preclinical findings into human subjects research and (2) the translation of evidence-based practices and research findings and knowledge into clinical and community settings (NIH, 2013b; van der Laan & Boenink, 2012). These two areas are often colloquially referred to in the literature as “bench-to-bedside” and “bedside-to-community” research (Drolet & Lorenzi, 2011; ITHS, 2016; Khoury et al., 2007).

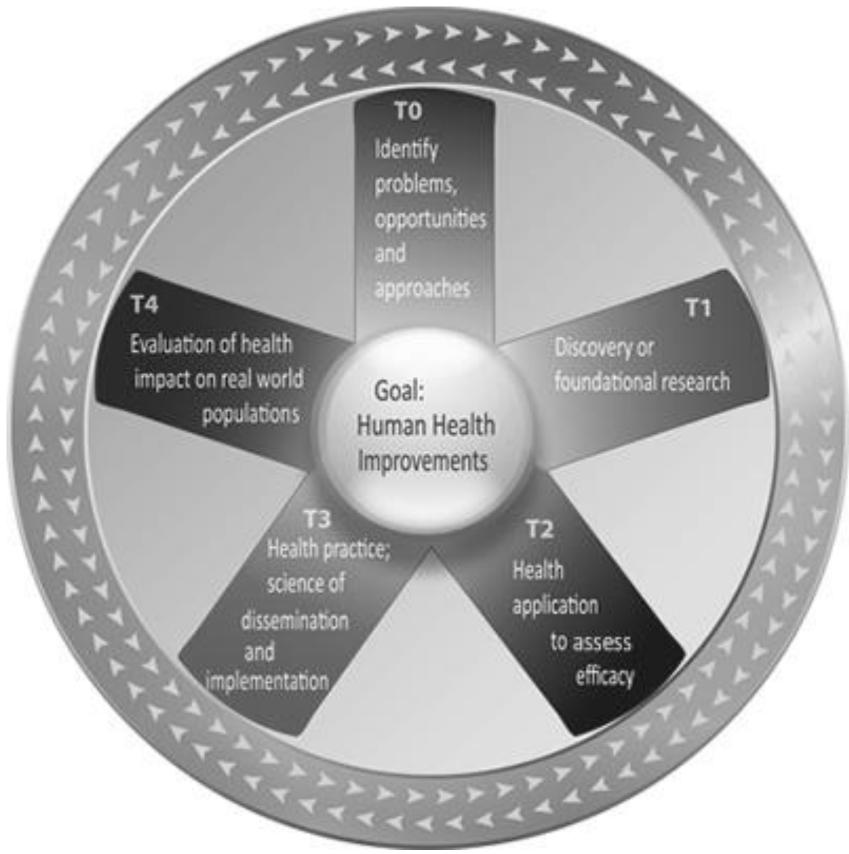
As translation research advances and evolves, it is apparent that translation science is tremendously complex and involves more than just two, step-like categories (Westfall, Mold, & Fagnan, 2007). The Institute of Medicine’s (IOM, 2013) report on CTSAs suggests that translation research consists of five phases, reflecting a conceptual progression across a dynamic continuum from basic science (T0) (e.g., laboratory, preclinical studies) to care delivery in clinical and community settings (T3 and T4) (Figure 2.1). The IOM's conceptualization depicts translational research as a linear progression with distinct beginning and end points. Even though the model includes feedback loops between each phase, it fails to describe the circular, interacting nature of translation research across all translation phases. The Institute of Translational Health Sciences' (ITHS, 2016) model addresses this critique by illustrating the same five phases explicated by IOM as occurring in a circular and continuous manner (Figure 2.2).

Figure 2.1. IOM Phases of Translation Research



(IOM, 2013)

Figure 2.2. ITHS T-Phases of Translational Health Research



(ITHS, 2016)

As noted by Woolf (2008) and demonstrated above, translational research means different things to different people but it seems important to almost everyone. For the science to advance, it is crucial that investigators agree on how translational research is conceptualized and operationalized. Conceptualizing translational research as a linear process on a continuum from laboratory to sustainability fails to articulate the dynamic and iterative nature of translational research. Rather than a continuous progression through phases, translational research involves integrative, dynamic, and overlapping scientific activities contributing to and reflecting the iterative nature and evolution of knowledge creation and application. After basic scientific discovery, each phase of translation research is in itself a form of knowledge translation and/or clinical application. Effectiveness, dissemination, and implementation sciences are translational sciences and activities, falling within the broad scope of translational research. However, nearly a decade after the launch of the NIH CTSA program, most activity has focused on improving the translation of basic science discoveries into clinical trials, rather than the implementation of effective interventions into patient care and community settings (Mittman, Weiner, Proctor, & Handley, 2015).

Effectiveness science. Effectiveness science is concerned with the impact and value of efficacious interventions in real-world settings. The goal of effectiveness research is to test and enhance the generalizability of valid results achieved in efficacy studies across different populations and settings (Potempa, Daly, & Titler, 2012; Titler & Pressler, 2011). Effectiveness science is translational in that it aims to translate efficacious interventions (T1 phase of translational research) into real-world settings (T2 phase of translational research). One type of effectiveness science is comparative effectiveness research (CER), which compares at least two effective interventions in actual day-to-day clinical settings (IOM, 2009; Lauer & Collins, 2010; Sox & Greenfield, 2009). Findings from CER provides evidence regarding which interventions are most beneficial and for which population (IOM, 2009). This knowledge is exceptionally valuable to providers and health care consumers as they weigh care and treatment options. More studies are needed to test the effectiveness of promising interventions with significant and impactful clinical findings into real-world clinical settings with heterogeneous populations (IOM, 2009; Titler & Pressler, 2011). Results from effectiveness and comparative effectiveness studies provide an evidence base upon which clinicians, patients, and other decision-makers can make health care decisions and guide the delivery of care (IOM, 2009; Potempa et al., 2012; Titler & Pressler, 2011).

Implementation studies are sometimes considered a type of effectiveness science in that many involve the translation of efficacious and effective interventions into a local practice setting. As noted later in this chapter, implementation studies commonly report the effectiveness of an EBP intervention on a clinical topic (e.g., the impact of an implementation of a fall prevention bundle on the number of patient falls). A key distinction between effectiveness and implementation science is that implementation science is primarily interested in the development and testing of various strategies and mechanisms influencing successful uptake and use of EBPs in various practice contexts.

Dissemination science. The National Institutes of Health (NIH) has defined dissemination as “the targeted distribution of information and intervention materials to a specific public health or clinical practice audience” with the intent to “spread (‘scale up’) and sustain knowledge and the associated evidence-based interventions” (NIH, 2013a). Thus, dissemination science is concerned with “how, when, by whom, and under what circumstances research evidence spreads throughout the agencies, organizations, and front line workers providing public health and clinical services” (Glasgow et al., 2012; NIH, 2013a).

Communication and distribution of research findings are the major mechanisms in dissemination research and involve knowing how to package and convey research findings for uptake and use in local settings and communities (Brownson, Colditz, & Proctor, 2012; Proctor, 2014). It is imperative to understand the characteristics, needs, and preferences of the stakeholders on the receiving end, as well as, those responsible for disseminating research findings to inform decision-making (Tinkle, Kimball, Haozous, Shuster, & Meize-Grochowski, 2013). Though linked in their use of planned strategies and interventions, dissemination science differs from implementation science in that its driving aim is the communication and distribution of research findings to identified stakeholders (Rabin et al., 2012). Studies are needed to identify mechanisms and approaches to package and communicate the evidence-based information to effectively improve public health and clinical care services in ways relevant to local settings and that balance fidelity and adaption (NIH, 2013a).

Implementation science. The National Institutes of Health has placed significant attention on implementation research and defines implementation as "the use of strategies to adopt and integrate evidence-based health interventions and change practice patterns within specific settings" (NIH, 2013a). Implementation research is the scientific study of methods to promote the integration of research findings and evidence-based interventions into healthcare and policy. Implementation science seeks to understand the behavior of healthcare professionals and support staff, healthcare organizations, healthcare consumers, and policymakers in context as key variables in the adoption, implementation, and sustainability of evidence-based interventions and guidelines (NIH, 2013a).

In addition to the NIH definition, experts in the implementation field have provided clear and more comprehensive definitions that portray implementation as an activity and a science. Eccles and Mittman (2006) define implementation science as the “scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services” (p. 1). Though their definition recognizes uptake and routinization of EBP to improve care quality, it fails to acknowledge identification and testing of implementation interventions, adoption of EBPs at multiple levels (e.g., clinician, unit, organization), and sustainability of implemented EBPs.

A more comprehensive definition is provided by Titler, Everett, et al. (2007), who define implementation science as the

> “Investigation of methods, interventions, and variables that influence adoption of evidence-based healthcare practices by individuals and organizations to improve clinical and operational decision making, and includes testing the effectiveness of interventions to promote and sustain use of evidence-based healthcare practices” (p. S53).

This definition more precisely delineates key factors and elements comprising implementation science. We cannot assume that empirically supported interventions can be transferred into any service setting without attention to the local context, nor that a unidirectional flow of information (e.g., publishing a recommendation, trial, or guideline) is sufficient to achieve practice change (NIH, 2013a). Implementation studies develop a knowledge base about “how” interventions are transmuted into real-world practice settings, and the mechanisms that are effective to promote successful uptake and use of the scientific findings in communities and healthcare organizations. Therefore, the definition provided by Titler, Everett, et al. (2007) serves as the definition of implementation science used in this dissertation because this study investigates context factors (e.g., leadership and climate) that affect how EBP interventions are successfully implemented in practice settings.

Knowledge translation. Dissemination and implementation is often confused with knowledge translation. Knowledge translation is a term primarily used in Canadian implementation research and is defined by the Canadian Institute for Health Research (CIHR) as “a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge” (CIHR, 2016). Synthesis refers to the integration of research studies into one body of knowledge (e.g. systematic review, evidence summary report). Dissemination involves identification of the stakeholders and tailoring communication strategies to impart synthesized knowledge to these stakeholders. The exchange component refers to the interaction between the stakeholders and the researchers. This interaction is a mutual learning process and provides a platform for integrating new knowledge in decision-making processes. The final component of the CIHR knowledge translation definition is the ethically-sound application of knowledge, that is assuring that the synthesized evidence and translation actitivities are congruent with the ethical norms of the consumer, practice agency, and regulatory bodies.

Knowledge translation has similar features to the other terms mentioned above, namely dissemination as both are concerned with the uptake and use of disseminated knowledge in clinical practice (Estabrooks, 2007). Knowledge brokers facilitate the translation of knowledge to stakeholders. Bornbaum, Kornas, Peirson, and Rosella's (2015) systematic review identified the knowledge broker role as a knowledge manager, linkage agent, and capacity builder; however, the effectiveness of knowledge brokers as a knowledge translation mechanism remains unclear. Knowledge translation is quite similar to knowledge transfer, which is defined as the process of moving knowledge from producers to users (Graham et al., 2006). However, knowledge transfer has been criticized as unidirectional with limited interest in actual implementation processes supporting knowledge transfer (Graham et al., 2006). The transfer of knowledge into practice settings is only one aspect of implementation science, which is further interested in the uptake and use of EBPs and interventions.

Summary. This dissertation focuses on the science of implementation, that is, understanding the mechanisms and contexts promoting the uptake and use of evidence in care delivery. By increasing our knowledge regarding "how" and "why" interventions are successfully implemented in various contexts, we can more readily speed the translation of evidence-based practices into care delivery and improve patient outcomes and public health. As noted by many, there is a tremendous need for significant advancements and efforts in implementation science in order to accomplish this (Mittman et al., 2015; Titler, 2010, 2014; Titler et al., 2013).

Conceptual Models for Implementation Science

Multiple models of implementation have been set forth and are based on the theoretical underpinnings of social-cognitive theory, diffusion of innovation, theory of planned behavior change, normalization process theory, and social networking theory (Davies, Walker, & Grimshaw, 2010; Estabrooks, Thompson, Lovely, & Hofmeyer, 2006; May, 2013; May & Finch, 2009; Nilsen, 2015; Tabak, Khoong, Chambers, & Brownson, 2012). A number of implementation models are based upon Everett Rogers' well-established Diffusion of Innovations (DI) theory (Kitson et al., 1998; Greenhalgh, Robert, MacFarlane, Bate, & Kyriakidou, 2004; Titler and Everett, 2001). DI involves five main elements: innovation, adopters, communication channels, time, and social system (Rogers, 2003). The DI contends that diffusion is the process by which an innovation is communicated through various channels over time to individuals (e.g., nurses) within a social system (Rogers, 2003; Titler & Everett, 2001; Titler et al, 2009; Titler et al, 2016). Implementation science should be based on a conceptual framework or model to gain insight into the mechanisms by which implementation strategies work in some settings, under what circumstances, and why (Davies et al., 2010; Mitchie, Johnston, Francis, Hardeman, & Eccles, 2007; Tabak et al., 2012; Titler, 2010).

Over the last decade, many conceptual models have been developed and are available to facilitate implementation research (see Table 2.1). Some efforts have attempted to develop an overarching model of implementation (Cook et al., 2012; Damschroder, Aron, et al., 2009; Greenhalgh et al., 2004; May, 2013; Moullin, Sabater-Hernández, Fernandez-Llimos, & Benrimoj, 2015). May (2013) describes the purpose of implementation theory is to develop a "robust set of conceptual tools that enable researchers and practitioners to identify, describe, and explain important elements of implementation processes and outcomes" (p. 2). Despite these efforts, others argue that multiple perspectives have more utility compared to an overarching theory (Estabrooks et al., 2006).

Since many implementation models are available, it is imperative that investigators not only explicitly cite the model underpinning their study, but also integrate these models in the development of specific aims or hypotheses, design of the study, development and testing of implementation strategies, and selection and measurement of study variables and outcomes (Field, Booth, Ilott, & Gerrish, 2014; Rycroft-Malone et al., 2013). Table 2.1 provides an overview and comparison of seven selected conceptual models used to guide implementation research. These models were selected because they are commonly cited in implementation research studies. Main constructs and concepts of each conceptual approach are presented, along with brief evaluations of their strengths and limitations.

Many similarities and differences were noted across the selected implementation models. Five of the seven models include the characteristics specific to the innovation, evidence, or knowledge being implemented. All include a diffusion or communication mechanism, such as, facilitation (e.g., PARIHS), communication processes (e.g., Translation Research Model), persuasion (e.g., Dissemination and Use of Research Evidence for Policy and Practice), and diffusion and dissemination (e.g., Diffusion of Innovations in Service Organizations). Only three of the selected frameworks and models identify an outcome of implementation (Dobbins, Ciliska, Cockerill, Barnsley, & DiCenso, 2002; Glasgow, Vogt, & Boles, 1999; Titler & Everett, 2001). Although all included models and frameworks involve context, none clearly and comprehensively describe the context dimension. Finally, very few identify and delineate the dynamic, interrelationships between the constructs and concepts, which may be distinct but have multiple overlapping sub-elements. Despite these limitations, these selected frameworks and models have proven application and relevance in implementation research in that they guide the selection and development of implementation strategies, selection of variables, outcomes, and measures, and evaluation of implementation processes and outcomes.

Table 2.1. Selected Conceptual Models Used in Implementation Science

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
Promoting Action on Research Implementation in Health Services (PARIHS) Kitson, Harvey, & McCormack (1998).	Evidence. Context. Facilitation.	*Evidence* 1. Research. 2. Clinical experience. 3. Patient experience. 4. Local data/information. *Context* 1. Culture. 2. Leadership. 3. Evaluation. *Facilitation* 1. Purpose/Role. 2. Skills and Attributes.	Identifies an outcome. Flexible and applicable to multiple settings. Clearly explicates how to use the framework to guide diagnostic analysis of evidence and context - which will guide facilitation strategies. Includes local data and information.	Lack of conceptual clarity. Overlapping sub elements. Facilitation only addresses the role and the individual fulfilling the role and does not include implementation interventions. Does not capture the dynamic interrelationships between the components. Main outcome of successful implementation is unclear and vague.	Balbale et al. (2015) Cummings et al. (2007) Helfrich, Li, Sharp, & Sales (2009) Ward, Baloh, Zhu, & Stewart (2017)

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
Titler and Everett Translation Research Model Titler & Everett (2001).	Characteristics of the innovation. Communication process. Users. Social System.	*Characteristics of the innovation* 1. Nature and credibility 2. Localization 3. Practice prompts *Communication process* 1. Methods. 2. Audience *Users* 1. Characteristics of the users. 2. Adoption strategies. *Social System* 1. Leadership 2. Organization characteristics 3. Social system interventions	Includes implementation interventions for each domain. Addresses the context as user and social system. Identifies an outcome.	Does not include knowledge and/or innovation development. Does not address the outer context (e.g., policy, regulating agencies, community).	Titler et al. (2009) Herr et al. (2012) Titler et al, 2016; Dockham et al, 2016

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
Knowledge-To-Action Cycle Graham et al. (2006).	Knowledge creation. Action/application.	*Knowledge Creation* 1. Knowledge inquiry. 2. Synthesis 3. Products/tools. 4. Tailoring knowledge. *Action Cycle* 1. Identify problem 2. Identify, review, select knowledge. 3. Adapt knowledge to local context. 4. Assess barriers to knowledge use. 5. Select, tailor, implement interventions. 6. Monitor knowledge use. 7. Evaluate outcomes. 8. Sustain knowledge use.	Incorporates the knowledge creation process. Includes empirical and experiential knowledge. Captures the dynamic nature of implementation. Addresses the context in the knowledge creation as well as the action phase. Addresses sustainability.	Fails to explicate evaluation of implementation outcomes. Level of application (micro, macro) is unclear.	Brosseau et al. (2012) McLeod et al. (2015)

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
Dissemination and Use of Research Evidence for Policy and Practice Dobbins, Ciliska, Cockerill, Barnsley, & DiCenso (2002).	Knowledge. Persuasion. Decision. Implementation. Confirmation.	*Knowledge* 1. Identification of evidence 2. Selection of evidence *Persuasion* 1. Innovation characteristics 2. Individual characteristics 3. Organizational characteristics 4. Environmental characteristics *Decision* 1. Decision to adopt evidence *Implementation* 1. Dissemination of information about the innovation 2. Includes implementation interventions *Confirmation* 1. Process and outcome evaluation to judge success of innovation adoption	Helps organizations identify areas for capacity development. Provides an easy to understand approach to implementation. Intended for multiple users (knowledge brokers; informaticians; nurses; policy-makers; managers).	The step-approach to implementation is too simplistic – does not capture the complexity of the dynamic process. Weak attention to the importance of context and organizational, environmental, and individual characteristics.	Armstrong, Waters, Crockett, & Keleher (2007) Jack et al. (2010).

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
Normalization Process Model May (2006; May et al., 2016).	Interactional workability. Relational integration. Skill-set workability. Contextual integration.	*Interactional workability* 1. Congruence (cooperation, legitimacy, and conduct) 2. Disposal (goals, meaning, and outcomes) *Relational integration* 1. Accountability (validity, expertise, dispersal) 2. Confidence (credibility, utility, and authority) *Skill-set workability* 1. Allocation (distribution, definition, and surveillance) 2. Performance (boundaries, autonomy, and quality) *Contextual integration* 1. Execution (resourcing, power, and evaluation) 2. Realization (risk, action, and value)	Conceptualizes the complex nature of practice implementation. Applicable for various settings. Recognizes characteristics of the individual adopters.	Context dimension is vague. Fails to include leadership factors. Does not explicate implementation interventions or strategies for normalization.	Elwyn, Légaré, van der Weijden, Edwards, & May (2008) Gask et al. (2010)

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
Diffusion of Innovations in Service Organizations Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou (2004).	Innovation. Adoption by individuals. Assimilation by the system. Diffusion and dissemination. System antecedents for innovation. System readiness for innovation. Outer context: interorganizational networks and collaboration. Implementation and routinization.	*Innovation* Relative advantage; Compatibility; Complexity; Trialability; Observability; Reinvention; Fuzzy boundaries; Risk; Task issues; Knowledge required to use it; Augmentation/support *Adoption by individuals* General psychological antecedents; Context-specific psychological antecedents; Meaning; Adoption decision; Concerns in preadoption stage; Concerns during early use; Concerns in established users *Assimilation by the system.* *Diffusion and dissemination* Network structure; Homophily; Opinion leaders; Harnessing opinion leader's influence; Champions; Boundary spanners; Formal dissemination programs *System antecedents for innovation* Structural determinants of innovativeness; Absorptive capacity for new knowledge; Receptive context for change *System readiness for innovation* Tension for change; Innovation-system fit; Assessment of implications; Support and advocacy; Dedicated time and resources; Capacity to evaluate the innovation *Outer context: interorganizational networks and collaboration* Informal interorganizational networks; Intentional spread strategies; Wider environment; Political directives *Implementation and routinization* Organizational structure; Leadership and management; Human resource issues; Funding; Intraorganizational communication; Interorganizational networks; Feedback; Adaptation/reinvention	Addresses the individual and system characteristics. Extensively covers the many factors in implementation.	Very complex. Difficult to apply in practice and test in research.	Many studies cite this as one of many frameworks guiding research. However, no exemplar studies were identified.

Conceptual Model Name and Citation	Main Constructs	Main Concepts *(Constructs in italics)*	Strengths	Limitations	Examples of Studies Using the Framework or Model
RE-AIM Framework Glasgow, Vogt, & Boles (1999).	Reach. Efficacy. Adoption. Implementation. Maintenance.	*Reach* 1. Characteristics of the recipients 2. Characteristics of the participants *Efficacy* 1. Positive outcomes 2. Negative outcomes *Adoption* *Implementation.* *Maintenance.*	Incorporates individual and organization level. Prioritizes interventions to be implemented based on reach and efficacy.	Conceptualization of adoption, implementation, and maintenance are vague. Adoption and implementation are not well differentiated.	Dzewaltowski, Glasgow, Klesges, Estabrooks, & Brock (2004) Glasgow, McKay, Piette, & Reynolds (2001) King, Glasgow, & Leeman-Castillo (2010)

Conceptual Model for Dissertation Study

This dissertation study is based on the Promoting Action on Research Implementation in Health Services (PARIHS) model (Harvey & Kitson, 2015a; Harvey et al., 2002; Kitson et al., 1998; Rycroft-Malone, 2004; Rycroft-Malone et al., 2002). This model is widely used prospectively to guide implementation projects and research (Balbale et al., 2015; Cummings, Estabrooks, Midodzi, Wallin, & Hayduk, 2007; Helfrich et al., 2010; Ward, Baloh, Zhu, & Stewart, 2017). The PARIHS model contends that successful implementation of research into practice is a function of interplay among the evidence, facilitation, and context. When each of these elements is considered “high-level”, successful implementation is more likely to be achieved.

The level of evidence to inform clinical practice can either be low or high. High-level evidence is supported by significant and well-designed research (e.g., demonstrated effectiveness in RCTs; systematic reviews), clinical expertise, patient experience, and is relevant to the local setting (Kitson et al., 1998). The PARIHS model’s definition of evidence aligns well with the definition of evidence-based practice used in this dissertation, which identifies that care delivery and decision-making should be predicated on the best available evidence in conjunction with clinician expertise and patient preferences (Titler, 2014). In addition, PARIHS includes local data and information in determining the strength of evidence.

In the PARIHS model, facilitation refers to the process of supporting or enabling the implementation of evidence into care delivery (Harvey et al., 2002). Facilitation includes numerous roles and activities that range in level of involvement with the implementation (e.g., supporting specific goals; general efforts to transforming the culture to be more conducive to EBP implementation) to support and manage the implementation (Harvey & Kitson, 2015a). PARIHS presents two levels of facilitation on a continuum, low and high. High-level facilitation is holistic and relational, and it enables stakeholders to adopt the practice change. Low-level facilitation, on the other hand, is task-oriented without a focus on developing partnerships, relationships, and climates that enable successful implementation (Harvey & Kitson, 2015a).

Context refers to the setting or environment in which the evidence is to be implemented. Contextual factors influencing successful implementation fall into three broad and interrelated domains: culture, leadership, and evaluation. Organizations and patient care units with high organizational receptivity and capability for change are more likely to achieve successful implementation of evidence into practice (French et al., 2009; Greenhalgh et al., 2004). In addition, these organizations tend to have decentralized decision-making processes, adaptive clinicians who are flexible and open to change, facilitative management styles and organizational structure, and motivating leaders who provide timely and useful evaluative feedback at multiple levels (e.g., individual, team, unit, or system).

The PARIHS model was selected to guide this dissertation study because of its attention to the context in which the implementation is situated and identifies an outcome (successful implementation). The model recognizes that some practice contexts are more conducive than others to successful implementation, which may be due in part to leadership and organization characteristics and processes (Kitson et al., 2008; McCormack et al., 2002). In addition, leaders and facilitators of practice change build relationships with clinical staff and foster practice climates that value EBP implementation (Harvey & Kitson, 2015a).

A noted weakness of the PARIHS model concerns the ambiguity of the context domain and the indistinctness of its sub-elements (culture, leadership, and evaluation) (McCormack et al., 2002). In addition, the model seems to conceptualize context as a static element that can be directly observed and easily measured. However, in the current organizational studies literature, it actually is more understood to be complex, dynamic, multileveled, and multifaceted (Dopson, 2007; Dopson & Fitzgerald, 2005; McCormack, McCarthy, Wright, & Coffey, 2009). Previous research has placed increased attention on conceptualizing and operationalizing context (Bahtsevani, Willman, Khalaf, & Östman, 2008; Cummings et al., 2007; Estabrooks, Midodzi, Cummings, & Wallin, 2007; Helfrich, Li, Sharp, & Sales, 2009; McCormack et al., 2009; Titler, Everett, et al., 2007). Efforts to develop a model that better describes the complexity of implementation context have recently been offered (Pfadenhauer et al., 2017), but no published studies explicitly using or testing this model have been done.

Although there is substantial literature on various aspects of context relevant to implementation, context has traditionally been defined as place or physical setting for implementation with little attention to the dynamics at work in the practice environment (May et al, 2016). Rather, investigators have focused on structural context factors such as staffing, bed capacity, and hospital size. Context is much more versatile, embracing not only the setting but also roles, interactions, and relationships. (May et al, 2016).

This dissertation study is interested in advancing understanding on the social dynamic context factors affecting implementation of EBP, with a particular focus on unit level leadership and unit climate for implementation. A conceptual model developed for this dissertation study was derived from the PARIHS framework (Kitson et al., 1998) with theoretical underpinnings in the Diffusion of Innovations theory (Rogers, 2003) (Figure 1.1). In the PARIHS framework, context includes three sub-elements: leadership, culture, and evaluation. As mentioned previously, these sub-elements are hard to distinguish from each other, as they may be highly correlated and overlapping. The model for this dissertation focuses on the unit level context, which includes the leadership behaviors and competencies of nurse managers in EBP implementation and the unit climate for EBP implementation.

It is imperative that climate is properly defined and made distinct from culture. The shared values and norms held by members of an organization comprise the culture with climate being an outward manifestation of culture (Klein & Sorra, 1996). Culture can be identified in organizational documents, such as, mission statements, vision statements, and employee orientation materials. Climate refers to the perceptions of employees regarding what is rewarded, expected, and supported by the organization and is measured by soliciting employee perceptions using qualitative and/or quantitative methods (Ehrhart, Aarons,& Farahnak, 2014; Scheider, Ehrhart, & Macey, 2013). This dissertation focuses on the unit climate because it can be observed at staff and manager levels, can be more reliably measured via self-report, and incorporates members' behaviors (e.g., creativity, innovation, safety, and service) that are key factors promoting successful EBP implementation and improved patient outcomes (Jacobs, Weiner, & Bunger, 2014; Patterson et al., 2005; Schneider et al., 2013; Weiner, Belden, Bergmire, & Johnston, 2011).

Summary. Research in implementation science must be grounded on theory rather than empirical evidence alone. Theory development in this field has progressed over the past two decades and many conceptual frameworks and models have been proposed to explain the mechanisms and factors contributing to implementation success and to offer prescriptive guidance for implementation projects. The Promoting Action on Research Implementation in Health Services (PARIHS) framework provides the foundation for the conceptual model (Figure 1.1) guiding this dissertation study. Despite wide application in implementation research, the PARIHS framework does not adequately describe the context factors and implementation interventions addressing these factors, nor does it include patient outcomes as a dependent variable of successfully implemented practice change. This study adds to the framework by investigating the effects of the practice context (e.g., leadership and climate) on the implementation of EBP and, ultimately, on patient outcomes.

Implementation Science in Nursing

Nurses play a very important role in evidence-based care delivery, implementation efforts, and patient outcome improvement (Estabrooks et al., 2008; McHugh, Van Dyke, Yonek, & Moss, 2012). In acute care settings, nurses are responsible for the majority of care delivered to hospitalized patients and are therefore actively involved in the implementation of evidence-based practices within their units. Implementation science spans numerous disciplines (e.g., mental health; medicine; public health; education; nursing). To determine the state of the science in implementation research with a focus on the nursing discipline, a literature search was conducted in PUBMED and CINAHL, as these two databases are top indexers of health services and clinical research. Titles and abstracts in the English language, and published between 2005-2017, were searched using multiple variations of the following search terms: implementation, translation, nursing, and hospital/acute care. Select filters were applied to include only original research meeting one of the following criteria: comparative study, clinical trial, clinical study, evaluation study, observational study, and randomized control trial. After removing duplicates the search yielded 464 articles.

Titles and abstracts of the 464 articles were then screened using the following inclusion criteria: (1) included nurses in the sample or involved an implementation by nurses or involved nursing practice; (2) reported on implementation strategies used in the study; and (3) focused on acute care settings. Studies were excluded using the following exclusion criteria: (1) the study was a published research protocol; (2) the setting was long term, primary, or community care (e.g., home care) without including acute care; or (3) an effectiveness study focusing on the effect of the practice intervention rather than the implementation strategies and outcomes. After applying the above inclusion and exclusion criteria, 35 full-text articles were retrieved for full text review. The *Implementation Science* journal was also searched using the same key words to identify articles potentially missed using the primary search strategy, and yielded one additional study.

After thoroughly reviewing full text articles, 24 were excluded for the following reasons: 1) implementation strategies not clearly explicated (n=16); 2) nurses not included in the sample (n=4); and 3) primary focus of the study was on intervention effects rather than implementation (n=4). Eleven studies were included in the final synthesis (Table 2.2).

The search resulted in four observational studies (Ellis et al., 2007; Koh et al., 2009; Stevens et al., 2012; Slattery et al., 2015) and seven experimental studies (Biai et al., 2007; Enns et al., 2014; Katz et al., 2012; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2010; van Gaal et al., 2011). The studies focused on various clinical topics, including: prevention of adverse events (e.g., pressure injuries, urinary tract infections, and falls) (n = 4); smoking cessation (n = 2); pain in hospitalized pediatric patients (n = 2); acute pain in hospitalized older adults (n = 1); physical restraint use in older adults (n = 1); and management of malaria in pediatric patients (n = 1). Three studies were on pediatric units (Biai et al., 2007; Ellis et al., 2007; Stevens et al., 2012) and two studies were specifically focused on older adult populations (Enns et al., 2014; Titler et al., 2009).

Studies either investigated the effect of implemented EB clinical interventions on patient outcomes or the effect of implementation strategies on process (e.g., adoption) and outcome (e.g., patient outcome) variables. Dependent variables were wide-ranging but were generally measured using patient chart review (n = 10) (Biai et al., 2007; Ellis et al., 2007; Enns et al., 2014; Katz et al., 2012; Koh et al., 2009; Slattery et al., 2015; Stevens et al., 2012; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2011), questionnaires (n=6) (Ellis et al., 2007; Katz et al., 2012; Koh et al., 2009; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2010), or interviews and focus groups (n = 1) (Ellis et al., 2007). Six studies explicitly referenced a theoretical or conceptual model guiding the study (Ellis et al., 2007; Enns et al., 2014; Koh et al., 2009; Stevens et al., 2014; Titler et al., 2009; Titler et al., 2016). The Translation Research Model was cited twice (Titler et al., 2009; Titler et al., 2016). The Promoting Action on Research Implementation in Health Services framework, the Ottawa Model of Research Use, Plan-Do-Study-Act framework, and the Knowledge-To-Action framework were each cited once (see Table 2.2).

Descriptions of implementation strategies used were required for inclusion in this review. Every study utilized a multifaceted implementation approach ranging from use of three to sixteen implementation strategies, with a mean between six and seven. The implementation strategies described in the reviewed studies are summarized in Table 2.2. Although there are several taxonomies of implementation strategies that are being developed and suggested, there is not yet one agreed upon approach (Colquhoun et al., 2014; Lokker, McKibbon, Colquhoun, & Hempel, 2015). Without a common taxonomy of strategies, it is difficult to identify differences and similarities between strategies and accumulate evidence of effectiveness across studies (Michie et al, 2011; Michie et al, 2013; Lokker et al., 2015). For purposes of this review, implementation strategies are organized using the following categories: 1) education; 2) targeted messages; 3) point of care reminders and decision aids; 4) change agency; 4) audit and feedback; 5) leadership support; 7) outreach visits and teleconferences; and 8) revision of organizational policies, procedures, and/or documentation.

Education

Education was a common implementation strategy used across studies and includes staff training sessions, train-the-trainer workshops, and education materials (education workbooks, information boards, handouts, digital education, and unit in-services). All studies included staff education and training and nine specifically mentioned use of educational materials (e.g., handouts, CD-ROM) (Ellis et al., 2007; Enns et al., 2014; Koh et al., 2009; Slattery et al., 2016; Stevens et al., 2014; van Gaal et al., 2010; van Gaal et al., 2011; Titler et al., 2009; Titler et al., 2016).

Targeted Messaging

Targeted messaging refers to disseminating information or providing reminders to clinical staff or leadership using various communication modes (e.g., newsletters; posters; emails). Eight studies included targeted messaging (Ellis et al., 2007; Enns et al., 2014; Koh et al., 2009; Slattery et al., 2016; Stevens et al., 2014; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2011).

Point of Care Reminders and Decision Aids

Point of care reminders and decision aids include quick reference guides and charting/reminder tools to help clinicians adopt and deliver the clinical intervention of interest (e.g., smoking cessation program; falls prevention bundle). Six studies used point of care reminders or decision aids (Biai et al., 2007; Katz et al., 2012; Koh et al., 2009; Slattery et al., 2016; Stevens et al., 2014; Titler et al., 2009; Titler et al., 2016).

Change Agency

In addition to education, targeted messaging, and point of care reminders and decision aids, change agency strategies were also commonly reported. Change agency refers to the specific identification and use of an individual or group of individuals who play a significant role in implementation and includes change champions and opinion leaders (Caldwell, 2003; McCormack et al., 2013). Change champions were used in six studies (Ellis et al., 2007; Koh et al., 2009; Stevens et al., 2014; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2010). Three studies used opinion leaders (Enns et al., 20014; Titler et al., 2009; Titler et al., 2016).

Audit and Feedback

Audit and feedback involves the ongoing auditing of performance indicators and the communication of findings with stakeholders (e.g., clinicians, management). Audit and feedback and/or evaluation were used in seven studies (Ellis et al., 2007; Katz et al., 2012; Koh et al., 2009; Stevens et al., 2014; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2011).

Leadership Support

Six of the eleven studies either engaged with or gained the support of leaders at the executive level (senior leaders) or unit level (nurse managers) (Ellis et al., 2007; Enns et al., 2014; Katz et al., 2012; Slattery et al., 2016; Titler et al., 2009; Titler et al., 2016). In all studies, leaders were identified prior to implementation, briefed on the study and their organization's requested involvement, and asked to support implementation on study units.

Outreach Visits and Teleconferences

Outreach included outreach visits by an investigator/facilitator and/or planned outreach conference calls. Five studies used outreach as an implementation strategy (Slattery et al., 2016; Stevens et al., 2014; Titler et al., 2009; Titler et al., 2016; van Gaal et al., 2010).

Revision of Organizational Policies, Procedures, and/or Documentation

Assistance with revision of organizational policies, procedures, and documentation was used in 5 studies (Katz et al., 2012; Koh et al., 2009; Slattery et al., 2016; Stevens et al., 2014; Titler et al., 2009).

Other strategies not categorized and not used as frequently across studies included: Performance Gap Assessment (Titler et al., 2009; Titler et al., 2016); financial incentives (Biai et al., 2007); and patient involvement (van Gaal et al., 2011).

Table 2.2. State of the Science: Implementation and Nursing

Citation	Design	Clinical Topic	Theory	Independent Variable(s)	Dependent Variable(s)	Covariates	Implementation Strategies	Context Factors
Biai et al. (2007)	Randomized control trial	Management of children under 5 years admitted to hospital with malaria	Not reported	1. Financial incentive 2. Improved malaria management protocol 3. Free emergency drugs for malaria	1. In-hospital mortality 2. Cumulative mortality after discharge at day 28 3. Length of hospital stay	None	1. Financial incentive 2. Education 3. Point of Care Reminders and/or Decision Aids	Tested financial incentives and free resources.
Ellis et al. (2007)	Descriptive, evaluation study	Pediatric pain management practices	Ottawa Model of Research Use	Implementation of comprehensive program to improve pain	1. Nurse questionnaires a. RN perception of current pain management practices b. RN assessment and management of pain in hospitalized children c. RN beliefs and perceptions about children in pain 2. Patient record audits a. Pain history b. Pain assessment c. Pain management strategies 3. Focus groups	None	1. Education 2. Targeted Messaging 3. Change Agency 4. Audit and Feedback 5. Leadership Support	None
Enns et al. (2014)	Quasi-experimental randomized stepped-wedge trial	Reducing the use of physical restraints in older hospitalized adults	Knowledge-to-Action Cycle	Multi-component strategy to reduce physical restraint use in hospitalized older adults	1. Rate of restraint use 2. Number of physician orders for physical restraints 3. Fall reports	1. Study unit 2. Month	1. Education 2. Targeted Messaging 3. Change Agency 4. Leadership Support	Study unit was controlled for only.

Citation	Design	Clinical Topic	Theory	Independent Variable(s)	Dependent Variable(s)	Covariates	Implementation Strategies	Context Factors
Katz et al. (2012)	Pre-post quasi-experimental	Smoking cessation counseling in ED	Not reported	Implementation of smoking prevention counseling intervention	1. Performance of each guideline-recommended actions (n=5) 2. RN and MD Decisional balance scores 3. RN and MD self-efficacy scores 4. RN and MD role satisfaction scores	Study site Patient characteristics: 1. Age 2. Sex 3. Race 4. Education 5. Presence of smoking-related condition 6. Concern that ED symptoms might be smoking related 7. Cigarettes per day 8. Contemplation ladder	1. Education 2. Point of Care Reminders and/or Decision Aids 3. Audit and Feedback 4. Leadership Support 5. Revision of Organizational Policies, Procedures, and/or Documentation	Contextual variables controlled for but not specifically tested.
Koh et al. (2009)	Comparative (2 hospitals, intervention and control)	Fall prevention	PARIHS Moulding et al.'s conceptual framework for dissemination and implementation of clinical practice guidelines	Tailored, multifaceted implementation of a fall prevention program	1. RN knowledge assessments 2. Fall rates 3. Fall prevention practices	None	1. Education 2. Targeted Messaging 3. Point of Care Reminders and/or Decision Aids 4. Change Agency 5. Audit and Feedback 6. Revision of Organizational Policies, Procedures, and/or Documentation	None

Citation	Design	Clinical Topic	Theory	Independent Variable(s)	Dependent Variable(s)	Covariates	Implementation Strategies	Context Factors
Slattery et al. (2016)	Interrupted time series	Smoking cessation	Not reported	Smoking cessation care intervention	Provision of smoking cessation care	1. Site 2. Patient gender 3. Pt. aboriginality 4. Pt. age 5. Pt. length of hospital stay 6. Pt. smoking related disease 7. Type of unit	1. Education 2. Targeted Messaging 3. Point of Care Reminders and/or Decision Aids 4. Leadership Support 5. Outreach Visits and Teleconf. 6. Revision of Organizational Policies, Procedures, and/or Documentation	Contextual variables controlled for but not specifically tested.
Stevens et al. (2014)	Observational, multi-method	Procedural pain in hospitalized children	Plan-Do-Study-Act framework	1. Evidence-based Practice for Improving Quality (EPIQ) intervention to improve pain assessment and management in hospitalized children 2. Number of implementation strategies used	1. Use of pain assessment and management recommendations	None	1. Education 2. Targeted Messaging 3. Point of Care Reminders and/or Decision Aids 4. Change Agency 5. Audit and Feedback 6. Outreach Visits and Teleconf. 7. Revision of Organizational Policies, Procedures, and/or Documentation	None

Citation	Design	Clinical Topic	Theory	Independent Variable(s)	Dependent Variable(s)	Covariates	Implementation Strategies	Context Factors
Titler et al. (2009)	Cluster randomized trial	Acute pain management in older adult hip fracture patients	Translation Research Model	Multifaceted Translating Research Into Practice (TRIP) intervention	1. Adoption of evidence-based acute pain management practices for older adults a. Nurse and physician adherence to the EBP guideline b. Nurses' perceived use of research findings to guide nursing practices for acute pain management c. Nurses' and physicians' stage of adoption of specific pain assessment and treatment practices 2. Nurse and physician perceived barriers to evidence-based pain management practices 3. Mean pain intensity	1. Baseline values 2. Patient age 3. Patient gender 4. Patient ethnicity 5. Patient dementia status 6. Hospital size 7. Hospital location 8. Case-mix index 9. M.D. years since residency 10. Physician age 11. Nurse skill mix 12. RN years of experience 13. RN attitudes to practice guidelines	1. Education 2. Targeted Messaging 3. Point of Care Reminders and/or Decision Aids 4. Change Agency 5. Audit and Feedback 6. Leadership Support 7. Outreach Visits and Teleconf. 8. Revision of Organizational Policies, Procedures, and/or Documentation 9. Performance Gap Assessment	Many context variables controlled for, not specifically tested.

Citation	Design	Clinical Topic	Theory	Independent Variable(s)	Dependent Variable(s)	Covariates	Implementation Strategies	Context Factors
Titler et al. (2016)	Prospective pre-post implementation cohort	Fall prevention	Translation Research Model	1. Implementation of Targeted Risk Factor Fall Prevention Bundle 2. Patient days 3. Unit-level characteristics	Medical Record Abstracts 1. Fall rates 2. Fall injury rates 3. Fall injury type 4. Use of Targeted Risk Factor Fall Prevention Bundle Nurse Questionnaires: 1. Stage of Adoption Scale 2. Use of Research Findings in Practice Scale	Unit characteristics: 1. Bed capacity 2. Average daily census 3. RN skill mix 4. RN HPPD Patient characteristics: 1. Age 2. Severity of illness (APR-DRG) RN Characteristics: 1. Work experience 2. Education 3. Age	1. Education 2. Targeted Messaging 3. Point of Care Reminders and/or Decision Aids 4. Change Agency 5. Audit and Feedback 6. Leadership Support 7. Outreach Visits and Teleconf. 8. Performance Gap Assessment	Context variables controlled for, not specifically tested.
van Gaal et al. (2010)	Cluster randomized trial	Prevention of adverse events: pressure ulcers, urinary tract infections, and falls	Not reported	Implementation of interactive education program	RN knowledge test	None	1. Education 2. Change Agency 3. Outreach Visits and Teleconf.	None
van Gaal et al. (2011)	Cluster randomized trial	Prevention of adverse events: pressure ulcers, urinary tract infections, and falls Simultaneous multiple guideline implementation	Not reported	Implementation of the SAFE or SORRY? bundle	Incidence of adverse events (pressure ulcers, urinary tract infections, falls) per week	1. Institution 2. Number of patients at risk for adverse event on first visit 3. Incidence of adverse events on each unit at baseline	1. Education 2. Targeted Messaging 3. Audit and Feedback 4. Patient involvement	Context variables controlled for, not specifically tested.

It is interesting to note that Stevens and colleagues (2014) was the only study to test whether the number of strategies used in implementation were predictive of improvements in process and outcome measures. Biai et al. (2007) directly tested the effect of financial incentives as an implementation strategy to improve use of a clinical practice guideline to treat pediatric malaria. The other studies did not test or report the unique effect of implementation strategies used in the study, which would be helpful in determining which interventions are most effective and in what settings (Grimshaw et al., 2001).

Facilitating the implementation of EBPs requires the skillful identification and strategic use of implementation interventions, tailored to the context, adopters, and the change being implemented. The review presented above focused on nursing studies. Studies outside of nursing have identified and defined implementation strategies (e.g., Cochrane Effective Practice and Organisation of Care (EPOC) Group, Ballini et al., 2011). These strategies include: audit and feedback (Cheater et al., 2006; Foy et al., 2005; Hysong, Best, & Pugh, 2006; Ivers, Grimshaw, et al., 2014; Ivers et al., 2012; Ivers, Sales, et al., 2014; Titler et al., 2009); change champions (Damschroder, Banaszak-Holl, et al., 2009; McCormack et al., 2013; Ploeg, Davies, Edwards, Gifford, & Miller, 2007; Shaw et al., 2012; Titler et al., 2009); local opinion leaders (Flodgren et al., 2011; Grimshaw, Eccles, Greener, et al., 2006; McCormack et al., 2013; Soumerai et al., 1998; Titler et al., 2009); local consensus processes (Bero et al., 1998; Grol, 2001); quick reference guides and decision aids (Titler et al., 2009; Garg et al., 2005; Kawamoto, Houlihan, Balas, & Lobach, 2005; Reilly & Evans, 2006; Welch & Kawamoto, 2013); clinical reminders (Feldman, Murtaugh, Pezzin, McDonald, & Peng, 2005; Förberg et al., 2016); education materials (Grol & Grimshaw, 2003; Grudniewicz et al., 2015; Titler et al., 2009); education meetings (Forsetlund et al., 2009; McCluskey & Lovarini, 2005); outreach visits(O'Brien et al., 2007, Titler et al., 2009); and mass media (Grilli, Ramsay, & Minozzi, 2002; Grol & Grimshaw, 2003). Selected implementation strategies from the above literature review and Cochrane EPOC reviews are outlined in Table 2.3.

It is important to select implementation strategies that not only include clinician perspectives, but also address context factors, such as, organization and unit characteristics (e.g., nurse manager EBP leadership behaviors; nurse manager EBP competency; unit climates for EBP implementation). Since the context of care is dynamic and complex, multifaceted implementation strategies are required for promoting adoption and use of evidence-based practices (Titler, 2010). Over the past decade, there has been some debate on whether single or multifaceted implementation strategies are more effective. Grimshaw, Eccles, Thomas et al. (2006) found that multifaceted implementation strategies are no more effective than single strategies, however, as Titler (2010) notes, their findings are questionable because context was not included as a factor in their synthesis methodology. Harvey and Kitson (2015b) suggest that the debate over single vs. multifaceted strategies is too simplistic and fails to address the complexity of implementation and knowledge translation. Consequently, they recommend a focus on implementation strategies that address the nature of the evidence being implemented, the context of implementation, and the facilitative individuals and processes. This literature review highlighted that the use of multifaceted strategies has proven effective in multiple implementation studies. Selected implementation strategies from the above literature review and Cochrane EPOC reviews are outlined in Table 2.3.

A thorough understanding of implementation strategy effectiveness must also include the setting in which they are intended to be applied. This review observed that most studies on implementation science in nursing have focused on clinician adoption and use of EBPs, with structural context factors being used as confounders, thereby limiting understanding of what implementation strategies work for whom and in what circumstances. In this review of the science, data on structural context factors were often included to describe the setting in which the implementation was delivered rather than examining the unique effects of structural and social context factors to provide insights into the implementation outcomes.

In six of the included studies, multiple structural context variables were identified as confounding variables in the data analyses, including: site characteristics (e.g., hospital size and location, case-mix index) (Enns et al., 2014; Titler et al., 2016; Titler et al., 2009); unit characteristics (e.g., unit type, bed capacity, RN skill mix, RN HPPD) (Titler et al., 2016; Titler et al., 2009); clinician characteristics (e.g., experience, education) (Titler et al., 2016; Titler et al., 2009); and patient characteristics (e.g., age, severity of illness, comorbidities, sex, race, risk for adverse events) (Katz et al., 2012; Slattery et al., 2016; Titler et al., 2016; Titler et al., 2009). The effects of structural context factors (e.g. staffing) were not specifically tested as primary independent variables, and social dynamic context factors (e.g., leadership behaviors; unit climate) were not included in any study.

Therefore, more studies addressing the effect social dynamic context factors have on implementation processes and outcomes are needed. Specifically, no study was identified that examined the influence of nurse manager EBP competencies and nurse manager EBP leadership behaviors in promoting and fostering unit climates for EBP implementation. In addition, the state of the science regarding implementation in nursing reveals that the influence of social dynamic context factors on single or multifaceted implementation strategies and implementation outcomes has not been adequately investigated in nursing practice.

Table 2.3. Commonly Reported Implementation Strategies Across Disciplines

Implementation Intervention/Strategy	Definition	Strengths	Limitations	Selected Studies
Audit and Feedback	"A summary of the clinical performance of healthcare provider(s) over a specified period of time" that is delivered in a written, electronic, or verbal format (Ivers et al., 2012).	Common strategy. Also used in performance evaluation of staff. Feedback is a well-supported mechanism in organizational literature.	Variable evidence supporting its effectiveness Unclear how to effectively use this strategy.	Cheater et al. (2006). Foy et al. (2005). Hysong, Best, Pugh (2006). Ivers et al. (2012). Ivers, Grimshaw, et al. (2014). Ivers, Sales, et al. (2014)
Change Champions	"Expert practitioners within the local setting (e.g., patient care unit), committed to improving quality of care, and possessing a positive working relationship with others" (Titler et al., 2009)	Cost-effective. Utilizes colleague and peer relationships to encourage change. Engages stakeholders and end users.	Total number of change champions needed is unknown. Unclear how to select, train, and use this champions effectively.	Damschroder et al. (2009). Ploeg et al. (2007). Shaw et al. (2012). Titler et al. (2009).
Local Opinion Leaders	"A respected source of influence, trusted to judge the fit between the new practice and the local situation, alter group norms, and posses a wide sphere of influence across the practice setting" (Titler et al., 2009).	Able to influence others through interpersonal communication networks May be very useful in specialized groups. Utilizes stakeholder input. Can identify barriers unknown to investigators.	Limited empirical evidence supporting this strategy. Numerous issues related to identification and selection of opinion leaders.	Flodgren et al. (2011) Grimshaw et al. (2006) Soumerai et al. (1998) Titler et al. (2009)

Implementation Intervention/Strategy	Definition	Strengths	Limitations	Selected Studies
Local Consensus Processes	The "inclusion of participating practitioners in discussions to ensure that they agree that the chosen clinical problem is important and the approach to managing the problem is appropriate" (Bero et al., 1998)	Has demonstrated some effectiveness. Helps to ensure that end-users accept the change.	Lack of empirical evidence supporting effectiveness. No guidelines for directing these discussions.	Bero et al. (1998) Grol (2001)
Quick Reference Guides	Paper or electronic guides that assist clinicians in applying new evidence into practice. These guides are condensed versions of the evidence-based guideline or implementation.	Provides support for users. Assists users in adoption after investigators leave the site.	Unknown what content should be included. Lack of empirical evidence suggesting how these should be delivered. May require training to use.	Titler et al. (2009)
Decision Aids	Includes manual or computer based systems that attach care reminders to patient medical record charts needing specific preventive care services. Also includes computerized physician order entry systems that provide patient-specific recommendations and reminders as part of the order entry process.	Demonstrated effectiveness in some studies. Guides clinicians to evidence-based recommendations. Recommendations are patient-specific.	Effectiveness has been variable. Not specifically described well in studies.	Kawamoto et al. (2005) Reilly & Evans (2006) Welch & Kawamoto (2013)
Reminders	Quick communication with clinicians and adopters to repeat information regarding the change or prompt decisions based upon the change to be implemented. These can be delivered verbally (face-to-face) or electronically (email)	Addresses the need to reinforce. Easy to deliver. Can be used long after initial implementation efforts to encourage sustainability.	Best method for delivering reminders unknown. Reception and impact of email reminders is difficult to measure.	Förberg et al. (2016) Feldman et al. (2005)

Implementation Intervention/Strategy	Definition	Strengths	Limitations	Selected Studies
Education Materials	Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials and electronic publications. The materials may have been delivered personally or through mass mailings	Enhances what is taught in workshops or education in-services. Visual aids can increase understanding of change being implemented. Can be referred back to by adopters.	Variable results. Unknown which types of education (materials, courses, CME) are most effective.	Grol & Grimshaw (2003) Grudniewicz et al. (2015) Titler et al. (2009)
Education Meetings	Gathering of adopters to participate in conferences, lectures, workshops or traineeships.	Can train multiple adopters at one time. Provides opportunity for discussion and feedback.	Costly. Unknown which structure, content, and delivery method can maximize effectiveness.	Forsetlund et al. (2009) McCluskey & Lovarini (2005)
Education Outreach Visits	Use of a trained person to meet with adopters in their practice settings to supply information with the intent of changing practice.	Provides face-to-face contact with adopters. Allows investigator to observe context.	Costly. Unknown how many visits are needed to be effective. Difficult to meet with each adopter.	O'Brien et al. (2007)
Mass Media	Use of media outlets, such as, radio, television, newspapers, magazines, leaflets, posters and pamphlets to communicate information to a specified audience (adopters) or population	Involves the public (patients). Provides ability to inform/remind adopters of the change when they are not on site.	Variable empirical evidence supporting its effectiveness. May be costly. Unknown which media venue is most effective.	Grilli, Ramsay, Minozzi (2002) Grol & Grimshaw (2003)

Implementation Science and Context

Context is an essential and central dimension of evidence-based practice implementation (Squires, Hayduk, et al., 2015); however, it has long been insufficiently understood (Brown & McCormack, 2011). Context as a construct has been defined in various ways, but as Squires, Graham, et al. (2015) note, there is likely to be a core set of domains influencing the implementation of EBP and explaining variation in implementation strategy effectiveness across different contexts. Acute care settings, although categorized together as a type of practice context, are not homogenous and have specific characteristics that can influence whether EBPs are successfully implemented and used in routine care delivery (Kajermo et al., 2010). Understanding context factors enhancing or impeding implementation of EBPs in acute care settings is crucial for identifying implementation strategies that address these factors (Newhouse et al., 2013; Schultz & Kitson, 2010; Squires, Graham, et al., 2015).

For the purposes of this dissertation, context is comprised of two major categories: 1) structural context factors, and 2) social dynamic context factors. Structural context factors are defined as characteristics of the setting, such as, staffing, unit size, and types of patients cared for in the unit. Social dynamic context factors pertain to the roles, relationships, and dynamics of the individuals and groups within a setting and are defined in this dissertation as unit climate for implementation, nurse manager leadership behaviors for EBP, and nurse manager competency for EBP.

To determine the state of the science in implementation research that focuses on context (either structural or social dynamic factors) in acute care settings, a literature search was conducted in PUBMED and CINAHL. Titles and abstracts in the English language, and published from 2005-2017, were searched using multiple truncated variations of the following search terms: implementation, translation, context, and hospital/acute care. Filters were applied to include only original research meeting one of the following criteria: comparative study, clinical trial, clinical study, evaluation study, observational study, and randomized control trial. After removing duplicates the search yielded 157 articles.

Titles and abstracts were then screened using the following inclusion criteria: (1) explicitly focused on context or context factors as either dependent variables or independent, fixed effects and (2) focused on acute care settings. Studies were excluded based upon the following criteria: (1) study was a published research protocol; (2) setting was long term, primary, or community care (e.g., home care); or (3) study did not measure context in some way. After applying the above inclusion and exclusion criteria, 24 full text articles were retrieved for full text review. The *Implementation Science* journal was also searched using the same key words to identify articles potentially missed in the original search strategy, which yielded an additional two studies. After further review, 14 studies were excluded because context was not measured. Ten studies were included in the final synthesis (Table 2.4).

All ten studies were observational or descriptive. A guiding conceptual framework, model, or theory was cited in nine studies, with the Promoting Action on Research Implementation in Health Services cited in six studies (Brown & McCormack, 2011; Doran et al., 2010; Doran et al., 2012; Estrada, 2009; Gunningberg et al., 2010; Rycroft-Malone et al., 2013). Context was explicitly defined in six studies, with the majority describing it as the environment or setting in which the implementation or intervention is targeted or takes place. This definition aligns with the conceptual definition of context provided in the PARIHS framework (Kitson et al., 1998).

Measurement of context and context factors varied across studies. Structural context factors of institutional processes, staffing, infrastructure, technology, organizational resources, and organization initiatives were measured in six studies (Augustsson et al., 2015; Clarke et al., 2013; Doran et al., 2010; Doran et al., 2012; Estrada, 2009; Rycroft-Malone et al., 2013). Social dynamic context factors of leadership, culture, communication, and staff commitment to implementation were measured in 8 studies (Augustsson et al., 2015; Brown & McCormack, 2011; Clarke et al., 2013; Doran et al., 2012; Gunningberg et al., 2010; Kitson et al., 2011; Krein et al., 2010; Rycroft-Malone et al., 2013). Four studies measured both structural and social dynamic context factors (Augustsson et al., 2015; Clarke et al., 2013; Doran et al., 2012; Rycroft-Malone et al., 2013).

Characteristics related to the context of care have a significant effect on implementation, as well as, patient outcomes (Titler, 2010). Evidence-based care is delivered within a context of care – the patient care unit nested within a hospital. Just as the practice context influences the implementation of EBP, many context characteristics can influence patient outcomes (Aiken et al., 2011; Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Aiken et al., 2014; Duffield et al., 2011; Kelly, McHugh, & Aiken, 2011; Van den Heede, Sermeus, et al., 2009). As such, many implementation studies, including those identified in the literature review of implementation research in nursing above, use structural context factors as covariates to control for variation of patient outcomes associated with differences between units and hospitals.

The results of the synthesis highlight the lack of attention given to understanding the practice context for implementation research. Organization, unit, and staffing factors influence the use and adoption of EBPs and patient outcomes. Overall, the studies revealed that the practice context is an ambiguous, complex construct with many facets, which aligns with other criticisms that context is not well understood in implementation science (Squires, Graham, et al., 2015). Despite not being explicitly tested in every study, each study included in the review described leadership as a key variable within the practice context that significantly influences the implementation and use of EBPs into care delivery. EBP leadership behaviors and EBP competencies of nurse managers were not measured in any study.

In addition, no study included in this review measured the unit climate for EBP implementation as a practice context variable. Unit climate for EBP implementation is defined as the staffs' "shared perceptions of the practices, policies, procedures, and clinical behaviors that are rewarded, supported, and expected in order to facilitate effective implementation of evidence-based practices" (Ehrhart et al., 2014). Investigation of unit climates for EBP implementation, and the influence of nurse manager characteristics (e.g., leadership behaviors; competencies) in fostering such climates, is needed.

Table 2.4. State of the Science: Implementation and Context

Citation	Study Design	Theory	Context Factors Studied (Structural or Social Dynamic)	Definition of Context	Measurement of Context Variable(s)	Major Findings	Strengths and Limitations
Augustsson et al. (2015)	Case Study	Conceptual Framework for Implementation Fidelity Framework for Evaluating Organizational-level Interventions	Structural (Institutional processes) Social Dynamic (Leadership)	Not explicitly stated.	Interviews with unit staff	1. Units with high fidelity to the intervention had well-functioning and active processes 2. Low fidelity units had more changes and instability in management during implementation 3. Both high and low fidelity units described senior management (SM) support as important but reported that SM had not done anything to help facilitate unit level work. 4. High fidelity groups reported higher mean values for middle manager support, encouragement, positivity, and active engagement. 5. High fidelity groups allowed for employee input and participation. 6. Low fidelity groups reported lower expectations that the implementation of the intervention would have a positive effect.	Utilized a theoretical framework for investigating variation in implementation fidelity caused by contextual factors. Some sub-concepts of the intervention and mental model concepts in the theoretical model overlap with the concept of context. The study was conducted at one hospital, increasing the risk for cross-over effects.
Brown & McCormack (2011)	Observation	PARIHS	Social Dynamic (Culture; Leadership)	The environment or setting in which the proposed change is to be implemented	Qualitative interviews via facilitated critical reflection	Effective leadership and a psychologically safe environment enhanced all aspects of nursing practice.	Identified culture as a key determinant of practice context and can either enhance or support quality nursing practice. Identified leadership and psychological as key elements shaping practice culture.

Citation	Study Design	Theory	Context Factors Studied (Structural or Social Dynamic)	Definition of Context	Measurement of Context Variable(s)	Major Findings	Strengths and Limitations
Clarke et al. (2013)	Process evaluation	Normalization Process Theory	Structure (Staffing; Policies; Infrastructure) Social Dynamic (Leadership; Culture)	Implementation setting with pre-existing structures, historical patterns of relationships, and routinized ways of working	These contextual factors were observed by the investigators in site visits and through interviews with site informants.	Highlighted complex interrelationships between intervention components, implementation strategies, and participants who delivered or received the intervention. Settings with persistent staff shortages, team conflict, or newly formed teams will have a more difficult time with implementation efforts.	Identified local and national policy priorities as contextual factors influencing EBP implementation and urges implementation efforts to plan a priori for how to handle such directives introduced during the implementation period.
Doran et al. (2010)	Descriptive, evaluation	Diffusion of Innovations PARIHS	Structural (technology)	Where the practice change will occur including the following factors: prevailing culture, leadership role assigned, and measurement and feedback.	Questionnaires evaluating impact of mobile technologies on barriers to research utilization, perceived quality of care, and RN job satisfaction.	1. Improved RN research values and awareness 2. Improved accessibility of research evidence 3. Type of device and type of sector (acute care, long-term care, home care) impacts results.	Access to resources can facilitate EBP implementation efforts, however, providing a personal device can be extremely costly and infeasible. It is important to consider the type of resource needed by type of setting.
Doran et al. (2012)	Descriptive, pre-post	PARIHS	Structural (Technology; Organizational Resources) Social Dynamic (Leadership)	Where the practice change will occur including the following factors: prevailing culture, leadership role assigned, and measurement and feedback.	Alberta Context Tool Nurse questionnaires Maslach Burnout Inventory short form	The study involved the implementation of technology devices to enhance EBP use. Several context variables explained variations in frequency of utilizing information resources.	Explicitly measured context variables as predictors of utilizing an implementation. Study did not consider the interaction between organizational factors and individual nurse factors.
Estrada (2009)	Descriptive	Watkins and Marsick "Sculpting the Learning Organization" theoretical framework PARIHS	Structural (Learning Organization)	The setting for which practice takes place	Learning Organization: The Dimensions of the Learning Organization Questionnaire (n= 594 RNs)	1. RN perceptions of a learning organization were significant, although small, predictors of RN EBP beliefs 2. EBP beliefs explained 23% of EBP implementation by RNs	Study did not control for other contextual factors, like care setting (acute, primary, long-term), site size, RN characteristics. Study provides evidence that RN EBP beliefs positively predict their implementation.

Citation	Study Design	Theory	Context Factors Studied (Structural or Social Dynamic)	Definition of Context	Measurement of Context Variable(s)	Major Findings	Strengths and Limitations
Gunningberg et al. (2010)	Descriptive, comparative	PARIHS	Social Dynamic (Leadership)	The environment or setting in which the proposed change is to be implemented	Study-specific questionnaire on context factors inspired by PARIHS framework	Findings suggest: 1. Nurse managers need competency in EBP and research. 2. Nurse managers should provide feedback of quality indicators to staff	Study provided more information on a nurse manager's perceptions of context, rather than on nurse managers as a context variable.
Kitson et al. (2011)	Ethnographic descriptive	Not reported.	Social Dynamics (Leadership)	Not explicitly stated.	Self-selected clinical nursing leaders were interviewed, covering these key areas: 1. Reason for volunteering as change lead 2. Reason for choosing clinical topic for improvement 3. Prior experience of change 4. Experienced support during project	1. Identified importance of volunteer leadership role 2. Identified need for managerial support of this role	The role of the clinical nursing leader is poorly defined in the context of other leadership roles in implementation. It was difficult to identify this role as either a local opinion leader, change champion, or something completely different.

Citation	Study Design	Theory	Context Factors Studied (Structural or Social Dynamic)	Definition of Context	Measurement of Context Variable(s)	Major Findings	Strengths and Limitations
Krein et al. (2010)	Descriptive, qualitative	Diffusion of Innovations	Social Dynamic (Leadership; Culture)	Not explicitly stated.		1. Hospitals with a positive and emotional cultural context (strong emotional commitment to patients), unified culture focused on patient care, and active and engaged clinical leadership appeared more conducive for implementation efforts. 2. Externally-facilitated efforts may provide resources and motivation needed at hospitals with negative emotional, cultural, and political context, although this may not be enough to produce significant changes (consistent with theory of organizational readiness for change).	Highlights the potential importance of context in health services implementation research. Organizational context should be considered a source of heterogeneity in evaluation of implementation outcomes. Study had a small sample (n=6 hospitals) and a lack of attention to frontline staff (who implement the guidelines) perceptions of context factors.
Rycroft-Malone et al. (2013)	Descriptive, semi-structured interviews	PARIHS	Structural (integration of initiatives; organizational preparedness) Social Dynamic (communication; commitment)	Not explicitly stated.	Focus group interviews	Context challenges reported by focus group included: 1. Inter-professional issues 2. Communication challenges 3. Emotional response to change 4. Commitment to change 5. Lack of clarity regarding roles and responsibilities 6. Hospital preparedness for implementation 7. Integration with existing initiatives	Context was investigated generally. Findings suggest contextual factors requiring increased attention.

Role of Nurse Manager Leadership in Implementation

In accordance with the state of the science for implementation in nursing and context presented above, there is an emerging body of evidence that suggests nurse manager attitudes and behaviors of EBP are important to uptake and use of EBPs in healthcare (Aydin, Donaldson, Stotts, Fridman, & Brown, 2015; He, Dunton, & Staggs, 2012; He, Staggs, Bergquist-Beringer, & Dunton, 2013; Hempel et al., 2013; Jeffs, Sidani, et al., 2013; McCormack et al., 2009; Melnyk, 2014; Scott, VandenBeld, & Cummings, 2011; Stetler, Ritchie, Rycroft-Malone, Schultz, & Charns, 2009; Van Achterberg, Schoonhoven, & Grol, 2008; Wallen et al., 2010). In an initial search attempting to determine the state of the science regarding nurse managers' influence on EBP implementation, no studies were identified. Consequently, the search was revised to understand nurse managers' involvement in evidence-based practice generally in hopes of identifying characteristics or activities of nurse managers that may also apply to EBP implementation. To identify studies, multiple electronic databases were searched including: PsycINFO, OVID, CINAHL, EMBASE, and Web of Science. To ensure a broad reach, the combination of key words and subject headings were comprehensive and described in Table 2.5.

Titles and abstracts written in the English language were screened for relevancy (n = 642). Editorials, commentaries, book chapters, opinion pieces, dissertations, theses, letters to editors, and published abstracts were excluded in order to gather the most reliable research containing strong evidence. Many titles and abstracts were excluded due to a focus on nursing management of disease rather than the nurse manager role. Another common reason for exclusion was a focus on research implications for nurse managers rather than research on nurse managers. After applying exclusion criteria and screening titles and abstracts, full text articles were retrieved for additional screening (n = 110). Articles were required to meet the following inclusion criteria: 1) original research; 2) nurse managers identified in the sample; and 3) explicate a focus on the nurse manager's role in leading EBP in acute or long term care settings. Sixty-eight articles were excluded because the nurse manager was not represented in the sample. Thirty-three articles were excluded because the relationship of the nurse manager and EBP were not clearly explicated (n= 33). After removing articles not meeting criteria, 8 articles were included in the analysis.

Four articles were descriptive/comparison studies (Gifford et al., 2014; Gunningberg et al., 2010; Johansson et al., 2010; Pryse et al., 2014), two were qualitative (Stetler et al., 2014; Wilkinson et al., 2011), one was a systematic review (Sandstrom et al., 2011), and one was an integrative review (Gifford et al., 2007) (Table 2.6).

Table 2.5. Nurse Manager Influence on EBP Literature Search Strategy

Database	NM Terms	EBP Terms
CINAHL	Nurse Managers (MH) “nurse manag*” (ti, ab) Nurse Administrators (MH) “nurse administrat*” (ti, ab) Nursing Management (MH) “nursing manag*” (ti, ab) “nurs* middle manag*” (ti, ab)	Nursing Practice, Evidence-Based (MH) “evidence based nursing practice” (ti, ab) Professional Practice, Evidence-Based (MH) “evidence based professional practice” (ti, ab) “evidence based practice” (ti, ab) “evidence based” (ti, ab) “EBP” (ti, ab) “EBN” (ti, ab) Diffusion of Innovation (MH, ti, ab)
PsycINFO	“nurse manag*” (ti, ab) “nurse administrat*” (ti, ab) “nursing manag*” (ti, ab) “nurs* middle manag*” (ti, ab)	Evidence Based Practice (MH, ti ab) “evidence based nursing practice” (ti, ab) “evidence based professional practice” (ti, ab) “evidence based” (ti, ab) “EBP” (ti, ab) “EBN” (ti, ab) Diffusion of Innovation (MH, ti, ab)
Ovid	“nurse manag*” (ti, ab) Nurse Administrators (MeSH) “nurse administrat*” (ti, ab) “nursing manag*” (ti, ab) “nurs* middle manag*” (ti, ab)	Evidence Based Nursing (MeSH, ti, ab) “evidence based professional practice” (ti, ab) Evidence Based Practice (MeSH, ti, ab) “EBP” (ti, ab) “EBN” (ti, ab) “evidence based” (ti, ab) Diffusion of Innovation (MeSH, ti, ab)
Web of Science	“nurse manag*” (topic) “nurse administrat*” (topic) “nursing manag*” (topic) “nurs* middle manag*” (topic)	“evidence based practice” (topic) “evidence based nursing practice” (topic) “evidence based professional practice” (topic) “evidence based” (topic) “EBP” (topic) “EBN” (topic) “diffusion of innovation” (topic)
EMBASE	‘nurse manag*’ (ti, ab) Nurse Administrators (MeSH) ‘nurse administrat*’ (ti, ab) ‘nursing manag*’ (ti, ab) ‘nurs* middle manag*’ (ti, ab)	Evidence Based Nursing (MeSH, ti, ab) ‘evidence based professional practice’ (ti, ab) Evidence Based Practice (MeSH, ti, ab) ‘EBP’ (ti, ab) ‘EBN’ (ti, ab) ‘evidence based’ (ti, ab) Diffusion of Innovation (MeSH, ti, ab)
MH = Main Heading; ti = title; ab = abstract; MeSH = Medical Subject Heading		

A small amount of existing evidence suggests a positive relationship between nursing leadership behaviors and EBP (Newhouse, 2007; Rycroft-Malone, 2004; Stetler, 2002; Udod & Care, 2004). Furthermore, positive leadership for EBP implementation has been identified as a facilitator of EBP integration (Hutchinson & Johnston, 2006; Moser, DeLuca, Bond, & Rollins, 2004), while unsupportive leadership has been demonstrated as a barrier (Hutchinson & Johnston, 2006; Parahoo & McCaughan, 2001). An integrative review by Gifford and colleagues (2007) on nursing leaderships' abilities and behaviors for encouraging EBP use by nursing staff, revealed a lack of science on this phenomenon and called for increased attention to the nurse manager's role in successful EBP implementation. The leadership factors identified by Gifford and colleagues (2007) that facilitated EBP included leadership behaviors that support nurses' use of EBP (e.g., encouragement, motivation, resource allocation, feedback) as well as regulatory processes that reflect EBPs (e.g., audits, policy change). In the review conducted by Sandström and colleagues (2011), the authors highlight the relationship of leadership and organizational culture in EBP implementation. Furthermore, the investigators noted a lack of scientific rigor in research regarding nursing leadership's influence on implementation of EBPs and the need for well-designed studies in this area of research.

Nurse managers can influence EBP implementation and use by modifying structural and social dynamic context factors. Examples of structural factors nurse managers can modify include: staffing, skill mix, and availability of resources. As leaders and motivators for change, nurse managers can apply their EBP competency and leadership behaviors, to influence unit climates for using evidence in practice (Kueny, Shever, Mackin, & Titler, 2015). Their EBP competency and leadership behaviors are social dynamic context factors which can be developed to improve uptake and use of evidence by their staff (Aarons, Ehrhart, & Farahnak, 2014; Aarons, Ehrhart, Farahnak, & Sklar, 2014). In addition, nurse managers are instrumental in the embedding of strategic unit climates supportive of EBP implementation (Aarons, Ehrhart, Farahnak, & Sklar, 2014; Sandstrom et al., 2011). The shared values and norms held by members of an organization comprise the culture with climate being an outward manifestation of culture (Patterson et al., 2005). Climate incorporates members' behaviors such as creativity, innovation, safety, and service (Schneider et al., 2013). These behaviors are vital to successful EBP implementation and are observed at staff and manager levels (Everett & Sitterding, 2011). Using a case-study design, Stetler, Ritchie, Rycroft-Malone, and Charns (2014), identified nurse managers as instrumental in developing a climate supportive of EBP. Nurse manager engagement in EBP implementation fostered a team-oriented climate, in which EBP is esteemed and promoted. Although literature suggests that nurse managers should have a more active role in EBP implementation, Wilkinson et al. (2011) observed that most nurse managers are only passively involved because of competing demands (e.g., administrative responsibilities).

Table 2.6. State of the Science: Nurse Managers and EBP

Author Country Study Conducted	**Study Design Aim**	**Methods**	**Setting Sample**	**Findings**	**Notes**
Gifford et al (2007) Canada	Integrative Literature Review Aim: describe NM leadership activities that influence research use in practice and to identify interventions aimed at supporting NMs to influence research use in practice.	Integrative review	*N*=12 articles included.	NM leadership behaviors influencing research use: facilitative (support, encouragement, education, vision) and regulatory (monitoring performance and outcomes, policy change). Intervention studies: no conclusions do to lack of sufficient studies directed at NMs	Search strategy, appraising, and screening thoroughly explicated. Results thoroughly explained and correlated with aims of study. Study included research with many limitations to provide baseline of knowledge.
Gifford et al (2014) Canada	Qualitative and Quantitative Aim: field test and evaluate multiple organizational strategies to promote evidence-informed decision making by NMs.	Mixed method. Pre and post surveys. Workshop intervention: EBP role models; access to library resources; information-sharing activities; encouragement/recognition activities). Semi-structured phone interviews.	Home and community healthcare sites (*n*=4). Preintervention surveys (*n*=32); post (*n*=17). Interviews (*n*=15).	Four items on survey had statistically significant increases post intervention (*p*=<0.05): more resources to conduct research; relevant staff to contribute to EIDM discussions; receiving more feedback and rationale on decisions; more informed about how evidence influences decision making. Ranking of strategies in terms of utility: 1) role model support; 2) encouragement/recognition; 3) regular dissemination; 4) workshop; 5) library services.	Low response rate on post-intervention survey (40%). Items found to be statistically significant were not stated nor explained. No control or comparison group. Reliability and validity of tool not provided.

Author Country Study Conducted	**Study Design Aim**	**Methods**	**Setting Sample**	**Findings**	**Notes**
Gunningberg et al (2010) Sweden	Quantitative Aim: to describe and compare pressure ulcer prevalence in two county councils and explore NMs' perspectives of contextual factors.	Descriptive and comparative. Survey. European Pressure Ulcer Advisory Panel method for measuring pressure ulcer prevelancy.	Hospitals (n=5, university and non-university settings). Non-university NM (n=27). University NM (n=45).	University setting had significantly: less pressure ulcers grade 2-4(p=0.035). Greater team feeling (p=0.002). More quality measures reported by NM to staff (p=0.033). More dedicated time for quality improvement work (p=0.017). More agreement that RNs responsible for PU prevention (p=0.017). More clinical guidelines for PU prevention applied (p=0.025) NM with masters degree more supportive of EBP and research activity.	Methodology and statistical analysis clearly described and results clearly presented. Pressure ulcer prevalence method did not include hospital acquired pressure ulcers. Sample size (*n*=72) too small for factor analysis. Limits to generalizability: prominent UK focus.

Author Country Study Conducted	Study Design Aim	Methods	Setting Sample	Findings	Notes
Johansson et al (2010) Sweden	Quantitative Aim: to describe head nurse perceptions of EBP and to evaluate the effect of education level and years of duty on EBP activities.	Descriptive and comparative. Survey.	Head nurses at two hospitals (*n*=99). Head nurses maintain responsibility for staff, budget, and care provided on unit.	Majority expressed positive attitude towards EBP and encourage staff to provide evidence-based care; however, many reported lack of time for themselves and staff to engage in EBP activities. More years in position associated with increased agreement: read research papers at work, p=0.04; read research in professional journals, p=0.04; opportunities to conduct research during work time, p=0.02; and value research interest/experience in recruitment of staff, p=0.04). Additional education in scientific methodology agreed more strongly with: research utilization and quality development projects (p=<0.05). No statistical difference between participants in hospital EBP course (n=29) and nonparticipants (n=70).	Survey design increased risk bias. Survey has not demonstrated validity or reliability. Effect of education (type, level) not measured appropriately and not clearly explicated. Limits to generalizability: prominent Swedish focus.
Pryse et al. (2014) USA	Quantitative and Psychometric Analysis Aim: to report on the analysis of two new scales to measure leadership and work environment for EBP.	Psychometric analysis of two scales: EBP Nursing Leadership; EBP Work Environment.	n= 422	Content validity and reliability demonstrated (mean CVI=0.96; leadership, Cronbach α= 0.96; work environment, Cronbach α =0.86). 10-item scale, only 3 items rated >50%: encouragement, time, and support for EBP	Limits to generalizability: only 2 sites, 24% of site population represented.

Author Country Study Conducted	**Study Design Aim**	**Methods**	**Setting Sample**	**Findings**	**Notes**
Sandstrom et al. (2011) Sweden	Literature Review Aim: to systematically review literature regarding leadership and its possible influence on EBP implementation.	Systematic review and synthesis	n=7 articles synthesized	Outlines characteristics of the leader (role modeling, feedback, support, visible, enthusiastic, engaging); organization (policy, resources, human/material support, time, library); and culture (values, performance appraisal, positive milieu, innovative, commitment) that are vital to the process of implementing EBP.	Search and screening strategies clearly described. Multiple reviewers involved in process.
Stetler et al. (2014) USA	Qualitative. Aim: to describe what leaders at different levels/roles do to develop, enhance, and sustain EBP.	Case study. Focus groups. Interviews.	Role model hospital (interviews: *n*=30; focus groups: *n*=9). Beginner hospital (interviews: *n*=29; focus groups: *n*=5).	Strategic behaviors (planning, organizing, aligning); functional behaviors (inspiring, inducing, intervening, involving, educating, developing, monitoring, providing feedback); and cross-cutting leadership behaviors (strategic thinking, communicating, building and sustaining supportive EBP culture).	Interview and focus group items not explicated. Limits to generalizability: case study included only two sites.
Wilkinson et al. (2011) UK	Qualitative Aim: to explore and explain the EBP implementation role of NMs in Scottish acute care settings.	Case study, Interviews, Documentary analysis, Observational data	Interviews (n=51)	NM as champions and leaders of EBP. NM as links in EBP processes. NM empowers RNs for EBP. NMs lack personal involvement in EBP (lack of time, increased work load, limited knowledge of EBP).	Limits to generalizability: case study approach used difficult to generalize; prominent Scottish focus.

Gaps in the Science

Despite the support for leadership influence on EBP integration and climates, Wong et al. (2013) noted very few studies include nurse managers and patient outcomes as measureable study variables in nursing, leadership, and implementation research. Nurse managers influence patient outcomes through creating healthy work environments, stable nursing workforces, and evidence-based patient care processes (Aiken et al., 2008; Wong et al., 2013). Although some investigators have demonstrated the effect of nurse manager leadership style, turnover, and relational leadership behaviors on patient outcomes (Cummings et al., 2010; Wald, Richard, Dickson, & Capezuti, 2012; Warshawsky & Havens, 2014; Warshawsky, Rayens, Stefaniak, & Rahman, 2013; Wong & M Giallonardo, 2013), no studies have examined nurse managers' EBP competencies and EBP leadership behaviors on fostering unit climates for EBP implementation and the impact on patient outcomes.

In addition to the influence of nurse managers on EBP implementation, no studies focused on the unit climate for EBP implementation as an independent variable influencing patient outcomes in an acute care context. As leaders of patient care units, nurse managers are likely to significantly influence the EBP implementation climate on the units they manage.

Measurement in Implementation Science

The three literature reviews described above highlight some of the measurement controversies and challenges affecting implementation science (Chaudoir, Dugan, & Barr, 2013; Estabrooks, Wallin, & Milner, 2003; Kitson et al., 2008; Proctor & Brownson, 2012; Proctor et al., 2011; Rich, 1997; Titler, Everett, et al., 2007). Some of the challenges involve the selection and measurement of independent, dependent, and confounding variables.

Independent Variables

As noted in the reviews above, the majority of independent variables included in implementation research are multifaceted implementation strategy bundles. However, context factors, which affect implementation strategies and outcomes, are not always included as independent variables to be tested. Rather, they are often included as confounding factors and, thus, controlled for in analyses. While investigating the context factors affecting research use by nurses, Cummings et al. (2007) found that culture, leadership, and evaluation were important for both increased research utilization and improved patient outcomes. In their systematic review of measures for implementation, Chaudoir and colleagues (2013) argue a multilevel framework for predicting implementation outcomes and suggest that measurement of variables at micro-, meso-, and macro-levels must be considered to fully understand the causal factors predicting implementation success. They identified 62 measures with most lacking criterion validity and reliable association with an implementation outcome. Therefore, more studies are needed that use psychometrically sound measures to test implementation strategies and context factors as independent variables to explain implementation outcomes.

Dependent Variables

Measuring the success of implementation has unresolved issues, many rooted in a lack of conceptual and operational definitions for implementation outcomes (Eccles et al., 2009; Proctor et al., 2011). In addition, the lack of valid and reliable instrumentation poses measurement gaps and problems with continued use of poor quality instruments (Lewis et al., 2015). Lewis and colleagues (2015) observed that in mental and behavioral health settings, almost half of all included quantitative implementation instruments (n= 104) assess acceptability (n= 50) and only 19 evaluate adoption. In addition, the authors note that many instruments had rather poor psychometric properties, bringing into question their validity, reliability, specificity, and sensitivity.

Another challenge in implementation research involves the selection of dependent variables to measure and how to measure them. In experimental studies on testing implementation interventions, does one measure improvement in use of EBP care processes (e.g. every four hour pain assessment; reassessment; around-the clock opioid administration), the patient outcome(s) (e.g. improve pain intensity), or both as demonstrated by Titler and colleagues (2009). Proctor and colleagues (2011) have set forth a core set of implementation outcomes: acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration, and sustainability. However, it can be argued that many of these suggested outcomes do not measure successful implementation (e.g., appropriateness, cost) but, rather, reflect factors associated with the implementation process. Furthermore, this suggested core set of implementation outcomes is incomplete because it does not include relevant patient outcomes, which indicate whether or not the previously demonstrated and intended effect of the practice change(s) is benefiting patients. In other words, improved patient outcomes would reflect the successful implementation of the practice change(s) known to positively influence patient outcomes.

Without demonstrating the effect on patient outcomes, it is difficult to evaluate and confirm successful implementation of a practice change(s) intended to improve patient outcomes. For example, if the intended effect of a practice change is not realized upon implementation, then other implementation factors not investigated or perhaps unknown may be responsible (e.g., social dynamic context factors). Including patient outcomes along with other implementation outcomes (e.g., EBP uptake; EBP use) in implementation research has been demonstrated in previous studies (Balas et al., 2013; Herr et al., 2012; Titler et al., 2009).

Selecting appropriate measurement for dependent variables in implementation science proves difficult. Implementation processes and outcomes can be measured by self-report, observations, and medical chart review, each method with its own advantages and disadvantages. For example, self-report of implementation outcomes (e.g., EBP use) can be easily obtained via clinician questionnaires; however, the reliability of self-report has long been criticized (Campbell, Fayers, & Grimshaw, 2005; Lewis et al., 2015). In some instances, as in the case of measuring unit climate for EBP implementation, staff perceptions via self-report is likely to be the most reliable measure because this dependent variable is difficult to measure through observation alone and is not captured in medical record abstraction. Poon and colleagues (2013) utilized an observational approach for assessing surgical safety checklist adherence by medical students and nurses working in a perioperative unit and found observational assessment effective but noted the threat of observer bias in skewing results. Medical chart review can provide data on implementation processes (use of EBP) and outcomes (patient data) but may be cumbersome and costly. Titler and colleagues (2009) used a medical record abstract form to collect data reflecting implementation success via documented processes of clinician adherence to implemented pain management practices (e.g., every four hour pain assessment), as well as, documented clinical indicators of patient pain (e.g., mean pain intensity). In addition to self-report, observation, and chart review, a mixed methods approach, as noted by Alexander and Hearld (2012), allows the investigator to evaluate concepts not amenable to quantitative methodologies (e.g., organizational processes, effective communication networks). Including patient outcomes as a dependent variable, along with process measures (e.g. actual use of EBPs), in implementation research adds rigor and robustness to study results as demonstrated by Titler and colleagues (2009).

Confounding Variables

The above three literature reviews highlight the variation in confounding variables included in implementation science studies (e.g., staffing variables; unit, staff, and patient characteristics). It is important to carefully consider confounding variables in multisite or multiunit research, such as structural context characteristics. As noted above, more research is needed that focuses on the impact of structural context variables on implementation processes and outcomes. Determining which variables to include relies heavily on the study aims and study setting. In acute care settings, one must consider the effects of unit and organization characteristics on the dependent variable(s) (Chaudoir et al., 2013).

As identified in the literature reviews above, practice context is comprised of two main factors: structural factors and social dynamic factors. Measuring practice context can be done by evaluating individual, selected context factors or by examining the context as a whole. As noted above, more work is needed to investigate the unique impact of practice context factors on implementation and patient outcomes. Rather than measuring each individual factor within the practice context, some instruments have been developed to measure context as a construct using the PARIHS framework as a guide, including the Alberta Context Tool (ACT) (Estabrooks, Squires, Cummings, Birdsell, & Norton, 2009) and the Organizational Readiness to Change Assessment (ORCA) (Helfrich et al., 2009). The ACT is a theory-informed approach that measures context in eight domains: leadership, culture, evaluation, social capital, formal interactions, informal interactions, structural/electronic resources, and organizational slack (Estabrooks et al., 2009). A recent analysis of the reliability and validity of the ACT with professional nurses resulted in a Cronbach's alpha of greater than .70 for every domain except formal interactions (e.g., continuing education, patient rounds, team meetings), which had an alpha of .59 (Squires, Hayduk, et al., 2015). The ORCA tool is designed to measure each of the PARIHS domains: evidence, context, and facilitation. Within the context domain, the tool identifies six subscales: organizational culture at the senior level; organizational culture at the frontline staff level; formal leadership; informal leadership; evaluation; and resources. Despite demonstrating a Cronbach's alpha of .85 for the context domain, the authors recognized discrepant results regarding poor reliability of subscales measuring dimensions of evidence, as well as, factor analysis results suggesting some measures do not conform to the PARIHS framework (Helfrich et al., 2009). Neither the ACT nor the ORCA measures unit climate as a practice context factor. In addition, with 56 and 77 items respectively, the ACT and ORCA instruments are considerably lengthy.

Context factors influencing the implementation of EBP can be identified and measured at multiple levels (e.g., micro-, meso-, macro-), as noted by Chaudoir et al. (2013). Therefore, measuring context factors, whether as confounding, independent, or dependent variables, requires robust and relevant statistical techniques. Alexander and Hearld (2012) recommend using multilevel modeling to analyze the relative contributions of these multiple contextual levels: nurses within units within hospitals. This approach recognizes the nested data structures and enables the examination of whether the effect on the dependent variable is due to contextual factors and at which level (e.g., unit; hospital) (Goldstein, 2011). In addition, Alexander and Hearld (2012) recognize the importance of multilevel modeling for revealing cross-level interactions, and note its importance in identifying contextual factors that weaken or reinforce the effects of an intervention and account for variable results in other settings.

Unit- or organization-level patient outcomes reflecting the quality or delivery of care can be influenced by a wide array of patient characteristics. In implementation science, it is important to have a comprehensive understanding of the many factors contributing to implementation success and patient outcomes. Patient care units serve diverse populations with various and complex clinical needs. It is well documented that many patient population and individual characteristics have significant relationships with patient outcomes and should be adjusted for, such as: age, gender, acuity, comorbidity, socioeconomic status, and race/ethnicity (Aiken et al., 2011; Aiken et al., 2008; Iezzoni, 2013; Van den Heede, Sermeus, et al., 2009). Adjusting for pertinent characteristics of patients cared for in the study unit will assist in isolating the effect of the independent variable (e.g., implemented EBP or implementation strategy).

Summary. The above challenges in implementation science have been taken into careful consideration in designing the dissertation study. Independent variables requiring further investigation include the following practice context factors: nurse manager EBP leadership behaviors, nurse manager EBP competency, and unit climate for EBP implementation. As noted above, few studies investigate context factors for EBP implementation and none investigate the leadership and competencies of nurse managers and their impact on unit climates for EBP implementation and patient outcomes.

Patient Outcomes in Implementation Research

Including patient outcomes as an indicator of implementation success has been argued above. Numerous stakeholders are interested in patient outcomes research, especially since comparative outcomes are tied to financial incentives as part of the Affordable Care Act. Regulatory agencies, such as Centers for Medicare and Medicaid Services (CMS), are particularly interested in patient outcomes as indicators of care quality. Mitchell and Lang (2004) and Mitchell and Shortell (1997) suggest that adverse patient events (i.e., negative patient outcomes) might be a sensitive indicator of differences in care quality across health systems. As noted above, the successful implementation of EBPs should have a positive effect on patient outcomes. In implementation science, patient outcomes may be used as a dependent measure that helps to evaluate successful implementation of practice change(s).

Typology

Selection of patient outcomes for implementation research relies on the practice change being implemented and the context or population the practice change affects. For example, Titler and colleagues (2009) selected mean pain intensity as a patient outcome because the study involved implementation of EB pain management practices. Patient outcomes are categorized below as generic, condition-specific, and nursing-sensitive.

Generic*.* Kane and Radosevich (2010) define generic measures as being "comprehensive, broadly applicable across diseases, treatments (or interventions), and demographic groups that assess a single aspect of multiple aspects of health-related functioning in daily life" (p. 85). Since generic measures have broad utility, they have the unique ability to assess outcomes that transcend disease states and populations (e.g. physical, psychological, and social aspects of health). Traditionally, generic outcomes included morbidity and mortality only. However, the scope has since been expanded to include multiple domains. Kane and Radosevich (2010) define the expanded scope of generic measures, which includes: death, disease, disability, discomfort, dissatisfaction, and destitution or dollars spent for health services. This list captures the traditional morbidity and mortality outcomes, as well as, outcomes in other domains: physical functioning, psychological well-being, social functioning, pain, cognitive functioning, vitality, and overall well-being (Kane & Radosevich, 2010).

Examples of widely used generic measures include the 36-item Short-Form Health Survey (SF-36) measuring multiple domains of health (e.g. psychological well-being; vitality) (Ware, Kosinski, Dewey, & Gandek, 2000); Health Utilities Index Mark 3 measuring patient-reported health status (Feeny et al., 2002); Katz Index of ADLs (Activities of Daily Living) measuring physical functioning (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963); Mental Status Questionnaire measuring cognitive functioning (Kahn, Goldfarb, Pollack, & Peck, 1960); and the Pittsburgh Sleep Quality Index (PSQI) measuring vitality in terms of sleep and rest (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

Generic measures used to evaluate patient outcomes pose both advantages and disadvantages. Generic measures have the ability to compare outcomes across many different conditions or populations. Consequently, generic measures receive greater, widespread use leading to stronger standardization and psychometric evaluation. Other advantages include the ease of understanding and use for nonclinical professionals. Finally, generic measures assess domains relevant to patients. Despite these many advantages, generic measures have a few disadvantages. Generic measures are nonspecific regarding treatment effects; more likely to experience floor and ceiling effects; lack ability to capture small, clinically significant changes; and many fail to measure domains relevant to clinicians.

Condition-specific. Patrick and Deyo (1989) define condition-specific measures as “measures designed to assess specific diagnostic groups or patient populations, often with the goal of measuring responsiveness of ‘clinically important’ changes” (p. S217). Kane and Radosevich (2010) explain that condition-specific measures are “designed to measure changes in the most salient aspects of a specific condition, reflecting aspects of functioning that are closely tied to the condition" (p. 133). Condition-specific measures are further described in two categories: (1) clinical outcomes and (2) experiential outcomes. The former includes the signs, symptoms, laboratory tests, and other clinical assessments/findings. The latter, experiential, involves the impact of the disease or condition on the patient, such as the ability to climb stairs or perform other activities of daily living. Condition-specific measures are different than generic measures in their specificity and relevance to a particular condition and their responsiveness to small treatment effects.

Condition-specific measures vary by disease and/or population. Therefore, there are numerous measures available. Kane and Radosevich (2010) describe four types of condition-specific measures: (1) symptoms (e.g. pain, shortness of breath); (2) signs (e.g. heart murmur); (3) test (e.g. fasting blood glucose); and (4) function test (e.g. ability of patient to use stairs). The first three types measure condition-specific health statuses. The fourth, function, measures the impact of the condition on the patient's life or the patient's day-to-day experiences with the condition.

Quality of life (QOL) is a concept that is typically evaluated using generic measures, but often investigators further specify these generic measures, constructing them into condition-specific, to measure QOL for certain populations and conditions of interest. The World Health Organization Quality of Life assessment is a generic measure of the multidimensional QOL concept (WHO, 1995). Using this QOL concept, the Functional Assessment of Cancer Therapy—General (FACT-G) is a compilation of questions evaluating four quality of life domains for cancer patients (physical well-being, social/family well-being, emotion well-being, and functional well-being) (Cella et al., 1993). This QOL scale has been further specified to be used with patients with specific forms/types of cancers (i.e. the FACT-L scale is for lung cancer patients) (Cella et al., 1995).

Nurse-sensitive patient outcomes. Nurses play a key role in monitoring and mitigating the effect of adverse patient outcomes (Savitz, Jones, & Bernard, 2005). Nursing scientists at the University of Iowa School of Nursing have classified outcomes reflective of nursing care and coined the phrase “nursing-sensitive indicators” which reflects patient outcomes affected by nursing practice (Maas, Johnson, & Moorhead, 1996). Implementation research seeking to understand factors related to implementation of EBPs in nursing contexts and impact on patient outcomes should carefully consider the type of outcome(s) to include. Within an interdisciplinary care setting, understanding the contribution of one particular discipline on patient outcomes compared to another is a challenging task. Identification, measurement, and reporting of nursing-sensitive patient outcomes are primarily led by two large initiatives: National Database of Nursing Quality Indicators (NDNQI) and the National Quality Forum (NQF). Based on Donabedian’s quality framework (Donabedian, 1988), NDNQI provides quarterly and annual reporting of structure, process, and outcome indicators of participating hospitals to assess nursing care at the unit level (Montalvo, 2007; NDNQI, 2016). Created in 1999, NQF seeks to improve care quality and patient outcomes by establishing national priorities for quality improvement efforts and endorsing standards for quality measurement and reporting (NQF, 2016).

Selection of nursing quality indicators and measurement tools relies heavily on the research question, type of nursing unit(s) included (e.g., intensive care; pediatric), and participating study sites, because not all hospitals participate in NDNQI. Patient clinical adverse outcomes, such as, inpatient falls and hospital acquired conditions (e.g., infections, pressure injuries) can reflect the quality of care received by patients and should be matched to the practice context. For example, research interested in comparing quality of care across neonatal intensive care units may include central line-associated blood stream infection (CLABSI) rates and ventilator-associated pneumonia (VAP) rates. Using VAP as a quality indicator on a labor and delivery unit would be inappropriate because ventilated patients are not found in these units.

The selection of patient clinical outcomes as dependent variables in implementation science also depends upon the practice change being implemented and the local setting or context of implementation. For example, a Translating Research Into Practice (TRIP) intervention to improve older adults' acute pain management practices selected mean patient pain as a dependent variable reflecting the degree to which the intervention was successfully implemented (Titler et al., 2009). Similarly, in a TRIP study to improve pain management for cancer patients in community-based hospice settings, investigators selected pain severity as patient clinical indicator of implementation success (Herr et al., 2012).

This dissertation study involves medical-surgical units in acute care hospitals. Adverse patient outcomes commonly reported in these units include: inpatient falls, nosocomial pressure injuries, and catheter-associated urinary tract infections (CAUTI). These adverse outcomes have tremendous clinical, financial, and policy implications, and pose significant quality of life challenges for patients and their families. Inpatient falls are the most commonly reported adverse event in hospitals (Bouldin et al., 2013; Currie, 2006; Everhart et al., 2014). In 2013, the direct medical costs adjusted for inflation was $34 billion (Stevens, Corso, Finkelstein, & Miller, 2006). Many who fall, even if not injured, develop a fear of falling leading to decreased mobility, and function (Bell, Talbot-Stern, & Hennessy, 2000). Nosocomial pressure injuries are considered largely avoidable and are a serious reportable healthcare event that cost the US healthcare system $9.1-11.6 billion annually (AHRQ, 2011; NQF, 2011). CAUTIs account for 1/3 of all healthcare-associated infections and $350 million in annual costs in the U.S. (Kennedy, Greene, & Saint, 2013; Scott, 2009).

Inpatient falls, CAUTIs, and nosocomial pressure injuries are patient outcomes that are very sensitive to nursing care. Nursing practice significantly contributes to the prevalence and amelioration of these outcomes. For example, Titler and colleagues (2017) demonstrated reductions in fall rates after successful implementation of an EB fall prevention intervention. Using nurse-driven interventions to reduce CAUTI in two medical-surgical units, Oman and colleagues (2012) found reductions in total catheter days and product cost savings of $52,000 annually. Regarding nosocomial pressure injuries, Catania and colleagues (2007) observed a 50% reduction in nosocomial pressure injuries following implementation of nursing initiatives including accurate assessment, documentation, and treatment.

As noted above, very few studies include nurse managers, unit climates, and patient outcomes as measureable study variables in nursing, leadership, and implementation research (Wong et al., 2013). In addition, no studies have examined nurse managers’ EBP competencies and leadership behaviors on fostering unit climates for EBP implementation and the impact on patient outcomes.

Risk Adjustment and Patient Outcomes

Including patient outcomes as dependent variables in implementation science may involve multiple units or sites, such as internally (within a hospital across units) or externally (across hospitals). Therefore, when using patient outcomes in implementation research, the investigator must use proper risk adjustment and include relevant confounding variables as possible explanatory variables in the analysis. However, understanding outcomes across settings has been wrought with methodological issues, including: (1) identifying appropriate and rigorous severity and risk adjustment measures; (2) lacking access to usable and comparable data across multiple sites; (3) determining the unique contributions of multifaceted practice change interventions to improve outcomes; and (4) understanding how to effectively integrate and use generic and condition-specific measures (Lamb, 1997). This section describes common standardized risk adjustment methods that can be used to adjust for variation associated by patient characteristics.

Standardized Risk Adjustment Methods

As health services and patient outcomes research evolves, methodology for risk adjustment improves or adapts. The widespread use of standardized risk adjustment measures can help to compare findings across studies. It is important to consider the following when selecting a risk adjustment measures: (1) predictive ability; (2) population and/or context being studied; (3) structure of existing datasets; and (4) availability of data in existing datasets. The most prominent standardized risk adjustment methods in health services and patient outcomes research include the Charlson Comorbidity Index, Elixhauser Comorbidity Measure Set, Case Mix Index, and the 3M™ All Patients Refined Diagnosis Related Group Classification System (Iezzoni, 2013).

Charlson Comorbidity Index. The Charlson Comorbidity Index is the most widely used and extensively studied comorbidity index (de Groot, Beckerman, Lankhorst, & Bouter, 2003). The index includes 19 comorbidities based upon the International Classification of Diseases (ICD) diagnostic codes found in administrative data and hospital record abstracts. These comorbidities have been selected and weighted based on the strength of their association with mortality (Charlson, Pompei, Ales, & MacKenzie, 1987). The weights for each comorbidity category vary from 1 to 6, based on the adjusted risk of mortality. Each of the weighted comorbidities is summed to produce a single score to predict 1-year mortality. A zero score indicates no comorbidities found. A higher score predicts an increased likelihood that the outcome results in mortality or higher resource use. Through multiple revisions, it has demonstrated utility in working with administrative datasets using ICD-9-CM and ICD-10 codes (Deyo, Cherkin, & Ciol, 1992; Quan et al., 2005; Thygesen, Christiansen, Christensen, Lash, & Sørensen, 2011).

Upon demonstrating validity among different populations (Aaronson et al., 1997; Lee et al., 2003; Piccirillo, 2000), age was subsequently found to be predictive of mortality from comorbid diseases leading to the development of the Age-Adjusted

Charlson Comorbidity Index (ACCI), which combines age and comorbidity into a single score (Charlson, Szatrowski, Peterson, & Gold, 1994). A recent study conducted by Suidan and colleagues (2015) found that although the ACCI was not associated with minor or major perioperative complications in patients undergoing primary cytoreduction for advanced epithelial ovarian cancer, it was a significant predictor of progression free and overall survival. In nursing research, Aiken and colleagues (2014) used this index as a risk adjuster in a study interested in the associations between nurse staffing, nurse education, and 30-day patient mortality in nine European countries. The authors found that cutting nurse staffing hours as a cost-savings approach actually resulted in potential costs related to increased adverse patient outcomes. In addition, employing higher proportions of bachelor-prepared nurses could reduce preventable hospital deaths.

Despite its widespread use and application over the past three decades, the Charlson Comorbidity Index has received criticism regarding its generalizability and utility in multiple care settings (e.g., primary, acute, ambulatory) without requiring significant revisions (Carey, Shah, Harris, DeWilde, & Cook, 2013). In addition, since its introduction, advancements in treatment options have improved the mortality outcomes for many of the comorbidities included in the index (Needham, Scales, Laupacis, & Pronovost, 2005; Quan et al., 2011; Schaik, Vinichenko, & Rühli, 2014). Despite these criticisms, many versions of the Charlson Comorbidity Index continue to demonstrate the ability to predict mortality and may still be useful as a risk adjuster in multisite research (Yurkovich, Avina-Zubieta, Thomas, Gorenchtein, & Lacaille, 2015).

Elixhauser Comorbidity Measure Set. The Elixhauser Comorbidity Measure Set is gaining prevalence as an acceptable and excellent predictor of mortality, length of stay, and hospital charges (Quan et al., 2005; van Walraven, Austin, Jennings, Quan, & Forster, 2009; Zhu & Hill, 2008). Elixhauser, Steiner, Harris, and Coffey (1998) identified 30 conditions based on the International Classification of Diseases diagnostic codes found in administrative data and found that they were associated with length of stay, hospital charges, and in-hospital deaths. In this approach, instead of producing a single score like the Charlson Comorbidity Index, variables for each of the 30 comorbid conditions are entered into multivariate regression models allowing each to generate individual weights within the specific data set (Iezzoni, 2013).

The Elixhauser Comorbidity Measure Set has demonstrated similar ability to the Charlson Comorbidity Index to predict mortality (Li, Evans, Faris, Dean, & Quan, 2008) and, in some cases, better predictive ability (Lieffers, Baracos, Winget, & Fassbender, 2011; Menendez, Neuhaus, van Dijk, & Ring, 2014). The Elixhauser set has been used as a risk adjuster in nursing research. For example, Kendall-Gallagher, Aiken, Sloane, and Cimiotti (2011) used the Elixhauser set along with other adjusting variables (e.g., patient demographics, admission type) in their investigation of a relationship between a hospital's proportion of nurses with specialty certification and 30-day patient mortality and failure to rescue deaths. The investigators found that nurse specialty certification is associated with better patient outcomes.

A recognized disadvantage of the Elixhauser Comorbidity Measures Set is that it comprises 30 dichotomous variables, which represent each comorbidity, without providing a weighting system for calculating a single score (Yurkovich et al., 2015).

Therefore, due to the complexity of the measure, it may be difficult to incorporate the tool into existing datasets. However, each comorbid condition in the set had an independent effect on mortality and outcomes, suggesting that simplifying them into an index with a single score is inappropriate (Elixhauser et al., 1998). Gagne, Glynn, Avorn, Levin, and Schneeweiss (2011) have successfully combined the Elixhauser set and the Charlson index to produce a new risk adjustment tool that demonstrated initial evidence of better mortality predictability than using each measure independently.

Case Mix Index. Case Mix Index (CMI) is a Centers for Medicare and Medicaid Services (CMS) risk adjustment method that is frequently used in comparative or multisite/multiunit health services research. CMI represents the average diagnosis-related group (DRG) relative weight for a hospital or a unit. The DRG weights are summed for all Medicare discharges and then divided by the number of discharges. It reflects the diversity and clinical needs of the population served by the hospital or unit (Grosskopf & Valdmanis, 1993). CMI is commonly used, valid and reliable measure to determine resource allocation and hospital reimbursement (Pettengill & Vertrees, 1982).

However, since CMI was designed to calculate hospital payments, rather than disease severity, caution should be used when including it as a risk adjuster for patient acuity (Mendez, Harrington, Christenson, & Spellberg, 2014). Additionally, since CMI reflects the level of clinical need, it can be used to describe a system and/or unit and compare across systems and/or units. For example, Kuster and colleagues (2008) determined that CMI was a useful adjustment tool when investigating antibiotic use across multiple acute care hospitals. In addition, two of the major advantages of using

CMI as a risk adjuster in multisite research include: its low-to-no cost, data availability (commonly reported to CMS), and simplicity (single score). CMI is often used to describe hospital level acuity. Not all organizations may calculate unit level CMIs.

3M™ All Patients Refined Diagnosis Related Group Classification System. The 3M™ All Patients Refined Diagnosis Related Group Classification System (APR-DRG) is a widely used proprietary software application, which extends the basic DRG framework and adjusts for severity of illness and risk of mortality (3M, 2015). Severity of illness is defined as the extent of physiological decompensation or organ system loss of function as assigned by the 3M™ APR-DRG. The 3M™ APR-DRG includes a standardized retrospective four level system (1 = minor; 2 = moderate; 3 = major; 4 = severe). The 3M™ APR-DRG system produces derived data in which an automated system assigns a 3M™ APR-DRG severity of illness code for each patient.

The 3M™ APR-DRG has benefits over the CMS DRG classification (CMI). Whereas CMI only uses Medicare patients, the 3M™ APR-DRG classification system includes all patients receiving care within the hospital or unit. The 3M™ APR-DRG's ability to accurately adjust for illness severity has been demonstrated in multiple studies (Baram et al., 2008; Titler, Dochterman, et al., 2007; Titler et al., 2007; Titler et al., 2008). For example, Romano and Chan (2000) found that the measure is a powerful and useful tool for risk adjusting acute myocardial infarction mortality and Baram and colleagues (2008) determined its utility and accuracy in severity adjustment within medical intensive care units. The measure has been successfully used to control for relative risks in mortality among hospitals in their multisite study investigating the relationship between nurse staffing and education and inpatient cardiac surgery mortality using administrative datasets (Van den Heede, Lesaffre, et al., 2009). This measure has been used in multiple outcomes effectiveness study with evidence of being able to discriminate between known groups of patients (Titler, Dochterman, et al., 2007; Titler et al., 2005; Titler et al., 2008). Although the 3M™ APR-DRG system is used by many hospitals and health care systems, it is not used by all, which presents a potential limitation for use in multisite research.

Summary. When using patient outcomes as dependent variables in multisite, multiunit implementation research, it is important to consider the level and type of risk adjustment required for conducting robust and comparable analyses of the data. An array of valid and reliable standardized risk adjustment tools are available for use. Careful consideration of the population and/or context being studied, the structure of the existing datasets, and the availability of data at study sites/units must be taken into account when selecting a standardized or other risk adjustment measure. The 3M™ APR-DRG system is proprietary and was not used by all participating sites in this study. Consequently, I was unable to adjust for clinical severity variation across the participating units. One might suggest using CMI to adjust for hospital level severity as unit level severity contributes to overall site severity. However, this would be inappropriate because the outcomes of interest are unit level and CMIs across sites may be drastically influenced by other units not eligible for participation in the study. CMIs are included in this dissertation study to describe the type of hospitals in which the participating units are nested. The inability to adjust for unit level severity of illness was also due to lack of funding for compensating and training site coordinators to collect and compile data required for other risk adjustment measures described above. Consequently, this results in a limitation of study findings (discussed in Chapter 5).

Conclusion

To improve quality of care and minimize adverse patient outcomes, nurses must deliver care that is based on the current, best evidence. Evidence-based practice is the "conscientious and judicious use of current best evidence in conjunction with clinical expertise and patient values to guide health care decisions" (Titler, 2014). Most research has focused on facilitators and barriers to EBP implementation by clinicians with little attention given to the context factors to promote use of EBPs (Jeffs, Beswick, et al., 2013; Rycroft-Malone & Bucknall, 2010; Sandström et al., 2011; Shever et al., 2011).

There is emerging evidence that when EBPs are used in healthcare, patient outcomes improve (Grimshaw, Eccles, Thomas, et al., 2006; Lugtenberg, Burgers, & Westert, 2009; Titler, 2014). Little is known, however, about the types of practice contexts that foster delivery of evidence-based care. Further research is needed that focuses on factors that influence a unit's integration of EBP and the effect on patient outcomes (Jeffs, Beswick, et al., 2013; Jeffs, Sidani, et al., 2013; Titler et al., 2009). Social dynamic context factors (e.g., climate, leadership) influence the success or failure of EBP implementation efforts; however, this relationship has not been sufficiently studied. With the integration of EBP into health care delivery, patient outcomes have shown some signs of improvement, but research has not focused on the context factors (e.g., unit climate) for implementation.

Patient outcomes are affected by the context of care delivery (Shever & Titler, 2012; Titler, 2010). Little is known, however, about context factors regarding evidence-based practice (EBP) and patient outcomes. Unit bed capacity, registered nurse skill mix, registered nurse hours per patient day, patient age, and severity of illness are structural context factors with demonstrated influence on EBP implementation and patient outcomes (Dunton et al., 2004; Halm et al., 2002; Howell et al., 2010; Kerr et al., 2010; Lang et al., 2004; Shever & Titler, 2012; Titler et al., 2015; Titler, Dochterman, et al., 2007; Titler et al., 2005; Titler et al., 2009; Titler et al., 2008; Titler et al., 2011; Twigg et al., 2012). However, no multisite, multiunit studies have examined the social dynamic context factors of nurse manager EBP competencies, nurse manager EBP leadership behaviors, unit climate for EBP implementation, and the effect of these factors on patient outcomes. To advance the science of implementation and improve care delivery, these social dynamic context factors must be addressed (Newhouse et al., 2013; Shever & Titler, 2012).

This dissertation study is a multisite, multiunit study. Consequently, the type and number of EBPs actively being implemented was likely to vary across units and hospitals. Therefore, this dissertation study did not measure the actual use of implemented EBPs as a dependent variable. Data regarding three patient outcomes (e.g., inpatient falls,catheter-associated urinary tract infections, and nosocomial stage III and IV pressure injuries), which are known indicators of nursing EBP use, were collected as discussed in Chapter 3. As noted be Chaudoir and colleagues (2013), it is imperative that the implementation science field develops valid and reliable measures to accurately assess factors influencing implementation and success of implementation efforts at multiple levels. This study furthers the work of implementation science measurement by using valid and reliable measures for unit level analysis, as well as, further demonstrating the validity and reliability of a new measure that evaluates nurse manager EBP competency. More research is needed to understand and map context factors to implementation outcomes, like patient outcomes. Therefore, this dissertation provides empirical understanding of the relationships among social dynamic context factors (e.g., leadership and climate) and patient outcomes, which may ultimately reflect the successful implementation of EBP.

The following table provides an overview of the study concepts, variables, measurement, and data sources. This dissertation study collected data on social dynamic context factors, structural context factors (unit and hospital level), nursing-sensitive patient outcomes, and respondent demographics. The variables in relation to the specific aims set forth earlier are discussed in more detail in Chapter 3.

Table 2.7. Summary of Study Concepts, Variables, and Measurement

Study Concepts	Variables	Conceptual Definition	Operational Definition	Source	Type
Social Dynamic Context Factors: roles, relationships, and dynamics of individuals and groups within a setting	Nurse Manager EBP Competency	A nurse manager's expected level of purposeful performance regarding use of evidence to improve care delivery resulting from the integration of knowledge, skills, abilities, and judgment about EBP (Shuman, Ploutz-Snyder, & Titler, forthcoming)	Nurse Manager EBP Competency Scale (Shuman et al., forthcoming) 16 items with 2 subscales (EBP Knowledge; EBP Activity), 0-3 Likert response scale Face and context validity by 8 EBP experts Reliability: Total score Cronbach α=.95; EBP Knowledge: α=.90; EBP Activity: α=.94	Nurse manager questionnaire	Independent variable in Aims 1-3
	Nurse Manager Implementation Leadership Behaviors	Specific leadership behaviors enacted by nurse managers to facilitate EBP implementation and foster an EBP climate on their unit. (Aarons, Ehrhart, Farahnak, 2014)	Implementation Leadership Scale (Aarons, Ehrhart, Farahnak, 2014) 12 items, 4 subscales (Proactive, Knowledgeable, Supportive, Perseverant), 0-4 Likert response scale Convergent validity: .62 to .75. Total Cronbach α= .98 Subscales α = .89-.91 Confirmatory factor analysis .90 to .94	Nurse manager and Staff Nurse questionnaires	Independent variable in Aims 1-3

Study Concepts	Variables	Conceptual Definition	Operational Definition	Source	Type
	Unit Climate for EBP Implementation	Staffs' shared perceptions of the practices, policies, procedures, and clinical behaviors that are rewarded, supported, and expected in order to facilitate successful implementation of EBP. (Ehrhart, Aarons, & Farahnak, 2014)	Implementation Climate Scale (Ehrhart, Aarons, & Farahnak, 2014) 18 items with 6 subscales (Focus on EBP; Educational Support for EBP; Recognition for EBP; Rewards for EBP; Selection for EBP; and Selection for Openness), 0-4 Likert response scale Construct validity Reliability: Total Cronbach α=.91, Subscales α = .81-.91	Nurse manager and Staff Nurse questionnaires	Independent variable in Aims 1, 3. Dependent variable in Aim 2.
Nursing-Sensitive Patient Outcomes: patient outcome quality indicators which explicitly reflect the quality of nursing care performance	Inpatient fall rate	A patient fall is defined as an unplanned descent to the floor or extension of the floor (e.g. trash can, other equipment) with or without injury. This includes both "assisted" and "unassisted" falls. Exclude falls from patients who are not in the unit at the time of the fall (e.g. while in radiology).	Total number of falls (n) multiplied by 1000 then divided by total number of inpatient days. Calculated for each unit. NQF Measure	Site coordinator data collection*	Dependent variable in Aim 3.
	Catheter-Associated Urinary Tract Infection (CAUTI) rate	The total number of catheter associated urinary tract infections (both asymptomatic bacteremic UTI (ABUTI) and symptomatic UTI (SUTI)) on each study unit for each of the designated months.	Total number of CAUTIs (n) multiplied by 1000 then divided by the total number of catheter days. Calculated for each unit. CDC Measure	Site coordinator data collection*	Dependent variable in Aim 3.
	Nosocomial Stage III and IV Pressure Injury rate	ICD-10 diagnosis codes with a not present on admission (POA) indicator (N). Stage III and IV pressure injury codes include all possible	Total number of nosocomial stage III and IV pressure injuries (n) multiplied by 1000 then divided by the total number of unit discharges. Calculated for each unit.	Site coordinator data collection*	Dependent variable in Aim 3.

Study Concepts	Variables	Conceptual Definition	Operational Definition	Source	Type
		pressure injury sites with the POA indicator "N". Codes: L89.xx3 and L89.xx4, where L89= pressure injury, xx represents the site, 3= stage III, and 4= stage IV.	AHRQ Measure		
Structural Context Factors: characteristics of the setting, including both unit and hospital level	**UNIT LEVEL**				
	Patient Age	Average patient age in years for all patients on a study unit.	Mean Age in years of all patients discharged from each of the study units for each of the three designated months. Calculated for each unit.	Site coordinator data collection*	Confounding Variable in Aim 3
	Severity of Illness	Extent of physiological decomposition or organ system loss of function assigned by the 3M® All Patient Refined Diagnosis Related Groups (APR-DRG) and is the number and percent of inpatient discharges from each study unit in each category of minor, moderate, major, and severe for each of the designated months.	Number of discharges (n) in each severity of illness category (minor, moderate, major, and severe). Proportions in each category calculated for each unit.	Site coordinator data collection*	Confounding Variable in Aim 3
	RN Skill Mix	The percentage of nursing care hours performed by registered nurses.	Total number of direct nursing care hours performed by registered nurses divided by the total number of direct nursing care hours provided by all nursing personnel (RNs, LPNs, NAs) over the three designated months. Calculated for each unit.	Site coordinator data collection*	Confounding Variable in Aim 3

Study Concepts	Variables	Conceptual Definition	Operational Definition	Source	Type
	RN HPPD	The number of productive hours worked by RNs with direct patient care responsibilities for each in-patient unit in a calendar month per the number of patient days for the same month.	Total number of direct care hours by RNs divided by the total number of patient days over the three designated months. Calculated for each unit.	Site coordinator data collection*	Confounding Variable in Aim 3
	Unit Bed Capacity	The total number of inpatient beds available in the unit for each of the designated months.	Average unit bed capacity over the three designated months. Calculated for each unit.	Site coordinator data collection*	Confounding Variable in Aim 3
	Average Daily Unit Census	The average number of acute care patients in the unit.	The average number of acute care patients in the unit over the three designated months, based on midnight census.	Site coordinator data collection*	Unit description
	Clinical Nurse Specialist Hours	The amount of time a CNS is appointed to the study unit per week.	Total number of CNS hours per week for each unit; subsequently organized into three main categories: no CNS (0 hours), part time CNS (1-39 hours), and full time CNS (40 hours).	Site coordinator data collection*	Unit description
	HOSPITAL LEVEL				
	Hospital Size	Total number of acute care beds available in the hospital.	Total number of acute care beds over the six designated months. Subsequently organized into three main categories: small (<100 beds); medium (100-300 beds); and large (>300 beds).	Site coordinator data collection*	Hospital description
	Average Daily Hospital Census	The average number of acute care patients in the hospital.	The average number of acute care patients in the hospital over the six designated months, based on midnight census.	Site coordinator data collection*	Hospital description
	Average Case Mix Index (CMI)	The average diagnosis-related group (DRG) weight for all of a hospital's Medicare volume.	The average diagnosis-related group (DRG) weight for all of a hospital's Medicare volume over the six designated months.	Site coordinator data collection*	Hospital description
	Hospital Type	The classification of hospitals using a combination of provided categories.	Hospitals were categorized as one or more of the following public state or local, private not for profit, private for profit, church affiliated, urban, rural.	Site coordinator data collection*	Hospital description

Study Concepts	Variables	Conceptual Definition	Operational Definition	Source	Type
	Magnet® Designation Status	The hospital's current status regarding the Magnet Recognition Program®.	Categorized as: current or no/expired designation.	Site coordinator data collection*	Hospital description
Respondent Demographics: selected demographics of the sample for questionnaire data (staff RNs and nurse managers)	Age	The length of a person's existence.	The age of the respondent in whole years when completing the questionnaire.	Nurse manager and Staff Nurse questionnaires	Respondent description
	Gender	The behavioral, cultural, and psychological traits typically associated with one's sex.	Defined as female, male, prefer not to respond.	Nurse manager and Staff Nurse questionnaires	Respondent description
	Race	A group of people united by certain characteristics.	One or more of the following: American Indian or Alaskan Native; Asian; Native Hawaiian or Other Pacific Islander; Black or African American; White or Caucasian; Other; prefer not respond.	Nurse manager and Staff Nurse questionnaires	Respondent description
	Shift	A scheduled period of time in which a person works.	One of the following: days, evenings, nights, or rotate.	Nurse manager and Staff Nurse questionnaires	Respondent description
	Years of Experience as a Registered Nurse	The total time in years an individual has maintained work as a registered nurse.	Number of years worked as a registered nurse when completing the questionnaire.	Nurse manager and Staff Nurse questionnaires	Respondent description
	Years of Experience as a Nurse Manager	The total time in years an individual has maintained work as a nurse manager.	Number of years worked as a nurse manager when completing the questionnaire.	Nurse manager questionnaire	Respondent description
	Years of Experience in Current Role in Current Hospital	The total time in years an individual has maintained work in current role in current hospital.	Number of years worked in current role in current hospital when completing the questionnaire.	Nurse manager and Staff Nurse questionnaires	Respondent description

Study Concepts	Variables	Conceptual Definition	Operational Definition	Source	Type
	Years of Experience in Current Role in Current Unit	The total time in years an individual has maintained work in current role in current unit.	Number of years worked in current role in current unit when completing the questionnaire.	Nurse manager and Staff Nurse questionnaires	Respondent description Staff Nurse responses used as confounding variable in Aim 2
	Educational Level	The highest level of formal schooling that a person has reached.	One of the following: diploma, associates, bachelors, masters, doctorate.	Nurse manager and Staff Nurse questionnaires	Respondent description Staff Nurse responses used as confounding variable in Aim 2
	Current Enrollment in Degree Program	The status of an individual regarding current enrollment in a nursing degree program at an accredited school.	No enrollment or yes enrollment.	Nurse manager and Staff Nurse questionnaires	Respondent description
	Degree Type Being Pursued	The level of formal education that a person is currently pursuing at an accredited school, if in fact that person is currently pursuing further education.	One of the following: BSN; Clinical Masters; Non-clinical Masters; DNP; PhD	Nurse manager and Staff Nurse questionnaires	Respondent description

*Note: Please see Appendix C for detailed description of data sources identified.

CHAPTER 3

RESEARCH DESIGN AND METHODS

In this chapter, the research design and methods are discussed. Study variables, instruments and measures (presented in Table 2.7 above) are further discussed. Study procedures, including data collection methods and data management, are discussed next. Finally, the data analyses are discussed in detail.

Introduction

The purpose of this multisite, multiunit cross-sectional study was to describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and unit climates for EBP implementation; examine the unique contribution of nurse manager EBP competency and leadership behaviors in explaining practice climates conducive for implementation of evidence-based practices; and examining the effect of these three social dynamic context factors on unit-level patient outcomes. Nurse managers are believed to play an important role in promoting EBP on clinical units. There is, however, a dearth of research focused on EBP competencies and EBP leadership behaviors of nurse managers and their effect on unit climates for EBP implementation. Additionally, there are no multisite, multiunit studies that have demonstrated the effect of these context variables on patient outcomes; therefore, there is a need for studies to explicate these relationships. This dissertation study addresses this gap in the science with the long-term goal of testing implementation interventions targeted to these context factors to improve evidence-based care delivery and patient outcomes.

The following specific aims guided this research:

Aim 1: To describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and unit climates for EBP implementation in hospital settings.

a. To describe the EBP competencies of nurse managers in hospital settings as perceived by nurse managers.
b. To describe the EBP leadership behaviors of nurse managers in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.
c. To describe the unit climates for EBP implementation in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.
d. To test for differences among staff nurse and manager perceptions of 1) EBP implementation leadership behaviors (subscale and total scores) and 2) unit climates for EBP implementation (subscale and total scores).

Aim 2: To examine the unique contributions of nurse manager EBP competencies and nurse manager EBP leadership behaviors (staff nurse reported) in explaining unit climates of EBP implementation (staff nurse reported) after controlling for staff nurse level of nursing education and years of experience as a registered nurse on current unit.

Aim 3: To explore the relationships among nurse manager EBP competencies (nurse manager reported), nurse manager EBP leadership behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and selected patient outcomes (inpatient fall rates, catheter-associated urinary tract infection rates, and nosocomial stage III and IV pressure injury rates) in hospital settings.

a. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining inpatient fall rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.
b. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining catheter-associated urinary tract infection rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.
c. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining nosocomial stage III

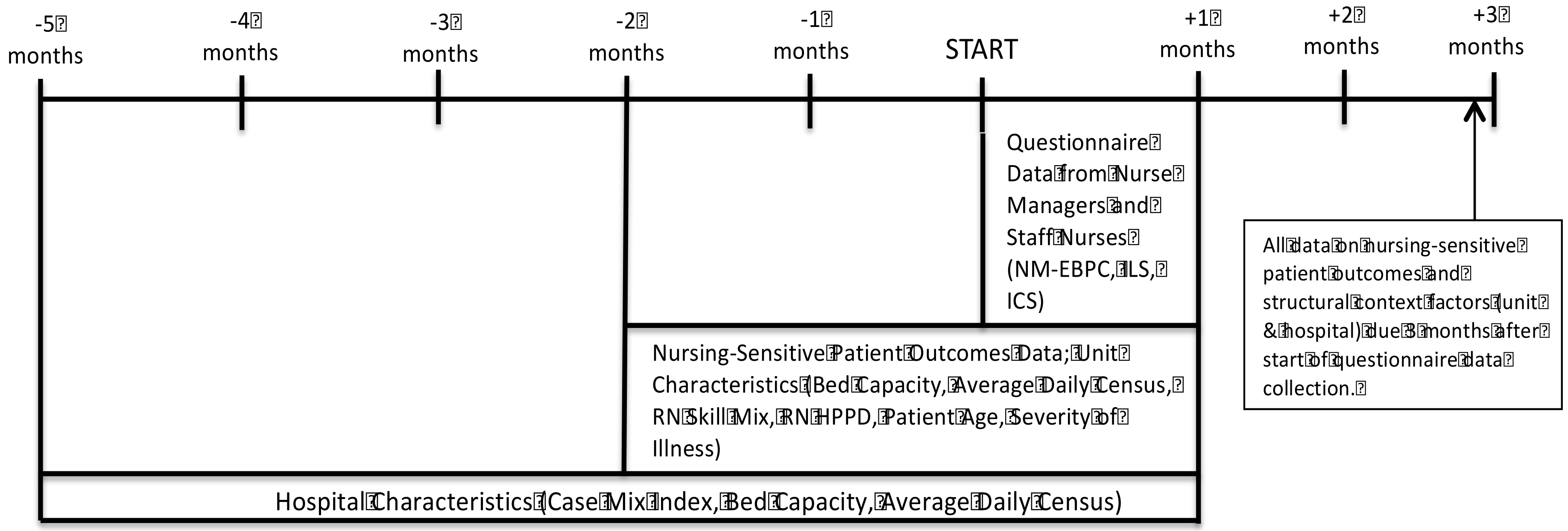
and IV pressure injury rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

Since no studies were found that investigated the competencies and leadership behaviors of nurse managers regarding EBP, unit climates for EBP implementation, and the impact of these context variables on patient outcomes, this study was designed to help identify social dynamic context factors regarding EBP that contribute to patient outcomes, as well as, provide the foundation needed to inform future implementation intervention development.

Research Design

A multi-site, multi-unit cross sectional design was used to address the specific aims. Table 2.7 above outlines the study concepts, variable definitions, and measures. Figure 3.1 depicts data collection points for questionnaire data, nursing-sensitive patient outcomes data, unit structural context factors, and hospital structural context factors.

Figure 3.1. Data Collection Timeline



Sample Size Estimation

Sample size was estimated from the pilot (see below) using a regression-based method recommended by Cohen (1988), Kelley and Maxwell (2008), and Maxwell (2000). In this method, multiple regression models are estimated to determine Cohen's f^2, or how much variance is explained by the predictor with the smallest effect in the full model. Based on pilot data, nurse manager EBP competency demonstrated the smallest effect in explaining unit climates for EBP implementation (f^2 = .04). Using the "pwr.f2.test" function in the *pwr* package (Champely, 2016) in R (R Core Team, 2016), I determined a staff nurse sample size of 286 would provide adequate power (.80) to detect a small effect of nurse manager EBP competency (.04) on unit climates for EBP implementation (α= .05).

Based on the number of hospitals recruited (N=7) and study units available (n=24) described below, and assuming 30 staff nurses per units, a 39.7% response rate would be required to achieve the sample size determined above. Based on response rates of the pilot study (28%), along with the inclusion of incentives (not offered in pilot), scheduled reminder processes (minimally used in pilot), and study marketing materials (not offered in pilot), the needed response rate was achievable. In other studies targeting nurses and utilizing similar questionnaire distribution and collection methods, investigators observed response rates from 47-83% (Shever et al., 2011; Titler et al., 2017).

Setting

The study was conducted at 7 community hospitals in the midwest and northeast US. Hospitals needed to meet the following inclusion criteria to participate: 1) agreement and support by the chief nursing officer or designee; 2) willingness to provide outcome data at the unit level; and 3) able to identify site coordinator to facilitate data collection. Hospitals were recruited through the National Nursing Practice Network. The study hospitals consisted of 3 small (<100 beds), 2 medium (100-300 beds), and 2 large hospitals (>300 beds).

Inclusion criteria for study units from each site were: (1) care for patients older than 21 years of age; and (2) designated as a medical, surgical, medical-surgical, or specialty unit (e.g. oncology, orthopedics, cardiac step-down unit). Mother-baby, pediatric, neonatal, psychiatric, and critical care/intensive care units were excluded. In total, 24 units were included in this study.

Sample

The samples for this study are 1) nurse managers of the study units and 2) staff nurses caring for patients on the study units. A nurse manager was defined as a registered nurse who oversees unit-level operations in a hospital and is responsible for care delivered by clinical staff. Managers of patient care units have various titles such as nurse manager, unit manager, and clinical coordinator. The definition of nurse manager excludes senior nurse leaders who have executive positions that involve organizational, operational activities for healthcare delivery and have titles such as chief executive vice president, senior executive, executive manager, and operating officer.

Inclusion criteria for nurse managers were: licensed as a registered nurse; has responsibility and accountability for unit-level operations; not serving as interim; and is direct supervisor of nursing staff on the study unit. Sample size of nurse mangers was 24.

Staff nurse was defined as a licensed registered nurse providing direct patient care on a designated inpatient study unit. Inclusion criteria for staff nurses were: licensed as a registered nurse; minimum of .40 full-time equivalents (FTE); provides direct patient care; and designated as staff on the study unit. Exclusion criteria included: works less than .40 FTE; designated as contingency/agency staff; and floats among units (float pool). Sample size of staff nurses was 553.

Study Variables, Instruments, and Measures

The study variables are conceptualized as Social Dynamic Context Factors, Structural Context Factors, Nursing-Sensitive Patient Outcomes, and Respondent Demographics. Variable definitions, measures and instruments for each are outlined in Table 2.7 above and further described below.

Social Dynamic Context Variables

Three social dynamic context variables are central to the study's specific aims: competencies of nurse managers regarding EBP, nurse manager leadership behaviors for EBP, and unit climate for EBP implementation.

Nurse Manager Evidence-Based Practice Competencies. Nurse manager evidence-based practice competency is defined as a nurse manager's expected level of purposeful performance regarding use of evidence to improve care delivery resulting from the integration of knowledge, skills, abilities, and judgment about evidence-based practice (American Nurses Association, 2013; Stevens, 2009).

Nurse manager evidence-based practice competencies were measured using the Nurse Manager EBP Competency Scale (NM-EBPC) (Shuman, Ploutz-Snyder, & Titler, forthcoming). Initial items (n=16) were informed by evidence-based practice competencies for baccalaureate-prepared registered nurses as described by Stevens (2009), relevant literature, previous research, EBP expertise, and comprehensive knowledge of the nurse manager role. Items were reviewed by 8 experts in EBP and in nursing leadership positions (e.g., chief nursing officer; nurse manager). Feedback on the initial items resulted in slight revisions to ensure appropriateness and uniqueness to the nurse manager role. Informed by Benner's novice-to-expert framework (Benner, 1982), a 0-3 Likert response scale was created (0 = not competent; 1 = somewhat competent; 2 = competent; and 3 = expertly competent).

The scale was then pilot tested with 4 nurse managers from two acute care hospitals to assess flow, readability, understandability, and answerability. No issues were identified. Next, an additional 4 nurse managers from 2 hospitals participating in the pilot study (discussed below) completed the scale. Pilot testing did not suggest a need for revision or modification. However, the investigators added the modifier "fully" to the third response category, making it "fully competent."

The psychometric properties of the instrument were tested with a sample of 83 nurse managers from 3 hospitals prior to this dissertation study. Exploratory factor analysis identified two subscales with 6 items loading on factor one and 10 items loading on factor two (See Appendix A). Four items demonstrated partial cross-loading, with each slightly loading more on factor 2 than 1. Each of these items was carefully examined by two experts independently to determine 1) item's importance for measuring the overall construct (NM EBP Competency) and 2) the factor to which the item aligns best. Each item was retained and included in factor two. Factor one was named "EBP Knowledge" and factor two was named "EBP Activity." The instrument demonstrated content validity and reliability (Total Score, α = .95; EBP Knowledge, α = .90; EBP Activity, α = .94) (Shuman, Ploutz-Snyder, & Titler, forthcoming).

Competency items are scored on a Likert response scale (0 = not competent; 1= somewhat competent; 2 = fully competent; 3 = expertly competent) for each item. Not competent was defined as not familiar with the item and requires assistance all of the time. Somewhat competent was defined as familiar with the item but requires assistance some of the time. Fully competency was defined as individually able to accomplish the item but may require minimal assistance from time to time. Expertly competent was defined as requires no additional assistance, and teaches and role models item to others. The scale has two subscales: 1) EBP Knowledge (6 items) and 2) EBP Activity (10 items). Total scores are calculated by summing all items on the scale and dividing by 16 for each nurse manager. Subscale scores are computed by summing all items on the respective subscale and dividing by the total number of items contained in the subscale. Only nurse managers complete the scale because items are specific to competencies of nurse managers which may not be observable by staff nurses.

Nurse Manager Leadership Behaviors for Evidence-Based Practices. Nurse manager leadership behaviors for evidence-based practice implementation is defined as specific leadership behaviors enacted by nurse managers to facilitate evidence-based practice implementation and foster an evidence-based practice climate on their unit(s) (Aarons, Ehrhart, & Farahnak, 2014).

The Implementation Leadership Scale (ILS) (Aarons, Ehrhart, & Farahnak, 2014) was used to measure nurse manager leadership behaviors for evidence-based practice. This is a 12-item scale that measures nurse managers' self-report and staff nurses' perceptions of their nurse manager's leadership behaviors supportive of evidence-based practice implementation in four areas/subscales: (1) proactive leadership; (2) knowledgeable leadership; (3) supportive leadership; and (4) perseverant leadership. Respondents indicate their agreement with each item using a 0-4 Likert scale (0 = not at all; 1 = slight extent; 2 = moderate extent; 3 = great extent; 4 = very great extent). Subscale scores are determined by adding the response values (0 to 4) for each item in the subscale and dividing by the number of items in the subscale. The total score is calculated by adding the response values (0 to 4) for each item across all subscales and dividing by 12. The tool has demonstrated internal consistency reliability (Cronbach α = 0.98) and higher-order factor structure reliability using confirmatory factor analysis (first-order factor loadings of .90 - .97; second-order factor loadings of .90 - .94; p = <0.001). Convergent validity with the Multifactor Leadership Questionnaire (r = 0.62 - 0.75) and discriminant validity with the Organizational Climate Measure subscales (r = 0.050 - 0.406) have also been demonstrated (Aarons, Ehrhart, & Farahnak, 2014). A staff nurse version and nurse manager version are available.

Unit Climate for Evidence-Based Practice Implementation. Unit climate for evidence-based practice implementation is defined as the staffs' "shared perceptions of the practices, policies, procedures, and clinical behaviors that are rewarded, supported, and expected in order to facilitate effective implementation of evidence-based practices" (Ehrhart et al., 2014).

The Implementation Climate Scale (ICS) (Ehrhart et al., 2014) was used to measure unit climate for evidence-based practice implementation. The ICS is an 18-item measure of a strategic climate for evidence-based practice implementation. It identifies the extent to which an employee's unit prioritizes and values evidence-based practice based on six domains: (1) focus on evidence-based practice; (2) educational support for evidence-based practice; (3) recognition for evidence-based practice; (4) rewards for evidence-based practice; (5) selection for evidence-based practice; and (6) selection for openness. All items are anchored to the unit as a point of reference. Respondents select their level of agreement with each item using 0-4 Likert scale (0 = not at all; 1 = slight extent; 2 = moderate extent; 3 = great extent; 4 = very great extent). Subscale scores (n=6) are calculated by adding the response value (0 to 4) for items in the subscale and dividing by the number of items in the subscale. The total score is calculated by adding the response value (0 to 4) for each item across all subscales and dividing by 18. Internal consistency reliability (Cronbach α = .91) and construct validity have been demonstrated (Ehrhart et al., 2014). The ICS was completed by staff nurses and nurse managers.

Nursing-Sensitive Patient Outcomes

Nursing-sensitive patient outcomes are defined as patient outcome quality indicators which explicitly reflect the quality of nursing care performance (Dubois, D'Amour, Pomey, Girard, & Brault, 2013; Maas et al., 1996). Examples include patient satisfaction, falls, nosocomial pressure injuries, catheter-associated urinary tract infections, catheter-associated blood stream infections, medication errors, and ventilator associated pneumonia (Dubois et al., 2013; Heslop & Lu, 2014Montalvo, 2007). For this study, the nursing-sensitive patient outcomes include inpatient falls, nosocomial stage III and IV pressure injuries, and catheter-associated urinary tract infections.

Nursing-sensitive patient outcomes are unit level variables and were measured by three indicators that are nurse sensitive: fall rates, stage III and IV hospital acquired pressure injury rates, and catheter associated urinary tract infection rates (Dubois et al., 1996).

Inpatient Falls. A fall was defined as an unplanned descent to the floor (National Quality Forum (NQF), 2004). A fall rate was calculated by the number of inpatient falls multiplied by 1000 and divided by the total number of inpatient days (NQF, 2004).

Nosocomial Stage III and IV Pressure Injuries. The incidence of nosocomial stage III and IV pressure injuries was defined using the National Pressure Ulcer Advisory Panel's (NPUAP) classification system (NPUAP, 2016). According to the NPUAP (2016), a nosocomial pressure injury is "localized damage to the skin and underlying soft tissue usually over a bony prominence or related to a medical or other device" with no documentation of the pressure injury in the medical record at the time of admission. A stage III pressure injury has full thickness tissue loss in which subcutaneous fat may be visible, however, bone, tendon, or muscle is not exposed. Slough, undermining, and tunneling may be present. A stage IV pressure injury has full thickness tissue loss with exposed or directly palpable bone, tendon or muscle. Slough and eschar may be present, as well as, undermining and tunneling. The pressure injury is hospital acquired if developed after admission; pressure injuries present on admission are not included. The Agency for Healthcare Research and Quality (AHRQ) recommended method to calculate incidence informed rate calculations. The AHRQ measure uses ICD-10 codes specific to stage III and IV pressure injuries (ICD-10 codes L89.xx3 and L89.xx4, where L89= pressure injury, xx represents the site, 3= stage III, and 4= stage IV) with a present on admission (POA) indicator of "N" (indicating not present on admission). The rate is calculated by dividing the count of nosocomial stage III and IV pressure injuries by the total number of unit discharges, and multiplied by 1000 (AHRQ, 2015).

Catheter Associated Urinary Tract Infections. Catheter associated urinary tract infections was defined using the Centers for Disease Control (CDC) criteria (CDC, 2017). A urinary tract infection (UTI) is an infection of the urinary system, including urethra, bladder, ureters, and kidneys. UTIs are often attributed to indwelling catheters (CDC, 2017; Magill et al., 2012). The CDC criteria for UTI from an indwelling catheter include: (1) patient has an indwelling urinary catheter in place for the entire day on the date of event and had been in place for >2 calendar days, on that date; (2) patient has at least one of the following signs or symptoms without any other recognized cause: fever (>38.0°C), suprapubic tenderness, or costovertebral angle pain or tenderness; and (3) patient has a urine culture with no more than two species of organisms, at least one of which is a bacteria of ≥105 CFU/ml. The incidence was calculated by: the total number of hospital acquired catheter-associated urinary tract infections divided by the total number of catheter days multiplied by 1000 (CDC, 2017).

Structural Context Variables

Structural context variables are those that reflect the characteristics of the hospitals and the study units. Hospital and unit characteristics will be used to describe the setting, with selected unit characteristics used as confounding variables in Aim 3 (see below).

Hospital Characteristics. Hospital characteristics were collected to describe the setting in which the study units were embedded. The following characteristics were selected based on previous research and because each are commonly reported data. Hospital size, defined as small=<100 beds; medium=100-300 beds; large=>300 beds, was collected from each hospital. The average daily hospital census for six months by month was collected to calculate an average over six months. Similarly, case mix index (CMI) for six months by month was collected and an average over the six months was calculated. Hospital type, defined as 1) private not for profit; private for profit; public; 2) church affiliated, and 3) urban; or rural), as well as, Magnet® designation status, defined as 1) current; or 2) expired/no designation, was also collected. Although none of these variables were used in Aim 2 or 3 analyses, random intercepts for hospitals were included to control for nested effects (see below).

Unit Characteristics. Structural context variables at the unit level were used describe the unit setting. Unit bed capacity was defined as the total number of staffed, inpatient beds available on the study unit. Data for unit bed capacity was collected by month for a three month period to calculate a three-month average for each unit. Average daily census was defined as the monthly average number of patients on a study unit at midnight census. Data for average daily unit census was gathered by month for three months to calculate a three-month average for each unit.

Patient data (age and severity of illness) was aggregated at the unit level and thus conceptualized as a unit characteristic, which further describes the unit. Average patient age was defined as the monthly mean patient age of all patients admitted to the unit. Data was collected by month for three months to calculate the three-month average patient age for each study unit. Severity of illness is defined as the extent of physiological decompensation or organ system loss of function as assigned by the All Patient Refined Diagnosis Related Groups (APR-DRG) (3M, 2015). The APR-DRG is a standardized retrospective 4 level system (1 = minor; 2 = moderate; 3 = major; 4 = severe) available in the Uniform Hospital Discharge Data Set records. The APR-DRG system produces derived data in which an automated system assigns an APR-DRG severity of illness code for each patient. This measure was used in multiple outcomes effectiveness study with evidence of being able to discriminate between known groups of patients (Titler et al., 2007; Titler et al., 2005; Titler et al., 2008).

Clinical nurse specialists (CNS) may be a resource supportive of EBP implementation and was included to describe the units. CNS appointed hours were defined as 1) no CNS (0 hours); 2) part-time CNS (1-39 hours); or 3) full-time CNS (40 hours).

Registered nurse (RN) skill mix is a staffing variable indicating the percentage of direct nursing hours worked by registered nurses. The National Database of Nursing Quality Indicators (NDNQI) definition and measure of skill mix was used (Montalvo, 2007). RN skill mix was calculated by dividing the total number of hours worked by RNs by the total number of hours worked by all nursing personnel (e.g., nurse aides; licensed practical nurses). Data for skill mix was collected by month for three months to calculate a three-month average for each study unit. In addition, data regarding registered nurse hours per patient day (RN HPPD) were collected by month for three months to calculate a three-month average for each study unit. Per NDNQI, RN HPPD is defined as the total number of direct nursing care hours worked by registered nurses per the number of patient days and is calculated by dividing the total number of RN direct nursing care hours by the total number of patient days(Montalvo, 2007).

Average unit bed capacity (over three months), average patient age (over three months), average severity of illness (percent per category), average RN skill mix (over three months), and average RN HPPD (over three months) were used as confounding variables in this study in order to control for their effect on unit level patient outcomes. The effect of these variables on nursing-sensitive patient outcomes has been previously demonstrated in effectiveness and implementation studies (Dunton et al., 2004; Halm, Lee, & Chassin, 2002; Herr et al., 2012; Howell et al., 2010; Kerr et al., 2010; Lang et al., 2004; Shever & Titler, 2012; Titler et al., 2016; Titler, Dochterman, et al., 2007; Titler, Dochterman, Picone, & Everett, 2005; Titler et al., 2009; Titler et al., 2008; Titler et al., 2011; Twigg et al., 2012)

Respondent Demographic Variables

Demographic data were collected from staff nurses and nurse managers in order to describe the samples. In addition, two staff nurse demographic variables were used as confounders in Aim 2 (education and years of experience as a registered nurse in current unit).

Staff Nurse Demographic Variables. Demographic data of staff nurses included age in years; gender; race; shift (defined as days, evenings, nights, rotating); education level (defined as diploma, associate, bachelor, master, doctorate); years of experienced as a registered nurse (RN); years of experience as a RN in current hospital; years of experience as a RN in current unit; current enrollment in a nursing degree program (defined as yes or no); and type of degree enrolled in (defined as BSN; MSN clinical; MSN nonclinical; DNP; and PhD).

Years of experience as RN on current unit and education level were used as confounding variables for Aim 2. RN respondents with more experience on the unit and/or higher levels of educational preparedness may have different perceptions of the unit climate for EBP implementation compared to RNs with less experience or education. Experience and level of education preparedness have demonstrated significant correlations among nurses' perceptions of unit culture, and readiness for EBP use (Melnyk, Fineout-Overholt, & Mays, 2008; Saunders & Vehviläinen-Julkunen; 2016; Thiel & Ghosh, 2008).

Nurse Manager Demographic Variables Demographic data for nurse managers included age in years; gender; race; education level (defined as diploma, associate, bachelor, master, doctoral); years of experience as a registered nurse; years of experience as a nurse manager; years of experience as a nurse manager in current hospital; years of experience as a nurse manager in current unit; current enrollment in a nursing degree program (defined as yes or no); and type of degree enrolled (defined as BSN; MSN clinical; MSN nonclinical; DNP; and PhD).

Pilot Study

A pilot study was conducted in preparation for this dissertation study. The goals of the pilot were: (1) to determine the feasibility of site recruitment, random selection of units and participants, data collection methods, and data analysis; and (2) to determine effect size for sample size calculations for this dissertation study. The pilot study involved four adult, inpatient medical-surgical units from two Midwest U.S. hospitals. I randomly selected two eligible units per hospital. A nurse manager and up to 30 eligible staff nurses randomly selected from each unit were invited to participate. In total, four nurse managers and 116 staff nurses received the study questionnaires. Ethics approval was obtained from the University of Michigan, as well as, from each site's institutional review board prior to data collection.

The pilot study helped to determine the selection and development of instruments, development of the questionnaires for nurse managers and staff nurses, and defining the patient outcome variables and data sources. The Nurse Manager EBP Competency scale was first used with nurse managers from this pilot. A data collection manual was created for the site coordinators, including the protocol for random selection of units and staff, and electronic submission of organization, unit, and aggregated patient data elements.

Findings from the pilot were used to calculate the sample size for the proposed study. Since there is a paucity of previous research about the variables in this study and patient outcomes, estimating an effect size is difficult without a pilot. The sample size estimation is discussed below.

Procedures for Dissertation Study

Overview

After recruiting and discussing study requirements with chief nursing officers and/or designees, study sites provided letters of intent to participate. Next, IRB approval from the University of Michigan was obtained (see Appendix B). Along with the assistance of site coordinators at each site, IRB approval from each participating site was then obtained prior to data collection.

The chief nursing officer or designee at each site identified a site coordinator to facilitate data collection. A detailed data collection manual was developed during the pilot study described above and was revised for this study (see Appendix C). The data collection manual was personalized to each site: 1) included site coordinator(s) name(s) and credentials; 2) used site specific title for nurse manager (e.g., unit director, clinical leader); and 3) presented data collection due dates specific to the site. Data collection training manuals were mailed to site coordinators. Upon receipt, teleconferences of 60 to 90 minutes with each site coordinator were conducted to provide training on data collection and respond to any questions. Site coordinators were encouraged to invite representatives from various departments familiar with the types and sources of data being collected. These representatives were typically from medical records, infection control, or the nursing research office. Following these teleconferences, additional questions were addressed via email or conference call as they arose.

Data Collection

Social dynamic context variables data were collected electronically from nurse managers and staff nurses using a web-based questionnaire application. Electronic data files tested during the pilot were used to facilitate acquisition and submission of data for hospital characteristics, unit characteristics, and patient outcomes data (see Appendix D for examples of electronic data files). Electronic files were sent through a secured file server at the University of Michigan. Site coordinators submitted data according to the data collection due dates detailed in their site's data collection manual.

The site coordinator identified eligible study units, and verified that the nurse managers of the study units met inclusion criteria. Four eligible nurse managers oversaw two eligible units. Therefore, one unit from each of these four managers was randomly selected for inclusion. Units were assigned a 2-letter code to preserve confidentiality, in which the first letter codes for hospital and the second denotes unit.

Nurse Managers. Each site coordinator provided nurse manager's e-mail addresses. Nurse managers of the study unit were invited to participate by receiving an e-mail invitation, describing the study, with a participant-specific link to a web-based nurse manager questionnaire inclusive of the informed consent document, Nurse Manager EBP Competency (NM-EBPC) scale, the Implementation Leadership Scale (ILS), Implementation Climate Scale (ICS), and demographic questions (see Appendices E (informed consent) and F (questionnaire)). Completion and return of the questionnaire signified consent to participate. Those not returning the questionnaire within one week were sent an e-mail reminder with a link to the web-based questionnaire. Similar reminders were sent each week, up to one month, as needed.

Nurse Manager questionnaires were built using Qualtrics, which is an online data collection software package (Qualtrics Software, 2015). Ease of use and feasibility of Qualtrics was tested by multiple nurse managers at different hospitals and geographic locations during the pilot study. No issues regarding hospital firewalls were noted.

Staff Nurses. Staff nurses were randomly selected from a list of those who were eligible. The site coordinator provided a coded list of staff RNs from the study units who met inclusion criteria. Thirty staff RNs were randomly selected using R (R Core Team, 2016) to generate a random sequence for each unit of eligible staff RNs. If there were less than 30 eligible staff RNs on the unit, the questionnaires were offered to all staff RNs meeting the inclusion criteria. Thirteen units had less than 30 eligible RNs. The randomly selected list of staff RNs was returned to the site coordinator at each hospital who then supplied work e-mail addresses for each staff RN.

The staff RNs were invited to participate by receiving an e-mail invitation, describing the study, with a participant-specific link to a web-based staff nurse questionnaire inclusive of the informed consent document, Implementation Leadership Scale (ILS), Implementation Climate Scale (ICS), and demographic questions (see Appendices E and G). Completion and return of the questionnaire signified consent to participate. Those not returning the questionnaire within one week were sent an e-mail reminder with a link to the web-based questionnaire. Similar reminders were sent each week, up to one month, as needed.

Similar to nurse manager questionnaires, staff RN questionnaires were built using Qualtrics. Ease of use and feasibility of Qualtrics was tested by multiple staff nurses at different hospitals and geographic locations during the pilot study in preparation for the current study. No issues regarding hospital firewalls were noted.

Lottery Incentive. In an effort to encourage response, participants completing the questionnaire were offered an opportunity enter a lottery drawing for a chance to win a $100 cash gift card. Participation in the lottery drawing was completely voluntary. Gift cards were available for a lottery drawing on each unit. The odds of winning depended on the number of eligible lottery entries received from each unit. Participants were only entered in one lottery drawing.

Lottery drawings for each site were done electronically. After the end of the web-based questionnaire participants were asked if they would like to enter a drawing for a

$100 cash gift card. Participants selecting “no” were exited from the questionnaire. If the participant desired to enter, they were directed to click a link to a lottery entry form on Qualtrics, which requests their name and email address. This second link was in no way associated with the questionnaire in order to protect confidentiality. R was used for random selection of lottery winners from each unit pool of eligible entries. In accordance with the State of Michigan’s lottery regulations, drawings were conducted on separate days to ensure that no more than $100 was awarded each day. The participant randomly selected first for each unit pool was sent the $100 cash gift card via their supplied email address. The R data containing participant information was retained for one week to ensure the winner received the prize. After one week, it was deleted along with the Qualtrics lottery entry forms.

Nursing-Sensitive Patient Outcomes. The site coordinator worked with the risk management or performance improvement department at their site to provide data on patient outcome variables for each study unit. They provided the number of falls and number of patient days per month for each of the study units for 2 months prior to and the month during the data collection from nurse managers and staff nurses (see Figure 3.1 above). Data for pressure injuries comes from the discharge administrative data of ICD-10 diagnosis codes with a not present on admission (POA) indicator (N). Stage III and IV pressure injury codes include all possible pressure injury sites with the POA indicator “N”. Codes: L89.xx3 and L89.xx4, where L89= pressure injury, xx represents the site, 3= stage III, and 4= stage IV. The site coordinator worked with the medical records department to provide data on the number of nosocomial stage III and stage IV pressure injuries and total number of unit discharges for each of the study units for 2 months prior to and during the month of data collection from nurses. Data on hospital acquired catheter associated urinary tract infections for each of the study units consisted of the total number of hospital acquired catheter associated urinary tract infections and the total number of catheter days on the study units for 2 months prior to and during the month of data collection from nurses. Data were submitted using electronic data submission forms (see Appendix D).

Hospital Characteristics. The Chief Nursing Officer or designee provided data on 1) type of hospital (public state or local; private not for profit; private for profit; church affiliated; urban; rural); 2) acute care bed capacity by month for six months; 3) average daily hospital census by month for six months; average monthly case mix index by month for six months; and 4) Magnet® designation status (current designation or no/expired designation). Data collected for a 6-month period included the month of questionnaire data collection and five months immediately prior (see Figure 3.1 above). These data were provided using an electronic data collection form provided to the site coordinator (see Appendix D).

Unit Characteristics. Site coordinators provided data on unit characteristics of 1) average monthly bed capacity by month for three months; 2) average daily unit census by month for three months; 3) average patient age by month for three months; 4) proportion of patients in each severity of illness category (minor, moderate, major, severe) by month for three months; 5) clinical nurse specialist appointed hours; and 6) total RN and non-RN nursing direct care hours by month for three months (used to calculate RN skill mix and RN HPPD). Data collected for a three-month period included the month of questionnaire data collection and two months prior (see Figure 3.1 above). Electronic data files were provided for data submission (see Appendix D).

Data Management

Questionnaire data completed by nurse managers and staff RNs were downloaded from Qualtrics files and entered into Microsoft Excel by a trained research assistant. The trained research assistant was an unpaid undergraduate nursing student receiving course credit and research experience by assisting with this study. The research assistant completed the University of Michigan's Program for Education and Evaluation in Responsible Research and Scholarship (PEERRS) training and was successfully added to the IRB application. Data provided in electronic data files for unit characteristics, hospital characteristics, and nursing-sensitive patient outcomes were migrated into Excel. Confidentiality was maintained using unique codes for hospital, patient care unit and type of subject (nurse manager or staff nurse).

Reports were run to display data values outside the specified ranges. Data verification involved the random auditing of 20% of the data, resulting in 96% accuracy. The originally submitted data sources were queried for questionable values, inconsistencies, and all queries were resolved. A second audit of 20% of the data using new records was conducted, resulting in zero discrepancies.

Electronic data and hospital and unit code lists were stored in a designated secure file space for research on the file server at the University of Michigan, School of

Nursing. Questionnaire responses printed from Qualtrics were stored in a locked file cabinet located in a locked research office at the University of Michigan, School of Nursing. Access to electronic and paper data files was only provided to the dissertation candidate, committee chair, and trained research assistant.

Data Analysis

Data were exported from Excel files to R version 3.1.2 for analysis (R Core Team, 2016). Demographic variables were analyzed using descriptive statistics (means and standard deviations for continuous variables; frequency and percentages for categorical variables). Psychometric properties of each instrument were also examined. Internal consistency reliability was evaluated using Cronbach’s alpha for total and subscale scores (Polit & Beck, 2008). A significance level of $p<.05$ was set a priori for all analyses.

Missing Data

Multilevel modeling (as described below) requires stable datasets composed of complete observations (i.e., no missing values). Missing observations in multilevel models can be addressed by 1) imputation or 2) listwise deletion. Methods for handling missing data were carefully considered as imputation may bias estimates, while deletion could diminish power. Observations with less than 50% of the items completed were omitted by listwise deletion from regression analyses. Since the sample size for the NM-EBPC scale was small (n=24), imputation for missing data was not done. Thus, the sample for AIM 2 and Aim 3 analyses included staff nurses from those units in which the nurse manager completed the NM-EBPC scale.

Missing values were examined using the “aggr” function in the *VIM* package (Templ, Alfons, Kowarik, & Prantner, 2011) in R. After removing observations with missing NM-EBPC values, over 90% of the dataset was complete for Aim 2 and Aim 3 analyses. The remaining missing values were associated with observations of less than 50% response. These observations were omitted by listwise deletion for Aim 2 and Aim 3.

Aim 1

To describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and unit climates for EBP implementation in hospital settings.

a. To describe the EBP competencies of nurse managers in hospital settings as perceived by nurse managers.
b. To describe the EBP leadership behaviors of nurse managers in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.
c. To describe the unit climates for EBP implementation in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

To address sub aims 1a-1c, descriptive statistics (mean and SD) were calculated for the Nurse Manager EBP Competency Scale (NM-EBPC) (subscales and total), the Implementation Leadership Scale (ILS) (subscales and total), and the Implementation Climate Scale (ICS) (subscales and total). The ILS and the ICS subscale and total scores were calculated for the nurse managers and staff RNs by role type.

d. To test for differences among staff nurse and manager perceptions of 1) EBP implementation leadership behaviors (subscale and total scores) and 2) unit climates for EBP implementation (subscale and total scores).

Independent t-tests with Bonferroni correction were used to test for significant differences between nurse managers and staff nurses scores on ICS and ILS subscales and total scale.

Aim 2

To examine the unique contributions of nurse manager EBP competencies and nurse manager EBP leadership behaviors (staff nurse reported) in explaining unit climates of EBP implementation (staff nurse reported) after controlling for staff nurse level of nursing education and years of experience as a registered nurse on current unit.

Prior to modeling, listwise deletion was performed resulting in a dataset with complete observations. To determine use of subscale and/or total scores in the analysis, multicollinearity was tested by examining correlations among 1) ILS subscale and total scores and 2) NM-EBPC subscale and total scores. In the case of highly correlated (> .70; $p<.05$) subscales, total scores were used instead. In addition, to meet normality assumptions skewed variables were appropriately transformed (i.e., log transformed if right skewed).

The R (R Core Team, 2016) package *lmerTest* (Kuznetsova, Brockhoff, and Christensen, 2016) was used to perform multilevel regression analyses to address Aim 2. To account for the nested structure of the data (individual observations nested in units nested in hospitals), random intercepts for unit and hospital were included in the analyses. Observations from the same unit and within the same hospital may be more alike than if observed at random from the entire population. Data for independent variables (fixed effects) included in the analyses were collected at the individual level (ILS total score; education level; and years experience as RN on current unit) and unit level (NM-EBPC total score). Data for random effects (unit and hospital) are categorical variables indicating group membership at the unit level and hospital level (Table 3.1). To allow for model comparison, all models were fit using maximum likelihood.

Table 3.1. Level of Variables Included in Aim 2 Analyses

Level	***Description***	***Variables included in Analysis***	***Type***
Level 1	Individual (N=238)	ILS Total Score ICS Total Score Education level Years as RN on current unit	Independent Variable Dependent Variable Confounder Confounder
Level 2	Unit (N= 22)	NM-EBPC Total Score *Random effects term of unit intercepts was used in models without NM-EBPC total score.*	Independent Variable *Random Effects Term*
Level 3	Hospital (N=7)	Hospital	Random Effects Term

To determine unique contribution of ILS score and NM-EBPC score in explaining variation in ICS total score, a series of multilevel models were computed. First, a null model was created using the selected staff RN demographic confounders (education level and years of experience as an RN on current unit) and the random effects grouping structure (e.g., units nested in hospitals). After determining variance accounted for in the null model, three additional models were created. The first model added ILS total scores to the null model. The second model replaced ILS scores with NM-EBPC scores. Since NM-EBPC is a level 2 variable, the random effects term for unit intercepts was dropped. The final model added ILS and NM-EBPC scores to the null model and dropped the random effects term for unit intercepts. Education level was an ordinal variable with five levels (diploma, associate, bachelor, master, doctorate). Diploma was used as the reference category in all analyses. Variance explained was calculated to determine the percent of variance accounted for by each added predictor(s). Variance explained after adding predictors was calculated as: 1 – (residual variance with predictor / residual variance without predictor).

Model fit was determined by comparing akaike information criterion (AIC) using log likelihood ratio tests. When comparing two or more models, the model with a lower AIC suggests better fit. Significance of differences in model AIC were determined by calculating log-likelihood ratio tests. A significant p-value suggests that including the additional predictor decreases AIC, thus, improving overall model fit (Burnham & Anderson, 2003).

Marginal and conditional r^2 were computed for each model. Marginal r^2 is the amount of variance explained by the fixed effects (confounders and independent variables) after partitioning variance explained by the random effects (e.g., grouping structure). The conditional r^2 is the variance explained by the entire model, which includes fixed effects and random effects (Nakagawa & Schielzeth, 2013). Although both r^2 values are reported, the marginal r^2 is of particular interest because hospital and unit were considered nuisance variables. Normality and homoscedasticity of the final model were evaluated through visual inspection of residual plots.

Aim 3

To explore the relationships among nurse manager EBP competencies (nurse manager reported), nurse manager EBP leadership behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and selected patient outcomes (inpatient fall rates, catheter-associated urinary tract infection rates, and nosocomial stage III and IV pressure injury rates) in hospital settings.

a. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining inpatient fall rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

b. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining catheter-associated urinary tract infection rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

c. To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining nosocomial stage III and IV pressure injury rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

Prior to modeling, listwise deletion was performed resulting in a dataset with complete observations. Patient outcomes were conceptually and operationally defined as unit-level variables because they reflect care provided by clinicians on the unit. Multilevel modeling requires predictors to be at the same level or higher than the dependent variable. Therefore, rater agreement by unit was determined using the James, Demaree, and Wolf (1984) and James, Demaree, and Wolf (1993) agreement index for multi-item scales ($r_{wg(j)}$) with $r_{wg(j)}$ scores >.70 considered acceptable (James et al., 1984). After demonstrating agreement, unit mean total scores for the ILS and ICS were calculated respectively by adding all subscale scores for each staff nurse in a given unit, dividing by the total number of subscales, then dividing by the total number of nurses providing response on the unit. These group mean values were attributed to each staff nurse in the dataset by unit so that all nurses from the same unit had the same group mean total score for ICS and ILS.

Independent variables in Aim 3 analyses included unit mean ICS total score and unit mean ILS total score. Unit bed capacity, skill mix, RN HPPD, average patient age, and severity of illness were included as confounding variables. Random intercept term for hospital was included as a random effect. Table 3.2 depicts level of variables used in analyses. Similar to Aim 2 analyses, a series of models were computed using the R package *lmerTest* (Kuznetsova et al., 2016) to examine the unique contribution of the independent variables on the dependent variables (patient outcomes). First, a null model was created using all confounding variables and the random effect term of hospital intercepts. The second model added unit mean ILS total score to the null model. The third model replaced unit mean ILS total score with unit mean ICS total score. The fourth model replaced unit mean ICS total score with NM-EBPC total score. The final model included all confounding variables, the random effect (hospital), and all independent variables.

Unique contributions of ILS and ICS on patient outcome variables were explored by determining the amount of variance explained by adding a predictor(s) and was calculated as: 1 – (residual variance with predictor / residual variance without predictor). As done in Aim 2, AIC was used to compare models with significance determined using log likelihood ratio tests (Burnham & Anderson, 2003). Marginal and conditional r^2 were also computed for each model (Nakagawa & Schielzeth, 2013). In order to compare models, models were fit using maximum likelihood (Kuznetsova et al., 2016). Visual inspection of residual plots were done to evaluate deviations from homoscedasticity and normality.

Table 3.2. Level of Variables Included in Aim 3 Analyses

Level	***Description***	***Variables included in Analysis***	***Type***
Level 2	Observations (N= 234) within Units (N= 20)	Unit mean ILS total score	Independent Variable
		Unit mean ICS total score	Independent Variable
		NM-EBPC Total Score	Independent Variable
		Average Patient Age	Confounder
		Severity of Illness	Confounder
		RN Skill Mix	Confounder
		RN HPPD	Confounder
		Unit bed capacity	Confounder
		Fall Rate	Dependent Variable
		CAUTI Rate	Dependent Variable
		Nosocomial Stg. III/IV Pressure Injury Rate	Dependent Variable
Level 3	Hospital (N= 5)	Hospital	Random effects term

CHAPTER 4

RESULTS

The results of the data analyses are described herein. The first section presents a description of the study sample and response rates from nurses and nurse managers. The remainder of the chapter presents findings for each aim.

Description of Sample

Descriptive and summary statistics were computed for the following: 1) hospital characteristics; 2) unit characteristics; and 3) participant demographics.

Hospital Characteristics

Seven hospitals participated in the study. Hospital characteristics are summarized in Table 4.1. Overall, hospital size was evenly distributed from small to large. Most hospitals were private, not-for-profit organizations and/or church affiliated. The mean case mix index over 6 months was 1.41 (*SD* = 0.4), ranging from 0.92 to 2.03. Average daily hospital census over 6 months was 132.49 (138.44), demonstrating a very large range due to variance in hospital size. The majority (71.4%) of participating hospitals had no or expired Magnet® designation.

Table 4.1. Summary of Hospital Characteristics

Hospital Characteristic (n=7)	
Hospital Size (*n*)[1]	
Small (<100 beds)	3
Medium (100-300 beds)	2
Large (>300 beds)	2
Average Daily Hospital Census[1] [M (SD)]	132.49 (138.44)
Average Case Mix Index[1] [M (SD)]	1.41 (0.4)
Hospital Type (n)	
Private/Not for profit	6
Private/For profit	1
Church affiliated	4
Urban	3
Rural	4
Magnet Designation (*n*)	
Current	2
Expired/No designation	5

[1]Data represents average over 6 months.

Unit Characteristics

Twenty-four units participated in this study. Unit characteristics are described in Table 4.2. Overall, unit characteristics were normally distributed across participating units. The majority of units had either no clinical nurse specialist (CNS) or a part-time CNS (<40 hours/week). Only 14 of 24 units provided data on severity of illness. Use of the 3M APR-DRG proprietary software was not used in the majority of hospitals (N=5). Consequently, severity of illness was not used as a confounding variable in subsequent analyses.

Table 4.2. Summary of Unit Characteristics

Unit Characteristics (n=24)	
Unit bed capacity[1] [M (SD)]	24.99 (9.52)
Average daily unit census[1] [M (SD)]	17.73 (9.54)
Average patient age[1] [M (SD)]	63.99 (5.24)
Clinical Nurse Specialist hours (*n, %*)	
No CNS (0 hours)	9 (37.5%)
Part Time CNS (1-39 hours)	10 (41.7%)
Full Time CNS (40 hours)	5 (20.8%)
Average skill mix[1] (% RN to other) [M (SD)]	60 (10)
Average RN HPPD[1] [M (SD)]	7.31 (1.49)

[1]Data represents average over 3 months.

Response Rate and Demographics of Nurses

Twenty-three nurse managers of 24 responded to the questionnaire, resulting in a 95.8% response rate. A total of 287 of 553 staff nurses responded to the questionnaire for a response rate of 51.9%.

Demographic characteristics of nurse managers and of staff nurses are in Table 4.3. The majority of nurse managers and staff nurses were Caucasian and female. Most nurse managers had a bachelor's (52.2%) or master's degree (30.4%), while most of the staff nurses held a bachelor's (59.2%) or associate's degree (28.9%). Nearly one-third of the nurse managers reported current enrollment in a nursing degree program at an accredited school of nursing. Roughly half of nurse managers enrolled in a degree program were earning a bachelor's of science in nursing (BSN), while the others were completing a non-clinical master's degree (i.e., leadership; administration). In contrast, only 18.8% of staff nurses reported current enrollment. Of staff nurses reporting current enrollment, 51.9% were in BSN programs and 42.6% were in MSN programs. None of the sample reported a doctoral level degree (PhD or DNP); however, two staff nurses reported enrollment in a DNP program. Type of shift (e.g., days, nights, rotating) was relatively evenly distributed in the staff nurse sample, with slightly more responses provided by staff nurses working the day shift.

Table 4.3. Respondent Demographics by Role

	Nurse Manager (*n* = 23)	Staff Nurse (*n* = 287)
Age in years [M (SD)]	41.76 (6.67)	34.9 (11.94)
Gender (*n*, %)		
Female	20 (87%)	241 (84%)
Male	2 (9%)	13 (4.5%)
Missing	1 (4%)	33 (11.5%)
Race (*n*, %)		
Caucasian	19 (82.6%)	240 (83.6%)
Other	2 (8.6%)	16 (5.4%)
Missing	2 (12.9%)	31 (11%)
Shift (*n*, %)	NA	
Days		102 (35.6%)
Evenings		13 (4.5%)
Nights		70 (24.4%)
Rotate		83 (28.9%)
Missing		19 (6.6%)
Years as RN [M (SD)]	15.64 (6.06)	7.84 (9.88)
Years as NM [M (SD)]	3.91 (2.56)	NA
Years in role in current hospital [M (SD)]	3.95 (2.61)	5.58 (7.9)
Years in role in current unit [M (SD)]	3.05 (2.46)	4.89 (7.23)
Education (*n*, %)		
Diploma	0	7 (2.4%)
Associates	3 (13%)	83 (28.9%)
Bachelors	12 (52.2%)	170 (59.2%)
Masters	7 (30.4%)	7 (2.4%)
Missing	1 (8.6%)	20 (7%)

	Nurse Manager (*n* = 23)	Staff Nurse (*n* = 287)
Currently Enrolled in School (*n*, %)		
Yes	7 (30.4%)	54 (18.8%)
No	15 (65.2%)	214 (74.6%)
Missing	1 (4.3%)	19 (6.6%)
Degree enrolled in (*n*, %)		
Bachelors of Science in Nursing	3 (42.9%)	28 (51.9%)
Non-clinical masters	3 (42.9%)	12 (22.2%)
Clinical masters	1 (14.2%)	11 (20.4)
Doctor of Nursing Practice	0	2 (3.7%)
Missing	0	1 (1.9%)

RN = registered nurse; NM = nurse manager

Aim 1 Results

To describe nurse manager EBP competencies, nurse manager EBP leadership behaviors, and unit climates for EBP implementation in hospital settings.

a. To describe the EBP competencies of nurse managers in hospital settings as perceived by nurse managers.

b. To describe the EBP leadership behaviors of nurse managers in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

c. To describe the unit climates for EBP implementation in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

d. To test for differences among staff nurse and manager perceptions of 1) EBP implementation leadership behaviors (subscale and total scores) and 2) unit climates for EBP implementation (subscale and total scores).

Nurse Manager EBP Competency

Sub Aim 1a: To describe the EBP competencies of nurse managers in hospital settings as perceived by nurse managers.

The Nurse Manager EBP Competency (NM-EBPC) scale (0 to 3 range) was completed by 22 nurse managers with no missing values. Cronbach's alpha for the total score was .93 (See Table 4.5). A summary of subscale and total scores are in Table 4.6. Full competency is denoted by a value of 2 and expert competency is denoted by a value of 3. The mean total score (1.62) is relatively low signifying deficiencies in nurse manager EBP competency. Mean scores for both subscales were also between "somewhat competent" (score of 1) and "fully competent" (score of 2) indicating deficiencies in nurse manager competency for both subscale areas. Summary statistics by item were computed and are in Appendix H.

Table 4.5. Reliability of NM-EBPC Using Cronbach's Alpha

	Nurse Manager (N=22)
Subscale	
EBP Knowledge	.88
EBP Activity	.87
Total Scale	.93

Table 4.6. NM-EBPC Scores

NM-EBPC	N	Range[1]	Mean	*SD*
EBP Knowledge	22	1-2.67	1.77	0.55
EBP Activity	22	0.8-2.4	1.53	0.49
TOTAL SCORE	22	0.88-2.44	1.62	0.5

[1]Range represents minimum and maximum values.
Note: Scale range is 0-3 (0=not competent; 1=somewhat competent; 2=fully competent; 3=expertly competent).

Nurse Manager EBP Leadership Behaviors

Sub Aim 1b: To describe the EBP leadership behaviors of nurse managers in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

Sub Aim 1d.1: To test for differences between staff nurse and nurse manager perceptions of nurse manager EBP implementation leadership (subscale and total scores).

The Implementation Leadership Scale (ILS) was completed by staff nurses and nurse managers. Of the 287 staff nurses submitting questionnaires, 3 responded to less than 50% of items on the ILS and thus were not included in the analysis. After removing the 3 observations not responding to any of the scale items, missing data were minimal, missing completely at random, and did not prevent calculating subscale and total scores. The resulting sample of staff nurses for this analysis was 284. All 23 nurse managers completed the ILS with no missing items.

Cronbach's alpha for the ILS total was .97 and .84 for staff nurses and nurse managers respectively (See Table 4.7). Cronbach's alphas for the subscales were higher for staff nurse than nurse managers, possibly related to the small sample of nurse managers (n=23).

Results of the ILS are reported separately for staff nurses and nurse managers (See Table 4.8). Total ILS score (0 to 4 range) for staff nurses was 2.88 (*SD* = 0.78) and for nurse managers was 2.73 (*SD=0.46).* Results for each item by role are in Appendix I. Subscale scores of Proactive and Knowledgeable were significantly different ($p < .05$) for staff nurses and nurse managers (See Table 4.8). On average, staff nurses scored their nurse managers higher on these two subscales than nurse managers scored themselves. Nurse managers perceived themselves to be more supportive and perseverant than staff nurses reported, however these differences were not significant.

Table 4.7. Reliability of ILS Subscales and Total Scale by Role Using Cronbach's Alpha

	Staff nurse (n=284)	**Nurse Manager (n=23)**
Subscale		
Proactive	.90	.65
Knowledgeable	.91	.70
Supportive	.89	.54
Perseverant	.91	.57
Total Scale	.97	.84

Table 4.8. ILS Scores by Role

ILS Scores	N	Range[1]	Mean	SD	t value[2]	p value[3]
Proactive						
Staff Nurse	284	0-4	2.67	0.87	2.75	.01
Nurse Manager	23	1-3.33	2.25	0.7		
Knowledgeable						
Staff Nurse	284	0.33-4	2.99	0.8	3.80	<.001
Nurse Manager	23	1.67-3.33	2.54	0.53		
Support						
Staff Nurse	284	0.33-4	3.03	0.8	-1.66	.11
Nurse Manager	23	2.33-4	3.23	0.54		
Perseverant						
Staff Nurse	284	0-4	2.84	0.84	-0.39	.70
Nurse Manager	23	1.67-4	2.88	0.5		
TOTAL SCORE						
Staff Nurse	284	0.33-4	2.88	0.78	1.49	.15
Nurse Manager	23	1.67-3.67	2.73	0.46		

[1]Range represents minimum and maximum values. [2]Independent t-test. [3]Bonferroni corrected.
Note: Scale range is 0-4 (0=not at all; 1=slight extent; 2=moderate extent; 3=great extent; 4=very great extent).

Unit Climate for EBP Implementation

Sub Aim 1c: To describe the unit climates for EBP implementation in hospital settings as perceived by: 1) staff nurses and 2) nurse managers.

Sub Aim 1d.2: Test for differences among staff nurse and manager perceptions of unit climates for EBP implementation (subscale and total scores).

Of the 287 staff nurses submitting questionnaire responses, 272 completed more than 50% of the Implementation Climate Scale (ICS) (0 to 4). Seven items had one missing value and one item had two missing values. Missing values were missing completely at random and did not prevent subscale and total score calculations. The final sample of staff nurses used to describe the ICS was 272. Twenty-two of 23 nurse managers completed the ICS with no missing items. One nurse manager did not provide response to any ICS item. Cronbach's alphas for ICS total were .94 and .92 for staff nurses and nurse managers respectively, and alphas for all subscale scores were .72 or higher (see Table 4.9).

Nurse manager and staff nurse total and subscale scores were calculated separately (see Table 4.10). The ICS total score (0 to 4 range) for staff nurses was 2.24 (*SD* = 0.74) and for nurse managers was 2.16 (*SD* = 0.67). Mean and standard deviations for each item by role (nurse manager or staff nurse) are described in Appendix J. No significant differences in mean total and subscale scores between staff nurses and nurse managers were observed.

Table 4.9. Reliability of ICS Subscales and Total Score by Role Using Cronbach's Alpha

Subscale	**Staff Nurse (n=272)**	**Nurse Manager (n=23)**
Focus on EBP	.89	.83
Educational Support for EBP	.82	.75
Recognition for EBP	.77	.75
Rewards for EBP	.73	.72
Selection for EBP	.87	.84
Selection for Openness	.87	.87
TOTAL	**.94**	**.92**

Table 4.10. ICS Scores by Role

ICS Scores	N	Range[1]	Mean	SD	t-value[2]	p-value[3]
Focus on EBP						
Staff Nurse	272	0.33-4	2.66	0.85	-0.03	.97
Nurse Manager	23	1.33-4	2.67	0.8		
Educational Support for EBP						
Staff Nurse	272	0-4	2.26	.93	0.16	.87
Nurse Manager	23	0.67-4	2.23	.89		
Recognition for EBP						
Staff Nurse	272	0-4	2.38	.83	0.75	.46
Nurse Manager	23	1-3.67	2.25	.82		
Rewards for EBP						
Staff Nurse	272	0-4	1.4	.96	1.69	.10
Nurse Manager	23	0-3.67	1.04	.99		
Selection for EBP						
Staff Nurse	272	0-4	2.25	.94	1.17	.25
Nurse Manager	23	0-3.33	2.03	.85		
Selection for Openness						
Staff Nurse	272	0-4	2.49	.8	-1.59	.12
Nurse Manager	23	1.33-4	2.72	.68		
TOTAL SCORE						
Staff Nurse	272	0.44-4	2.24	.74	0.57	.58
Nurse Manager	23	1.06-3.28	2.16	.67		

[1]Range represents minimum and maximum values. [2]Independent t-test. [3]Bonferroni corrected.
Note: Scale range is 0-4 (0=not at all; 1=slight extent; 2=moderate extent; 3=great extent; 4=very great extent).

Aim 2 Results

To examine the unique contributions of nurse manager EBP competencies and nurse manager EBP leadership behaviors (staff nurse reported) in explaining unit climates of EBP implementation (staff nurse reported) after controlling for staff nurse level of nursing education and years of experience as a registered nurse on current unit.

Subscale correlations were examined to identify potential for multicollinearity. ILS subscales scores were highly correlated (see Table 4.11). Similarly, the two NM-EBPC subscales were highly correlated (r = .888, p<.0001). Therefore, to reduce multicollinearity, total scores for ILS and NM-EBPC were used as the independent variables.

Table 4.11. ILS Subscale and Total Scale Correlations

Subscale	1	2	3	4	5
1. Proactive	1	.821*	.796*	.886*	.935*
2. Knowledgeable		1	.831*	.882*	.938*
3. Supportive			1	.849*	.923*
4. Perseverant				1	.963*
5. Total					1

Note: *correlation significant at <.0001 level

Multilevel modeling requires complete datasets without missing values. Two nurse managers did not complete the NM-EBPC scale resulting in the exclusion of all staff nurse responses from these two units in the analysis (n=23). In addition, 26 observations were not complete and were listwise deleted. The final sample size for Aim 2 analyses was 238 staff nurses, representing observations nested in 22 units from 7 hospitals. Years of staff nurse experience as an RN on current unit was right skewed and subsequently log transformed. Education of staff nurses was added as a categorical confounding variable with 4 reported levels of nursing education (diploma, associates, bachelors, masters). Diploma was used as reference category in all analyses.

Four models were estimated to address Aim 2. The first model was a null model including the confounding variables (level of education and log years experience as RN on current unit) and random effects (random intercepts of unit and hospitals). The second model added ILS total scores to the null model. The third model added NM-EBPC total scores to the null model. The fourth and final added both ILS total scores and NM-EBPC total scores to the null model. Table 4.12 provides a summary of each model. A more detailed description of each model and comparisons across models is discussed following the table.

Table 4.12. Summary of Aim 2 Multilevel Models Explaining ICS Total Scores

	Model 1 (Null)	Model 2 (ILS)	Model 3 (NM-EBPC)	Model 4 (Full)
Intercept (*b*)	1.99***	0.20	2.23***	0.56*
Confounding Variables				
Education (*b*)				
Associates	0.37	0.26	0.45	0.26
Bachelors	0.23	0.16	0.29	0.16
Masters	0.07	-0.01	0.07	-0.01
Log Years Experience as RN on Current Unit (*b*)	-0.13**	-0.06	-0.12**	-0.06
Independent Variables				
ILS Total Score (*b*)		0.65***		0.64***
NM-EBPC Total Score (*b*)			-0.18	-0.22*
Unique Variance Explained by Added Independent Variable(s)[a]		.434[b]	.014[c]	.489[c]
Fit Statistics				
AIC	515.3	371.1	519.2	364.8
Marginal r^2	.047	.49	.067	.502
Conditional r^2	.242	.55	.154	.548

[a]Calculated as: 1-(variance with predictor/variance without predictor)
[b]Residual variance compared with null model that included random terms for hospital and unit.
[c]Residual variance compared with null model that included only random term for unit.
Note: significance levels, *p<.05; **p<.01; ***p<.001; *b*= beta coefficient

Model 1 (Null Model)

The null model included the confounding variables (level of education and log years experience as RN on current unit) as well as the random effects (random intercepts of units and hospitals) (see Table 4.12). The significance of the variation accounted for by the random intercept terms was determined using log likelihood ratio tests. The variation accounted for by the random hospital and unit intercepts was significant (x^2 (2) = 23.7, p<.001). Log years of experience as an RN on current unit was significant in the null model (b= -0.13, p = .004); however, education was not significant.

As stated in Chapter 3, model fit was compared using AIC and log likelihood ratio tests. The null model provides a baseline for which to compare subsequent models. In addition, marginal r^2 and conditional r^2 were computed for each model to determine the proportion of residual variance accounted for in the model. As explained in Chapter 3, marginal r^2 is the amount of variance accounted for by the confounders (education, log years experience as RN on current unit) and independent variables (if any). Conditional r^2 is the amount of variance explained by confounders, independent variables, and random effects (nesting of units and hospitals). The null model AIC was 515.3 and marginal and conditional r^2 were .047 and .242 respectively.

Model 2 (ILS)

The second model added ILS total scores to the null model (see Table 4.12). ILS total scores had a significant effect on ICS total scores after controlling for confounders (b= 0.65, p<.001). Confounding variables were not significant in the model. The variance accounted for by the random intercepts of unit and hospital was significant (x^2 (2) = 11.7, p=.003). ILS total score explained 43.4% of the residual variance. Adding the ILS total score to the model resulted in a better overall model fit (AIC = 371.1, x^2 (1)= 146, p<.001) and improved marginal r^2 (.49) and conditional r^2 (.55).

Model 3 (NM-EBPC)

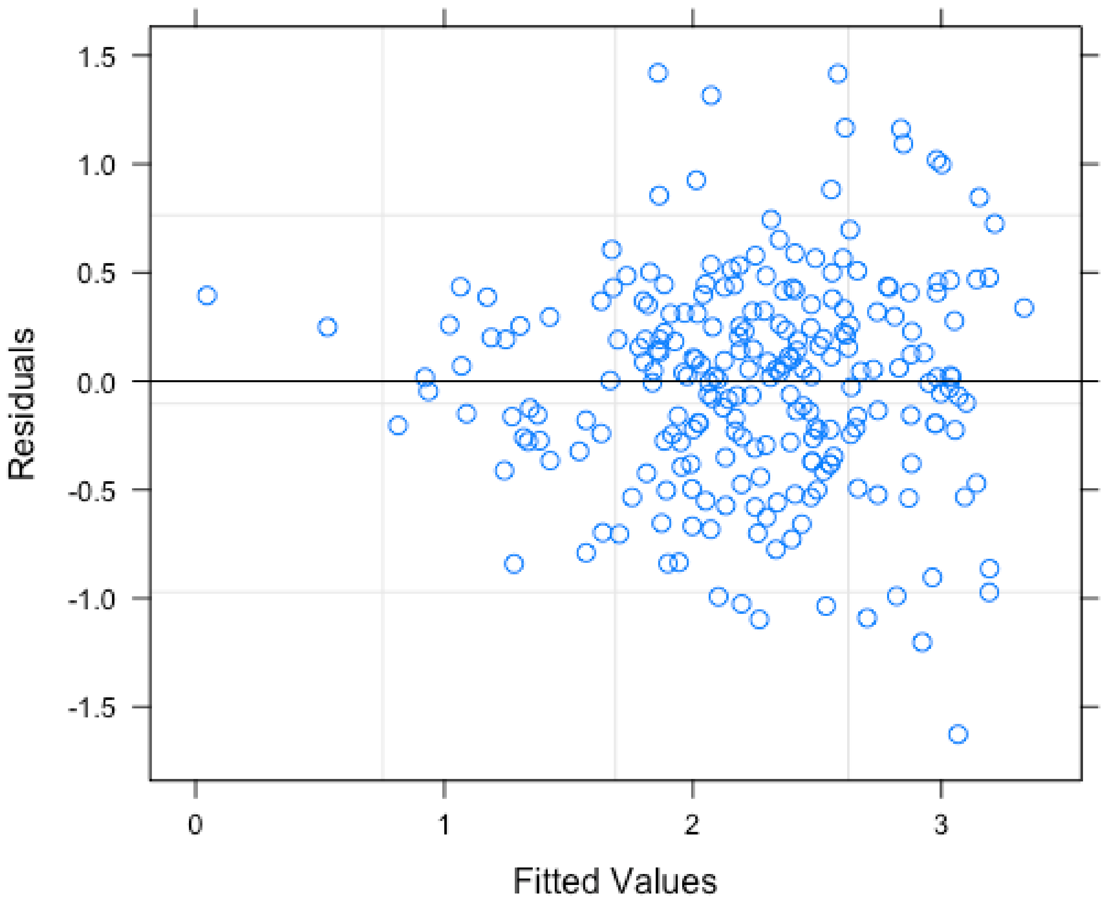
The third model added NM-EBPC total scores to the null model (see Table 4.12). NM-EBPC total score did not have a significant effect on ICS total scores after controlling for confounders *(b*= -0.18, *p*=.08). The variance accounted for by allowing random intercepts for hospitals was significant (x^2 (1) = 18.1, *p*<.001). NM-EBPC total score explained 1.4% of the residual variance. Adding a level 2 variable to a model introduces more variance. This resulted in an increased AIC (519.2), suggesting a poorer fit compared to the null model. Furthermore, in comparison to the null model, the addition of NM-EBPC improved marginal r^2 slightly (.067); but decreased conditional r^2 (.154).

Model 4 (Full)

The fourth and final model added ILS total score and NM-EBPC total score to the null model (see Table 4.12). The variance accounted for by allowing random intercepts for hospitals was significant (x^2 (1) = 13.1, *p*<.001). ILS total score had a significant effect on ICS total score, increasing it by 0.64 (*b*=0.64, *p*<.001). NM-EBPC total score lowered ICS total score by 0.22 (*p*=.003). The addition of both ILS total score and NM-EBPC total score explained 48.9% of the total variance. The AIC of the final model was 364.8. Marginal and conditional r^2 was .502 and .548 respectively. A log likelihood ratio test was used to compare the second model (with only ILS total score added) to the fourth model (with both ILS total score and NM-EBPC total score). The result was significant (x^2 (1) = 6.94, p= .008), suggesting the full model is a better fit for the data.

Visual inspection of residual plots did not reveal any obvious deviations from homoscedasticity or normality (Figure 4.1).

Figure 4.1. Fitted vs. Residuals Plot for Aim 2 Final Model



Summary

Nurse manager EBP leadership behaviors (ILS total score) and EBP competency (NM-EBPC) had a significant effect on unit climate for EBP implementation (ICS total score). Leadership behaviors (staff nurse reported) improved unit climate for EBP implementation and explained 43.4% of variance compared to the null model; whereas, EBP competency (nurse manager reported) decreased unit climate for EBP implementation and explained only 1.4% of variance. The full model, inclusive of leadership behaviors, EBP competency, and along with confounders and random intercepts for hospital was determined the best fit for the data and demonstrated a marginal r^2 of .502 and conditional r^2 of .548.

Aim 3 Results

To explore the relationships among nurse manager EBP competencies (nurse manager reported), nurse manager EBP leadership behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and selected patient outcomes (inpatient fall rates, catheter-associated urinary tract infection rates, and nosocomial stage III and IV pressure injury rates) in hospital settings.

Dependent variables in Aim 3 analyses were patient outcomes of inpatient falls, catheter-associated urinary tract infections, and nosocomial stage III and IV pressure injuries. Severity of illness was planned to be included as a confounding variable in Aim 3 analyses. However, as described above, 5 hospitals did not use 3M® APR-DRG software. Unit bed capacity, RN skill mix, RN HPPD, and average patient age were included as confounding variables. The random effect of hospital was included as a random intercept term. Unit mean ICS total scores and unit mean ILS total scores were added as independent variables. Both ICS and ILS scales demonstrated high interrater agreement (>.70) suggesting that using unit means was appropriate. The ILS scale mean $r_{wg(j)}$ was .96 (range = .88-.98) and the ICS scale mean $r_{wg(j)}$ was .95 (range = .83-.98). The mean of unit ICS total scores was 2.27 (SD=0.35), ranging from 1.46 to 2.48. The mean of unit ILS total scores was 2.93 (SD=0.39), ranging from 2.12 to 3.58.

Sub aim 3a

To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining inpatient fall rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

All 24 units provided data to calculate fall rates. Overall, 22 of 24 units reported at least one fall during the 3-month period of interest. Two units reported zero falls. Fall rates ranged from 0-6.3, with a mean of 2.93 falls per 1000 patient days (SD= 1.78).

For Aim 3 analyses, 234 observations (staff nurses) were complete (e.g., without missing data). 20 observations were omitted, as they did not meet the minimum requirement of >50% completion. Nurse managers from two units did not provide data for the NM-EBPC scale resulting in the omission of these units from analyses (n=23 questionnaires). Aim 3 analytical approach requires variation across units within hospitals. No variation is present when hospitals only have one unit. Two hospitals had only one unit each with only 5 observations per unit, and were thus removed (n=10 questionnaires). Thus, this analysis is based on 234 observations (staff nurses) nested in 20 units (20 NMs) in 5 hospitals. The fall rates from these units ranged from 0 to 6.3 with a mean of 3.24 falls per 1000 patient days (SD= 1.65).

Five multilevel models were estimated to address the aim. The first model (null model) included only the confounding variables (patient age, RN skill mix, RN HPPD, and unit bed capacity) and the random effect of hospital (random intercept). The second model added unit mean ILS total scores to the null model. The third model added unit mean ICS total scores to the null model. NM-EBPC total score was added to the fourth model. Finally, the fifth model added unit mean ILS total score, unit mean ICS total score, and NM-EBPC total score to the null model. Results are presented in Table 4.13. Each model is discussed in greater detail below, along with comparisons across models.

Table 4.13. Summary of Aim 3a Multilevel Models Explaining Fall Rates

	Model 1 (Null)	Model 2 (ILS)	Model 3 (ICS)	Model 4 (NM-EBPC)	Model 5 (Full)
Intercept (*b*)	5.38*	5.89**	7.12**	6.18**	7.10**
CONFOUNDING VARIABLES					
Patient Age (*b*)	-0.03	-0.03	-0.04	-0.05	-0.04
RN Skill Mix (*b*)	-0.11***	-0.10***	-0.11***	-0.12***	-0.11***
RN HPPD (*b*)	0.79***	0.80***	0.85***	0.80***	0.85***
Unit Bed Capacity (*b*)	0.07***	0.07***	0.07***	0.06***	0.07***
INDEPENDENT VARIABLES					
Unit Mean ILS Total Score (*b*)		-0.59*			-0.05
Unit Mean ICS Total Score (*b*)			-0.86**		-0.80
NM-EBPC Total Score (*b*)				0.28	0.02
Unique Variance Explained by Added Independent Variable(s)[a]		.026	.044	.009	.044
FIT STATISTICS					
AIC	731	727	724	732	728
Marginal r^2	.422	.405	.420	.423	.418
Conditional r^2	.846	.801	.843	.850	.843

Note: significance levels, *p<.05; **p<.01; ***p<.001; *b*= beta coefficient
[a]Calculated as: 1-(variance with predictor/variance without predictor)

Model 1 (Null Model)

The null model included confounding variables (patient age, RN skill mix, RN HPPD, and unit bed capacity) and random effect of hospital (random intercept) to explain fall rates (see Table 4.13). The random effect of hospital was significant ($x^2(1)=172$, $p<.0001$) in the null model. Three of the four confounding variables were significant in the null model. Patient age was not significant. Each 1% increase in RN skill mix was associated with a 0.11 decrease in fall rates ($p<.001$). RN HPPD had an unanticipated association with fall rates, in that each one unit increase in RN HPPD was associated with a 0.79 increase in fall rates (p<.001). Unit bed capacity, which reflects unit size, was associated with higher fall rates of 0.07 for each 1 bed increase (p<.001).

The null model provides a baseline AIC for which to compare subsequent models. The AIC for the null model was 731. In addition, marginal r^2 and conditional r^2 were computed for each model to determine the proportion of residual variance accounted for in the model. In the null model, marginal r^2 was .442 and conditional r^2 was .846.

Model 2 (ILS)

The second model added unit mean ILS total score to the null model (see Table 4.13). The random effect of hospital was significant ($x^2(1)= 174$, p<.0001). Unit mean ILS total score was associated with lower fall rates (β= -0.59; p= .015). Unit mean ILS total score explained an additional 2.6% of the residual variance. AIC was 727 and demonstrated a better fit than the null model ($x^2(1)= 5.99$, p=.01). The second model had a marginal r^2 of .405 and a conditional r^2 of .801.

Model 3 (ICS)

The third model added unit mean ICS total score to the null model (see Table 4.13). The random effect of hospital was significant ($x^2(1)= 158$, p<.0001). Unit mean ICS total score was associated with lower fall rates (β= -0.86; p= .003). Unit mean ICS total score explained an additional 4.4% residual variance compared to the null model. AIC was 724 which is slightly better than model 2. Model 3 demonstrated a better fit than the null model ($x^2(1)= 9.1$, $p= .003$). AIC was compared with model 2 but was not significant. Marginal r^2 was .420 and conditional r^2 was .843.

Model 4 (NM-EBPC)

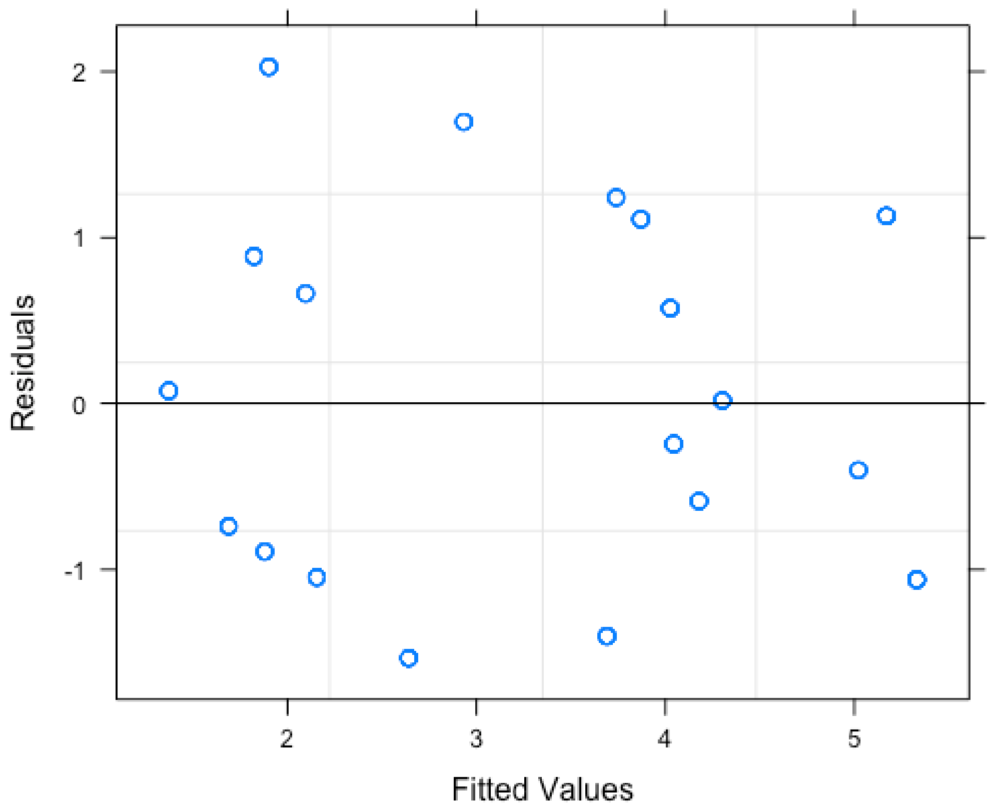
The fourth model added NM-EBPC total score to the null model (see Table 4.13). The random effect of hospital was significant ($x^2(1)= 165$, $p<.0001$). NM-EBPC was not significantly associated with fall rates (β= 0.28; $p= .21$) and only explained an additional 0.9% residual variance compared to null model. AIC was 732 which is relatively the same as the AIC for the null model (731). Therefore, the null model, as more parsimonious, is a better fit for the data than a model with NM-EBPC included. Marginal r^2 was .423 and conditional r^2 was .850.

Model 5 (Full Model)

The fifth and final model added unit mean ILS total score, unit mean ICS total score, and NM-EBPC total score to the null model (see Table 4.13). The random effect of hospital was significant ($x^2(1)= 132$, $p<.0001$). RN skill mix, RN HPPD, and unit bed capacity were significant in the full model; however, none of the independent variables (unit mean ILS total score, unit mean ICS total score, NM-EBPC total score) were significant in the full model. The independent variables together explained an additional 4.4% of the residual variance over the null model. AIC was 728, representing a slight improvement over the null model (731), but not over Model 2 (727) or Model 3 (724). Marginal r^2 was .418 and conditional r^2 was .843.

Visual inspection of residual plots for the full model did not reveal any obvious deviations from homoscedasticity or normality (Figure 4.2).

Figure 4.2. Fitted vs. Residual Plots for Aim 3a Full Model



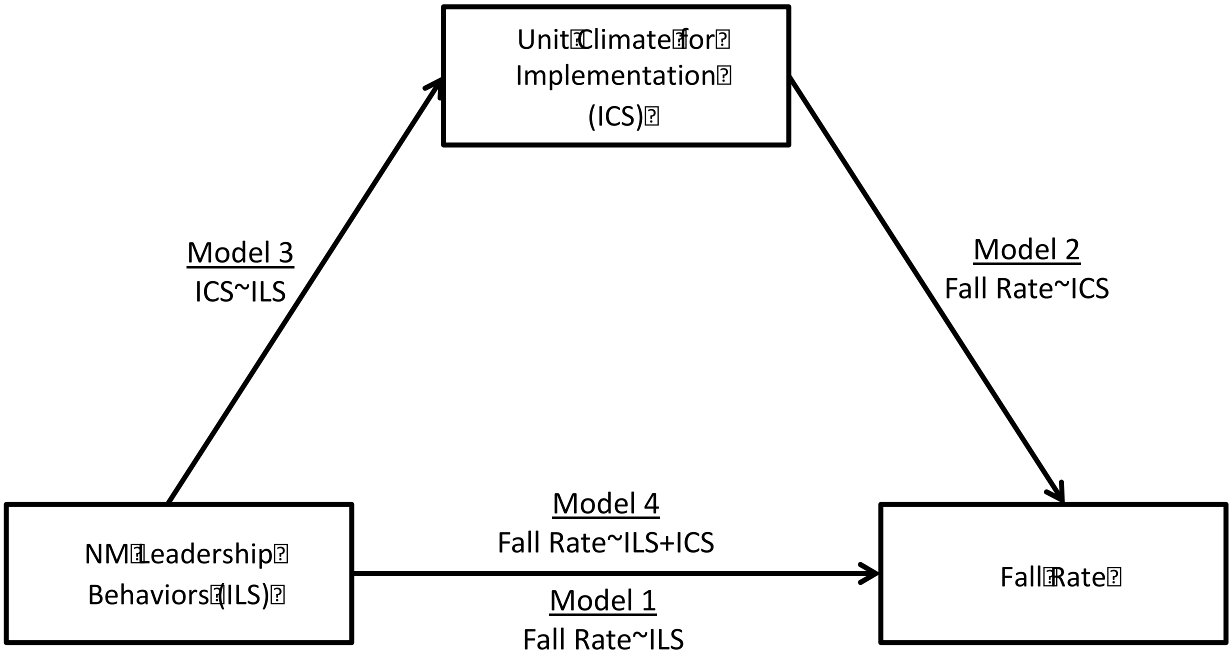
Post-hoc Mediation Analysis

The results of the above analyses suggested potential for mediation effects because significance of predictors (ILS total score and ICS total score) changed dramatically in the full model as compared to models 2 and 3 (see Model 5, Table 4.13). Based on the conceptual model for this study (Figure 1.1, discussed earlier) and on the results above, the mediating effect of unit climate for EBP implementation on the relationship between nurse manager leadership behaviors and nursing-sensitive patient outcomes (fall rates) is worth exploring.

Post-hoc Data Analysis

Mediation was tested using the method of Baron and Kenny (1986). First, a model was estimated to determine the significance of the effect of unit mean ILS total score on fall rate. A second model was estimated to determine the significance of the effect of unit mean ICS (mediator) on fall rate. A third model was estimated to determine the significance of the effect of unit mean ILS total score in explaining the mediator (unit mean ICS total score). Finally, if significance was demonstrated in each of the preceding three models mediation was present (Baron & Kenny, 1986). Finally, a fourth model was estimated including both the independent variable (unit mean ILS total score) and mediator (unit mean ICS total score) in explaining fall rate. If unit mean ILS total score effect on fall rate was no longer significant in the presence of the mediator (unit mean ICS total score), than full mediation is present (Baron & Kenny, 1986). If unit mean ILS total score remains significant, partial mediation results. Figure 4.3 presents the post-hoc mediation data analysis plan.

Figure 4.3. Post-hoc Mediation Data Analysis



Post-hoc Results

The first model run in mediation analysis demonstrates the significance of the independent variable's (unit mean ILS total score) effect in explaining variance in the dependent variable (fall rate) (Model 1, Table 4.14). Unit mean ILS total score was associated with lower fall rates (β= -0.59; *p*= .015), after controlling for confounding variables (patient age, RN skill mix, RN HPPD, and unit bed capacity) and accounting for random effects of hospital. The second model estimated the effect of unit mean ICS total score on fall rate after controlling for confounders and random effects (Model 2, Table 4.14). Unit mean ICS total score was associated with lower fall rates (β= -0.86; *p*=.003). The third model estimated the effect of unit mean ILS total score in explaining variance in unit mean ICS total score (mediator) after controlling for the same confounders and random effects (Model 3, Table 4.14). Unit mean ILS total score was associated with higher unit mean ICS total scores (β= 0.67; *p*<.001).

Table 4.14. Summary of Mediation Models

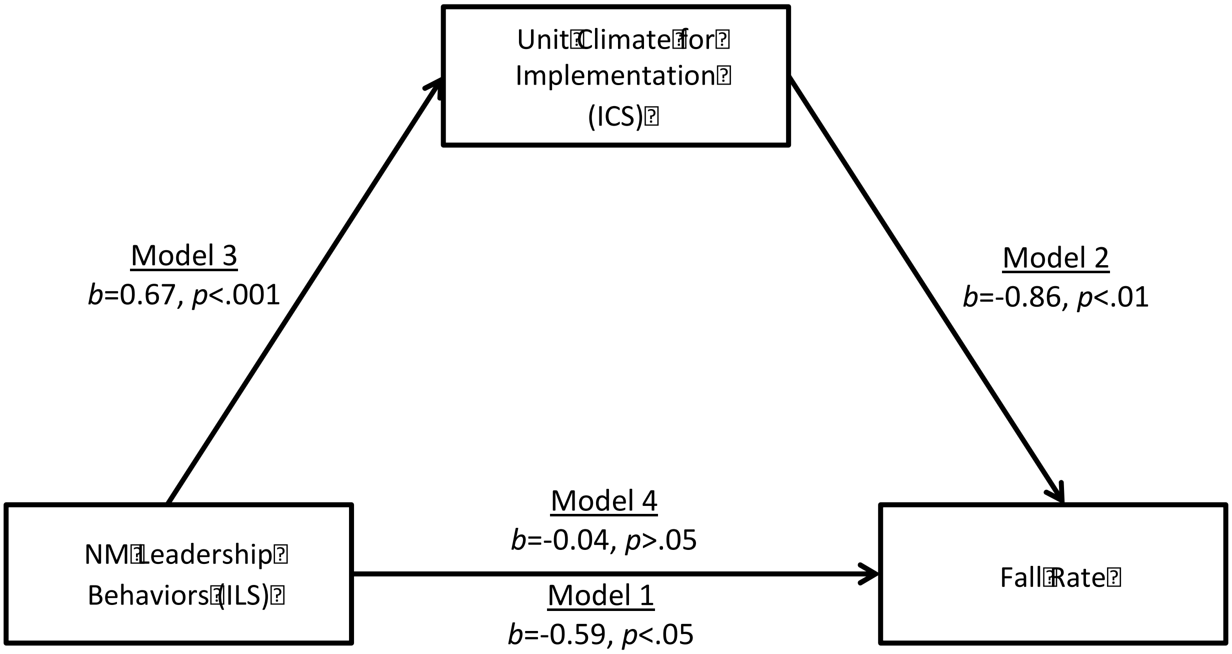
	Model 1	**Model 2**	**Model 3**	**Model 4**
Dependent Variable	***Fall Rate***	***Fall Rate***	***ICS***	***Fall Rate***
Intercept (*b*)	5.89**	7.12**	1.49***	7.07**
CONFOUNDING VARIABLES				
Patient Age (*b*)	-0.03	-0.04	-0.01**	-0.04
RN Skill Mix (*b*)	-0.10***	-0.11***	-0.01***	-0.11***
RN HPPD (*b*)	0.80***	0.85***	0.05***	0.85***
Unit Bed Capacity (*b*)	0.07***	0.07***	0.001	0.07***
INDEPENDENT VARIABLES				
Unit Mean ILS Total Score (*b*)	-0.59*		0.67***	-0.04
Unit Mean ICS Total Score (*b*)		-0.86**		-0.82
FIT STATISTICS				
AIC	727	724	NA	726
Marginal r^2	.405	.420	.736	.419
Conditional r^2	.801	.843	.833	.843

Note: significance levels, *p<.05; **p<.01; ***p<.001; *b*= beta coefficient

The first three models described above suggest mediation. To determine the extent of mediation (partial vs. full), a fourth model was estimated which included both unit mean ILS total score and unit mean ICS total score in explaining fall rate after controlling for confounding variables (patient age, RN skill mix, RN HPPD, and unit bed capacity) and random effects (random intercept for hospital) (Model 4, Table 4.14). In the fourth model, unit mean ILS (β= -0.04, *p*=.92) was no longer significant in the presence of the mediator. This suggests full mediation. The effect of unit mean ILS total score on fall rate was fully mediated by the unit mean ICS total score. Figure 4.3

displays this mediated relationship after controlling for confounding and random effects (not depicted).

Figure 4.4. Aim 3a Mediation Model



Sub Aim 3b

To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining catheter-associated urinary tract infection rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

All participating units provided data to calculate CAUTI rates (number of CAUTIs meeting criteria for three months by month and total number of catheter days for three months by month). However, only 5 units reported at least one CAUTI during the 3-month observation period. Rather than estimating models as planned in Chapter 3, units reporting at least one CAUTI were matched with units reporting zero CAUTIs. Matching was based on hospital and unit size. Since sample sizes were very small and normality cannot be assumed, Wilcoxon-Mann-Whitney tests were used to compare unit mean ILS total score, unit mean ICS total score, and NM-EBPC total score between the two matched groups.

The mean CAUTI rate of units reporting at least one CAUTI during the 3-month observation period was 5.61 (SD=5.73). Mean staff nurse ILS total scores, ICS total scores, NM-EBPC total scores, and Wilcoxon-Mann-Whitney test results are described in Table 4.15. The CAUTI group had a higher unit mean ICS total score, but a lower unit mean ILS total score and a lower NM-EBPC total score. However, these differences were not significant, which could be attributed to a lack of power associated with the small sample size.

Table 4.15. Comparison of CAUTI vs. No-CAUTI Reporting Units

	Unit mean ILS Total Score	**Unit mean ICS Total Score**	**NM-EBPC Total Score**
CAUTI Group (n=5)	3.14 (0.27)	2.61 (0.21)	1.46 (0.62)
Matched Group (n=5)	3.15 (0.35)	2.4 (0.33)	1.61 (0.63)
Wilcoxon-Mann-Whitney test	w= 13, p= .9	w= 18, p= .29	w= 9, p= .9

Sub Aim 3c

To examine the unique contributions of nurse manager EBP implementation behaviors (staff nurse reported), unit climates for EBP implementation (staff nurse reported), and nurse manager EBP competency (nurse manager reported) in explaining nosocomial stage III and IV pressure injury rates after controlling for patient age, severity of illness, unit bed capacity, RN hours per patient day, and RN skill mix.

All study units provided data to calculate nosocomial stage III and IV pressure injuries. Only 4 of the 24 units reported at least one incidence during the 3-month data collection period. The mean nosocomial stage III and IV pressure injury rate of units reporting at least one incidence was 6.96 pressure injuries per 1000 unit discharges (SD= 2.94). Units reporting at least one nosocomial stage III or IV pressure injury were matched with reporting zero incidences by hospital and unit size. The nosocomial pressure injury group had a higher NM-EBPC total score, but a lower unit mean ILS total score and unit mean ICS total score (Table 4.16). However, results from Wilcoxon-

Mann-Whitney tests found that these differences were not significant, which could be attributed to a lack of power associated with the small sample size.

Table 4.16. Comparison of Nosocomial Pressure Injury vs. No-Nosocomial Pressure Injury Reporting Units

	Unit mean ILS Total Score	**Unit mean ICS Total Score**	**NM-EBPC Total Score**
Nosocomial Pressure Injury Group (n=4)	2.54 (0.81)	1.98 (0.36)	1.93 (0.14)
Matched Group (n=4)	2.87 (0.55)	2.27 (0.55)	1.69 (0.28)
Wilcoxon-Mann-Whitney test	w= 7, p= .88	w= 6, p= .66	w= 13, p= .19

Summary

This multi-site, multi-unit cross-sectional study examined relationships among nurse manager EBP competencies, nurse manager EBP implementation leadership behaviors, unit climate for EBP implementation, and nursing sensitive patient outcomes. The findings support the proposition that nurse manager leadership, nurse manager competency, and unit climate are important context factors to investigate in implementation research. Findings from Aim 1 revealed room for improvement in nurse manager EBP competency, nurse manager EBP leadership behaviors, and unit climate for EBP implementation. Most total and subscale scores did not demonstrate significant differences between staff nurse and nurse manager respondents. However, significant differences were noted between staff nurse and nurse manager respondents for ILS subscales of Proactive and Knowledgeable.

Aim 2 examined the unique contributions of nurse manage EBP competency and nurse manager EBP leadership behaviors in explaining unit climate for EBP after controlling for confounding effects of education level, years of experience as an RN on current unit, and random intercepts for units and/or hospitals. Implementation leadership behaviors were significantly associated with higher ratings of unit climate for EBP implementation; whereas nurse manager EBP competency was negatively associated with unit climate for EBP implementation.

Aim 3 examined the unique contributions of the social dynamic context factors (nurse manager EBP competency; nurse manager EBP implementation leadership behaviors; and unit climate for EBP implementation) in explaining variation in nursing-sensitive patient outcomes after controlling for confounders and allowing for random intercepts of hospitals. In sub aim 3a, nurse manager EBP leadership behaviors and unit climate for EBP implementation were significantly associated with lower fall rates when entered independently in the model (in the absence of the other). When all social dynamic context factors were added, none were significant. However, in post hoc analyses, the relationship between implementation leadership behaviors of nurse managers and fall rate was fully mediated by the unit climate for EBP implementation. Very few units reported CAUTI and nosocomial stage III and IV pressure injury incidences. Therefore, regression modeling was not done. Units reporting these patient outcomes were matched by hospital and unit size to units reporting zero incidences. No significant differences were observed after comparing means between the two groups regarding nurse manager EBP competency, nurse manager EBP implementation leadership behaviors, and unit climate for EBP implementation.

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This multi-site, multi-unit cross-sectional study examined relationships among nurse manager EBP leadership behaviors, nurse manager EBP competencies, unit climate for EBP implementation, and nursing-sensitive patient outcomes. First, nurse manager EBP leadership behaviors, unit climates for EBP implementation, and nurse manager EBP competencies were examined by role. Next the unique contribution of nurse manager EBP leadership behaviors and EBP competencies (independent variables) on unit climate for EBP implementation (dependent variable) were examined using multilevel regression modeling, which accounted for nested effects while controlling for education level and years of experience of registered nurses on the study unit. Finally, the unique contributions of nurse manager leadership behaviors, nurse manager EBP competencies, and unit climates for EBP implementation (independent variables) in explaining variation in fall rate (dependent variable) were investigated using multilevel models accounting for random hospital effects and controlling for patient age, RN skill mix, registered nurse hours per patient day (RN HPPD), and unit bed capacity. Because CAUTI and nosocomial pressure injury rates (stage III and IV) demonstrated low incidence in the study sites, units reporting at least one CAUTI or nosocomial pressure injury were matched on hospital and unit size with units reporting zero CAUTIs or zero pressure injuries. Wilcoxon-Mann-Whitney tests were used to examine differences in unit mean implementation leadership behavior total scores, unit mean implementation climate scores, and nurse manager EBP competency total scores.

In this chapter, I discuss the findings and describe the study limitations. Implications for nursing practice are provided, as well as, suggestions for future research.

Demographic Findings

Staff Nurses and Nurse Managers

Staff nurses (n= 287) and nurse managers (n= 23) were from 24 medical-surgical acute care units nested in seven hospitals in the Midwest and Northeast U.S. Most staff nurse respondents were 20-30 years of age and had 1-10 years of experience as a registered nurse. The relatively young and inexperienced sample of staff nurses was unanticipated as respondents were randomly selected from a pool of eligible participants. This could indicate that younger, less experienced nurses expressed greater interest in responding, or that medical-surgical units have increased proportions of younger, newly licensed nurses providing the majority of patient care. The 2015 National Nursing Workforce Survey (NNWS) (2016) identified 50 years as the mean age of registered nurses in the United States; however, larger proportions of nurses under the age of 30 were employed full time and in hospitals. Thus the sample in this study appears to align with data from the recent NNWS, which suggests the sample reflects actual proportions in the population.

The level of nurse manager experience represents an additional unanticipated demographic finding. The mean years of experience as nurse manager on the current unit was 3.91 (range = 1-10 years) and in the current hospital was 3.95 (range = 1-10 years). This finding is slightly lower than the mean of 6.5 years (range = 9 months – 33 years) identified by Kueny et al. (2015). However, it parallels Johansson, Fogelberg-Dahm, and Wadenstein's (2010) sample of 168 nurse managers from two hospitals that demonstrated a median of 3 years of experience as nurse manager. In addition, Warshawsky and Havens (2014) found that the average nurse manager tenure is only 5 years. Therefore, the observed lower levels of nurse manager experience in acute care settings may reflect high nurse manager turnover rates. This turnover of nurse managers is concerning because nurse managers influence patient outcomes (Wong et al., 2013), and turnover has been associated with increases in adverse patient outcomes (Warshawsky et al., 2013).

Unit Characteristics Findings

The unit bed capacity (M=24.99, SD=9.52) was lower than a recent study of 81 acute care medical-surgical units in the United States (M=32.9, SD=8.6) (Catrambone, Johnson, Mion, & Minnick, 2009). Similarly, average daily census reported in this study (M=17.73, SD=9.54) was slightly lower than an experimental study collecting similar data from 12 units (experimental (M=24.7, SD=5.5); control (M=22.1, SD=7.1) (Titler et al., 2009). Average RN skill mix (M=60, SD=10) and average RN HPPD (M=7.31, SD=1.49) were similar to findings from a study investigating similar unit types (N=1,751 units; Mean skill mix range: 60.6 – 69.7; median RN HPPD range: 7.5 – 9.1) (Dunton, Gajewski, Taunton, & Moore, 2004). Most units had either no clinical nurse specialist or a part time clinical nurse specialist appointed to the unit. Clinical nurse specialists are argued to play an important role in promoting EBP use on units (Campbell & Profetto-McGrath, 2013) and may be identified as change agents for implementation studies (Reimers & Miller, 2014). However, almost 40% of units in this study had no CNS. Lack of CSN appointment may be related to the sample of small units or to budget constraints. The cost effectiveness of CNSs is suggested by some, however, quality and rigor of available studies have been found to be poor resulting in a weak evidence base (Kilpatrick, Reid, Carter, Donald, Bryant-Lukosius, et al., 2015). More work to empirically support the specific contributions of CNSs in promoting implementation of EBP is needed in future studies.

Discussion of Findings

This is the first study to describe the nurse manager (NM) EBP competencies, NM leadership behaviors, and unit climates for EBP implementation in medical-surgical units in acute care settings. The psychometric properties of the three scales used in the study were good with Cronbach internal consistency reliability alphas > .70 for total scores and all subscale sores except ILS Proactive, ILS Supportive, and ILS Perseverant subscale scores for nurse managers. This may be due to the small sample size of NMs (N=23). These findings, supported by others (Aarons, Ehrhart, & Farahnak, 2014; Aarons et al., 2017; Aarons, Ehrhart, Torres et al., 2017; Ehrhart et al., 2014; Shuman et al., in review), suggest that these social dynamic context measures are important for inclusion in future implementation research.

Discussion of Findings from Aims 1 and 2

The major findings are that 1) EBP competencies of nurse managers and leadership behaviors for EBP explain more than 50% of the variance of unit climate for implementation (Aim 2), and 2) there are opportunities to improve leadership behaviors and EBP competencies for nurse managers (Aim 1), which in turn should positively impact the unit climate for implementation.

Nurse managers perceive that they are somewhat but not fully competent in EBP knowledge and skills as total scores were less than 2.0 (fully competent) but greater than 1.0 (somewhat competent). Although the American Organization of Nurse Executives (AONE, 2015) has set forth competencies for nurse managers, these do not include competencies in EBP nor do they address leadership for fostering EBP. Since leadership is critical for successful EBP implementation (Birken et al., 2016; Kitson et al., 1998; Kueny et al., 2015; Leslie, 2016; Shirey et al., 2013;Titler, 2010), it is important that nurse manager competencies in EBP are developed to benefit EBP implementation efforts and assist in fostering climates supportive of EBP implementation.

Implementation climate total scores reported by NMs (2.16) and staff nurses (2.24) suggest that the practice climates for implementation are less than optimal for implementation of EBPs. Most of the ICS subscale scores reported by staff nurses (SN) and nurse managers (NM) were less than 2.5 (2=moderate). Subscale scores suggest that practice climates are low for rewarding EBPs (NM=1.04; SN=1.4) and moderate for EBP educational support (NM=2.23; SN=2.26), hiring of staff who value EBP (NM=2.03; SN=2.25), and recognizing staff for EBP (NM=2.25; SN=2.38). This is concerning because implementation scientists have noted that practice climates that value and reward EBP are more likely to implement EBPs in day-to-day care delivery (Aarons, Ehrhart, Farahnak, & Sklar, 2014; Ehrhart et al., 2014). For example, reward allocation is an indicator of what the organization or unit values (Aarons, Ehrhart, Farahnak, & Sklar, 2014). Consequently, nurse managers who allocate rewards with consideration of nurses' EBP implementation and use are actively embedding a climate supportive of EBP implementation (Aarons, Ehrhart, Farahnak, & Sklar, 2014).

Similarly, findings about nurse manager leadership behaviors for EBP suggest that most behaviors are moderate (2=moderate) with differences in perceptions by staff nurses and NMs. Demonstration of proactive leadership behaviors received the lowest scores (NM=2.25; SN=2.67). The substantial amount of administrative tasks required of nurse managers may deter proactive behaviors that influence EBP implementation, such as, establishing unit standards for EBP or developing a plan for EBP implementation (Wilkinson et al., 2011). Staff nurses' perceptions significantly differed from nurse managers' perceptions for proactive leadership behaviors (NM=2.25; SN=2.67; p=.01) and knowledgeable leadership behaviors (NM=2.54; SN=2.99; p<.001), suggesting that nurse managers perceived themselves to demonstrate these behaviors to a lesser extent than perceived by their respective staff. Aarons and colleagues (2017) found similar divergent perspectives and contend that some leaders scored themselves lower out of humility. In addition, as unit leaders and supervisors, nurse managers are often considered clinical and managerial experts (e.g., knowledgeable) with responsibility for maintaining, assessing, and evaluating unit standards (e.g., proactive) (Baxter & Warshawsky, 2014; Duffield, Roche, Blay, &

Stasa, 2010). The combination of humble leadership and potential for staff to rate leaders more highly on these subscales may help to explain the divergent perceptions.

Collectively, descriptive findings (Aim 1) suggest that an intervention to address EBP implementation should focus on improving nurse managers' knowledge and skills in EBP, address capacity to proactively plan EBP work, and detailing methods for rewarding and recognizing staff, supporting education of staff about EBP, and hiring staff with knowledge and skills in EBP. Although nurse managers may not be expected to be experts in EBP, they should be competent and display leadership behaviors that convey the importance of EBP to create practice environments that reward, support and value EBP.

The final model for Aim 2 found that 50.2% (marginal r^2) of variance in unit climate for EBP implementation was explained by nurse managers' leadership behaviors for EBP implementation (ILS total score; $p<.0001$) and EBP competencies of nurse managers (NM-EBPC total score, $p=.003$), after controlling for confounding variables (education; years of experience as an RN in current unit) and accounting for nested effects. This suggests that nurse managers have a significant effect on unit climates for EBP implementation through their leadership behaviors and EBP competency. Education level and years of experience as an RN on the current unit were not significant.

Nurse manager leadership behaviors for EBP explained 43.4% of variance, suggesting that this variable was highly associated with unit climate for EBP implementation. The results indicate that staff nurse perceptions of their nurse manager's leadership behaviors go hand-in-hand with their perception of unit climates conducive for the implementation of EBP. This finding mirrors the correlation observation of Torres and colleagues (2017) in mental health facilities. Even after controlling for confounding variables (years as RN on current unit and education) and the nesting effects of units in hospital, the effect of leadership behaviors on implementation climate scores remained significant (b= 0.64, p < .0001). This provides further evidence supporting the positive relationship between middle manager leadership and implementation (Birken et al., 2012; Birken et al., 2016).

Nurse manager EBP competency explained 1.4% of model variance and, when modeled with leadership behaviors, demonstrated a significant effect on unit climates for EBP implementation (b= -0.22, p=.003). The inverse relationship between nurse manager EBP competency unit climates for EBP was unexpected. Increased competency in EBP was expected to be associated with unit climates more conducive for EBP implementation. Sample size and variation in NM-EBPC scores were minimal as data for nurse manager EBP competency was obtained via self-report from nurse manages on each participating unit (n=23 nurse managers). In contrast, data for unit climate for EBP implementation reflects staff nurse perceptions (n=238 staff nurses). As a newly conceptualized and operationalized construct, nurse manager EBP competency should be examined in future studies to further understand its relationship with unit climate. Since its effect was rather small, nurse manager EBP competency may not be sufficient to embed unit climates for EBP implementation. Implementation leadership behaviors play a larger role in fostering unit climates, as demonstrated in the large difference in variance accounted for between NM-EBPC and ILS total score.

In summary, since unit climates for implementation are greatly influenced by leadership behaviors and NM EBP competencies, and yet, competencies and leadership behaviors are modest at best, development and testing of interventions targeting the professional development of NMs is essential to advance the science in this field and to improve acute care practice environments.

Discussion of Aim 3 Findings

Aim 3 examined the unique and combined relationships of nurse manager leadership behaviors, nurse manager EBP competencies, and unit climates for EBP implementation on inpatient fall rates. Both leadership behaviors and unit climates for EBP implementation had a significant unique association with lower inpatient fall rates. (leadership behaviors: b=-0.59, p=.015; unit climates: b=-0.86, p=.003). After running five distinct models, model 3, which included unit climate for EBP implementation, confounding variables, and nested effects, demonstrated the best fit with a marginal r^2 of .42. Unit climate for EBP explained 4.4% of the variance and had a significant association with fall rates (b=-0.86, p=.003). This suggests that units with climates more supportive of EBP implementation were associated with lowered fall rates. Therefore, interventions created to improve unit climates for EBP may help to improve unit-level inpatient fall rates over and above manipulation of staffing factors (RN skill mix; RN HPPD).

The confounding effects of RN HPPD, RN skill mix, and bed capacity were significant in Aim 3 analyses across all five models. The relationship of nurse staffing and fall rates in this study parallels findings demonstrated in previous studies on falls and nurse staffing (Brennan, Daly, & Jones, 2013; Titler et al., 2016; Titler et al., 2011). In this study, increasing the proportion of RNs (RN skill mix) by 1% was associated with approximately 0.11 lower fall rates. However, increasing the amount of hours per patient day worked by registered nurses was associated with 0.85 increased fall rate for every 1-unit increase in RN HPPD. This may reflect a higher acuity of patients and thus a higher risk for falling. Registered nurses comprise a large proportion of unit budgetary spending. Due to budget constraints and nursing workforce shortages, many healthcare organizations have shown interest in manipulating skill mix and staffing to achieve quality patient outcomes while simultaneously saving money (Jacob, McKenna, & D'amore, 2015; Yang, Hung, Chen, Hu, & Shieh, 2012). However, greater use of registered nurses has shown positive effects on many unit and patient outcomes, such as, reduced medication errors (Patrician & Brosch, 2009) and shorter lengths of stay (Needleman, Buerhaus, Stewart, Zelevinsky, & Mattke, 2006). The reduction in adverse patient events and length of stay achieved by utilizing a greater proportion of registered nurses actually results in greater cost savings (Martsolf et al., 2014).

Nurse managers and administrators must take into account the short- and long-term savings benefits in conjunction with the benefits to patient care and quality when making staffing decisions. Although numerous studies have investigated nurse staffing in relation to outcomes, the results are mixed and there is no consensus leading to EB staffing guidelines (Brennan et al., 2013). The findings from this study provide modest empirical evidence that proportional increases in registered nurse staffing is associated with decreased fall rates.

Post hoc analyses provided preliminary evidence of full mediation. This suggests the association of leadership behaviors enacted by a nurse manager on fall rates is mediated through unit climates that support EBP implementation. This is not surprising since Aim 2 demonstrated the significant effect of nurse manager leadership behaviors on unit climates for EBP implementation. In the majority of acute care units, nurse managers, although licensed to practice as registered nurses, do not regularly provide patient care. However, as leaders of patient care units they are accountable for the care delivered by staff on their units, which affects patient outcomes (Wong and Cummings, 2011). Although the influence on patient care is not direct (as with staff nurses), the EBP leadership behaviors of nurse managers may contribute to the development and sustainment of unit climates supportive of EBP implementation and use. This finding further suggests that interventions to improve EBP leadership behaviors and climates supportive of EBP implementation, may help units achieve better patient outcomes with fewer adverse patient incidences (e.g., falls). Findings from the post hoc analyses are preliminary and require further investigation with a study design powered to detect these mediation effects.

Catheter-Associated Urinary Tract Infection Rate and Nosocomial Stage III and IV Pressure Injury Rates

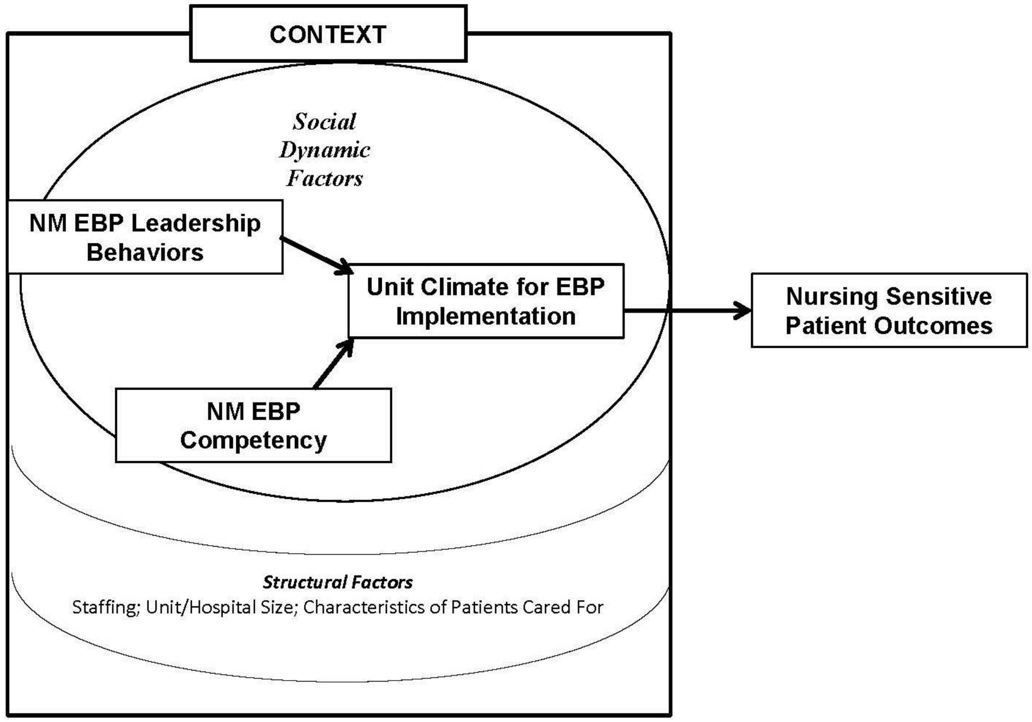
The majority of units (n=19 units) reported zero CAUTI incidences over three months. Units reporting either at least one CAUTI (n=5 units) were grouped in two of the seven hospitals. Development of a CAUTI is considerably related to length of stay, which suggests that patients on the majority of the study units were not on the unit long enough to develop one. Low incidence may also be due in part to availability of EBP recommendations to reduce CAUTI incidences, which generally include the following: 1) strict guidelines for appropriate catheter use, insertion, and maintenance; 2) rigorous surveillance; and 3) removal of catheters no longer clinically necessary (Lo et al., 2014). Implementations of these evidence-based CAUTI prevention interventions typically entail system level involvement (e.g., integration of surveillance mechanisms in electronic medical records; revision of physician order sets to prevent unnecessary catheter use) (Saint et al., 2008). Simple interventions have proven effective in reducing CAUTI incidences. Simple reminders sent to and by clinical care staff demonstrated significant reductions in catheterization days and CAUTI incidences (Huang et al., 2004; Saint, Kaufman, Thompson, Rogers, & Chenoweth, 2005). Although the implementation of simple interventions (e.g., reminders) may be difficult in complex health systems, the effect is large and immediate. In this study, units reporting at least one CAUTI were nested in two hospitals, which may have not yet successfully implemented system level evidence-based CAUTI prevention recommendations.

Similarly, units reporting at least one nosocomial pressure injury (n= 4 units) were nested in two of the seven hospitals, but not the same hospitals reporting CAUTI incidences. As with CAUTI, stage III and IV nosocomial pressure injuries are considerably related to length of stay. In addition, patients on a unit during a period of nurse manager turnover have a greater than three times likelihood for developing a nosocomial pressure injury (Warshawsky et al., 2013). Therefore, lower levels of nosocomial pressure injury incidences may be partially attributed to stable unit leadership. Similarly to CAUTI, experts suggest that successful pressure injury prevention requires implementation of rather simple interventions and/or intervention bundles (e.g., turning patients every 2 hours; encouraging mobility; performing routine skin assessments; raising bony prominences; utilizing specialty patient beds; using sensitive risk prediction tools) (Bååth, Engström, Gunningberg, & Athlin, 2016; Pancorbo-Hidalgo, Garcia-Fernandez, Lopez-Medina, & Alvarez-Nieto, 2006; Sullivan & Schoelles, 2013). Furthermore, pressure injury prevention efforts have intensified over the past 15 years as evidenced by numerous prevention programs and patient safety initiatives (CMS, 2017; IHI, 2017), as well as, the Centers for Medicare & Medicaid (CMS) nonpayment policy for stage III and IV pressure injuries (CMS, 2009). Finally, including incidences of nosocomial pressure injuries at any stage may have led to higher incident reports across units with the potential of identifying associations among this nursing-sensitive patient outcome and the social dynamic context factors of interest to this study.

Revised Conceptual Model

A revised conceptual model based on the results of Aims 2 and 3 is presented in Figure 5.1. Findings from Aim 2 are indicated by the arrows connecting nurse manager leadership behaviors and nurse manager EBP competency to unit climate for EBP implementation. Findings from Aim 3 suggest the effect of nurse manager EBP leadership behaviors on nursing-sensitive patient outcomes was mediated by the unit climate for EBP implementation. This relationship is also supported by recent work by Aarons, Ehrhart, Farahnak, and Sklar (2014) who contend that leaders strategically embed unit climates for EBP implementation and use by enacting specific leadership behaviors. It is likely that nurse manager EBP competency can improve a nurse manager’s leadership behaviors for EBP and their ability to foster practice climates supportive of EBP. The relationship of EBP competency to nurse manager leadership behaviors and unit climates for EBP implementation needs to be explored in future research. Although nurse manager EBP competency was not significant in Aim 3, a nurse manager’s level of competency in EBP may be a contributing factor to their leadership ability in fostering unit climates supportive of EBP implementation (suggested in Aim 2). Nurse manager EBP competency has not yet been studied in implementation research. Future implementation studies are encouraged to include nurse manager EBP competency as an independent variable in explaining implementation success or failure.

Figure 5.1. Revised Conceptual Model



Implications for Nursing

The integration of EBP into routine care delivery is considered a top priority by the IOM, which set a goal that by 2020, 90% of patient care would be evidence-based (Yong, Saunders, & Olsen, 2010). However, successful implementation of EBP is variable because the practice context in which implementation occurs differs across units and sites (Titler, 2010). The EBP implementation leadership behaviors and competencies of nurse managers contribute to the development of unit climates conducive of EBP implementation and use. In this study, the effect of nurse managers on patient outcomes is mediated through the unit climate, demonstrating the importance of EBP leadership behaviors in creating unit climates supportive of EBP implementation.

Therefore, it is imperative nurse executives and managers direct increased attention to developing nurse manager leadership and competency in EBP implementation.

Investment in nurse manager EBP leadership and competency development poses potential cost savings benefits. Adverse patient outcomes are extremely costly for hospitals and the entire healthcare system. Since many adverse patient outcomes are considered preventable and/or the result of clinician or system errors, hospitals are accountable for the expense associated with treating injuries resulting from adverse patient outcomes. Although manipulation of staffing factors may help to avoid adverse outcomes, these efforts tend to be associated with great cost.

Implications for Science

Numerous implications for future research are suggested from the results of this dissertation study. First, the mediating effect of unit climate for EBP implementation on the relationship between nurse manager EBP leadership behaviors and nursing-sensitive patient outcomes needs to be explored. This study was not designed nor powered to detect mediation effects. An implementation study using a cluster randomized design may help to further examine this relationship and determine potential causal mechanisms.

This is the first multi-unit, multi-site study describing and examining the nurse manager EBP competency. The competency of nurse managers regarding EBP is likely to contribute to their EBP leadership behaviors. This effect should be investigated in future studies incorporating a larger sample of nurse managers.

The moderating effects of the social dynamic context factors examined in this study on implementation outcomes should be explored in future implementation studies (Dobbins et al., 2009). Wilson et al. (2016) found that staff nurses reported nurse manager coaching and support as highly related to successful implementation of a fall prevention intervention. Similarly, Aarons, Ehrhart, Farahnak, and Sklar (2014) argue that coaching and support are vital leadership behaviors necessary for embedding a climate for EBP implementation. Investigating the potential moderating effects of nurse managerial leadership and unit climate for EBP will advance our knowledge regarding how context affects implementation.

In addition to the effects on implementation, the social dynamic factors studied in this dissertation may influence sustainability. Finn, Torres, Ehrhart, Roesch, & Aarons (2016) found that frontline leadership can predict EBP sustainment in state child-welfare service systems, with the most important leadership activities supportive of sustainment including championing the EBP intervention being implemented and providing practical support to staff. Very little research has addressed the sustainability of EBPs (Stirman et al. 2012; Chambers, Glasgow, & Stange, 2013) and no study has investigated the role of nurse managers in sustaining implemented EBPs in acute care. Studies are needed which examine the contributions of nurse manager EBP leadership behaviors and EBP competencies, and unit climates for EBP implementation on sustainability of implemented EBPs.

Limitations

This study had several limitations. First, hospitals were conveniently selected based upon willingness to participate in the study, which may affect generalizability of these findings. However, to mitigate this limitation, different sized hospitals from different parts of the United States were invited to participate. All eligible patient care units were included; however, one unit was randomly selected from units managed by the same nurse manager. This rigorous approach to site and unit selection represents an intentional effort to reduce bias that could have resulted from hospitals selecting better performing units to participate.

Staff nurse and nurse manager responses were collected at one point in time, and did not take into account EBP implementation efforts previously or currently in progress on the units. Units currently implementing fall prevention EBPs may have performed better on some of the scales due to increased attention on EBP implementation. Also, observing trends or stability in perceptions over time may have provided a more robust understanding of the social dynamic context for implementation. However, this approach was not feasible for the present study.

As discussed in Chapter 3, not all participating sites utilized 3M APR-DRG software. Consequently, I was unable to control for the confounding effect of severity of illness in Aim 3 models explaining fall rate. Patient age was included in the final models to provide some risk adjustment, as increased patient age is associated with increased falls. Finally, nurse manager EBP competency was assessed using a self-report measure. The NM-EBPC scale has demonstrated internal consistency reliability.

However, responses may be biased and not generalizable to other units (e.g., intensive care, pediatrics), hospitals, or care contexts (e.g., long-term care, public health).

Finally, the post hoc analyses investigating the mediation effect of unit climates for EBP implementation on the relationship of nurse manager leadership behaviors on fall rates is exploratory and preliminary. The study was not designed nor powered to detect mediation effects, so results should be interpreted with caution.

Conclusion

This study identified many significant relationships among social dynamic context factors, providing empirical evidence supporting recent theory development regarding the influence of middle managers in EBP implementation (Birken et al., 2012; Birken et al., 2016). As the first study investigating nurse manager leadership behaviors for EBP implementation, nurse manager EBP competencies, and medical-surgical nursing unit climates for EBP implementation, this study provides new knowledge not previously reported in nursing and implementation science literatures.

Considerable work is still needed to achieve the IOM goal of 90% of healthcare decisions being evidence based (EB) by 2020. As of 2014, AHRQ estimated that only 70% of care provided to patients is EB, an increase of only 4% since 2005 (AHRQ, 2014). Increasing the extent of EB care received by patients necessitates strategic implementation efforts, which are supported by robust empirical evidence and a deep knowledge base. Advancements in implementation science, in particular, research investigating the influence of practice context factors, will help to improve the speed and success of EBP implementation, resulting in improved patient care and outcomes.

Studies investigating implementation of EBP have primarily focused on clinician adoption and use, with little attention given to the influence of nurse managers in fostering climates supportive of EBP implementation. This is concerning because the practice context bears significant influence on implementation success or failure and is highlighted in numerous implementation conceptual frameworks and models. Advancements in the conceptualization and operationalization of context factors in implementation research are needed to inform this area of the science and to more thoroughly test available frameworks and models (e.g., PARIHS). This dissertation study provides empirical evidence supporting the significant relationships among leadership, unit climates, and patient outcomes.

This study encourages intervention development targeted to nurse manager EBP leadership behaviors and EBP competency. Interventions should also help nurse managers identify relevant EBP climate embedding mechanisms that can better create climates supportive of EBP. In addition, it is important that nurse managers are made aware of how their EBP competencies and leadership behaviors influence unit climates. It is crucial that nurse managers have a more comprehensive understanding of their role in establishing unit climates for EBP. Interventions should incorporate numerous mechanisms, not just didactic education. Mentoring, peer support, and hands-on assistance may be beneficial strategies to improve the leadership behaviors and competencies of nurse managers regarding EBP.

All implementation projects and research studies are encouraged to consider the impact of leadership and climate on the success or failure of the intended implementation. Prior to initiating implementation efforts, investigators, clinicians, administrators, and/or implementation facilitators should assess the leadership EBP competencies, EBP leadership behaviors, and unit climate for EBP implementation using valid and reliable instruments (e.g., Nurse Manager EBP Competency Scale; Implementation Leadership Scale; and Implementation Climate Scale). Insufficiencies in any one of these context factors could adversely affect implementation efforts and/or failure to achieve desired implementation outcomes (e.g., clinician use of the EBP; improved patient outcomes).

In conclusion, often overlooked or understudied in nursing and implementation research, the influence of leadership and climate on EBP implementation presents exciting avenues for future research and demonstrates considerable promise for improving implementation efforts and patient outcomes.

APPENDICES

APPENDIX A

Nurse Manager EBP Competency Scale Factor Loadings in Psychometric Study

Nurse Manager Evidence-Based Practice Competency Scale: Factor Loadings			
	I am able to…	Factor 1	Factor 2
1	Define evidence-based practice.	**.683**	.38
2	Locate primary evidence in bibliographic databases using search terms.	**.81**	.12
3	Critically appraise original research reports for practice implications.	**.796**	.254
4	Recognize ratings of strength of evidence when reading systematic reviews and evidence summary reports.	**.697**	.446
5	Identify key criteria in well-developed evidence summary reports using existing critical appraisal checklists	**.737**	.359
6	Differentiate among primary evidence, systematic reviews, and evidence-based guidelines.	**.807**	.324
7	Access clinical practice guidelines on various clinical topics.	.533	**.588**
8	Participate on a team to develop evidence-based practice recommendations for my unit(s), clinic(s), and/or organization.	.536	**.624**
9	Ensure the delivery of care on my unit(s) or clinic(s) aligns with evidence-based practice recommendations.	.293	**.762**
10	Assist in implementing evidence-based practice changes in my organization, unit(s), or clinic(s).	.137	**.832**
11	Use evidence to inform clinical decision-making.	.407	**.729**
12	Evaluate processes and outcomes of evidence-based practice changes.	.522	**.671**
13	Participate in resolving issues related to implementing evidence-based practice.	.378	**.787**
14	Use audit and feedback of data as an implementation strategy to promote use of evidence-based practice in my unit(s) or clinic(s).	.512	**.609**
15	Use criteria about evidence-based practice in performance evaluation of staff.	.247	**.812**
16	Use criteria about evidence-based practice in screening and hiring staff.	.263	**.734**

Shuman, Ploutz-Snyder, & Titler (in review)

APPENDIX B

IRB Approval Letter from University of Michigan

UNIVERSITY OF MICHIGAN
eResearch.umich.edu

Health Sciences and Behavioral Sciences Institutional Review Board (IRB-HSBS) • 2800 Plymouth Rd., Building 520, Room 1170, Ann Arbor, MI 48109-2800 • phone (734) 936-0933 • fax (734) 998-9171 • irbhsbs@umich.edu

---

To: Clayton Shuman

From:
Thad Polk

Cc:
Clayton Shuman
Marita Titler

Subject: Initial Study Approval for [HUM00117862]--**Two Year Approval**

SUBMISSION INFORMATION:
Study Title: Addressing the Practice Context in EBP Implementation: Leadership and Climate
Full Study Title (if applicable):
Study eResearch ID: HUM00117862
Date of this Notification from IRB: 8/2/2016
Initial IRB Approval Date: 8/2/2016
Current IRB Approval Period: **8/2/2016 - 8/1/2018**
Expiration Date: Approval for this expires at **11:59 p.m. on 8/1/2018**
UM Federalwide Assurance (FWA): FWA00004969 (For the current FWA expiration date, please visit the UM HRPP Webpage)
OHRP IRB Registration Number(s): IRB00000246

Approved Risk Level(s):

	Name	Risk Level
View	HUM00117862	No more than minimal risk

NOTICE OF IRB APPROVAL AND CONDITIONS:
The IRB HSBS has reviewed and approved the study referenced above. The IRB determined that the proposed research conforms with applicable guidelines, State and federal regulations, and the University of Michigan's Federalwide Assurance (FWA) with the Department of Health and Human Services (HHS). You must conduct this study in accordance with the description and information provided in the approved application and associated documents.

APPROVAL PERIOD AND EXPIRATION:
The approval period for this study is listed above. Note that this study has been granted a two year approval period as the research poses no more than minimal risk to subjects and there is no federal funding associated with this research effort. If your funding source should change to include federal funding, please notify the IRB. Federally funded research must follow federal regulations, one of which is an approval period not to exceed one year. Please note the expiration date. If the approval lapses, you may not conduct work on this study until appropriate approval has been re-established, except as necessary to eliminate apparent immediate hazards to research subjects. Should the latter occur, you must notify the IRB Office as soon as possible.

IMPORTANT REMINDERS AND ADDITIONAL INFORMATION FOR INVESTIGATORS

APPROVED STUDY DOCUMENTS:
You must use any date-stamped versions of recruitment materials and informed consent documents available in the eResearch workspace (referenced above). Date-stamped materials are available in the "Currently Approved Documents" section on the "Documents" tab.

RENEWAL/TERMINATION:
At least two months prior to the expiration date, you should submit a continuing review application either to renew or terminate the study. Failure to allow sufficient time for IRB review may result in a lapse of approval that may also affect any funding associated with the study.

AMENDMENTS:
All proposed changes to the study (e.g., personnel, procedures, or documents), must be approved in advance by the IRB through the amendment process, except as necessary to eliminate apparent immediate hazards to research subjects. Should the latter occur, you must notify the IRB Office as soon as possible.

AEs/ORIOs:
You must inform the IRB of all unanticipated events, adverse events (AEs), and other reportable information and occurrences (ORIOs). These include but are not limited to events and/or information that may have physical, psychological, social, legal, or economic impact on the research subjects or others.

Investigators and research staff are responsible for reporting information concerning the approved research to the IRB in a timely fashion, understanding and adhering to the reporting guidance (http://medicine.umich.edu/medschool/research/office-research/institutional-review-boards/guidance/adverse-events-aes-other-reportable-information-and-occurrences-orios-and-other-required-reporting), and not implementing any changes to the research without IRB approval of the change via an amendment submission. When changes are necessary to eliminate apparent immediate hazards to the subject, implement the change and report via an ORIO and/or amendment submission within 7 days after the action is taken. This includes all information with the potential to impact the risk or benefit assessments of the research.

SUBMITTING VIA eRESEARCH:
You can access the online forms for continuing review, amendments, and AEs/ORIOs in the eResearch workspace for this approved study (referenced above).

MORE INFORMATION:
You can find additional information about UM's Human Research Protection Program (HRPP) in the Operations Manual and other documents available at: http://research-compliance.umich.edu/human-subjects.

Thad Polk
Chair, IRB HSBS

APPENDIX C

Data Collection Manual

Addressing the Practice Context in EBP Implementation:
Leadership and Climate

Principle Investigators:
Clayton Shuman, MSN, RN, PhD(c)
Marita G. Titler, PhD, RN, FAAN

Data Collection Manual

EXAMPLE

Table of Contents

I. INTRODUCTION AND CONTACT INFORMATION

WELCOME!

This is the data collection manual to help facilitate the collection of data from Southwester Vermont Health Care. The success of this study is directly related to your participation. We look forward to working with you over the course of this study. Please feel free to contact us with questions or concerns. Our contact information is listed below for your convenience.

Principle Investigator
Clayton J. Shuman, MSN, RN, PhD(c)
University of Michigan School of Nursing
Department of Systems, Populations, and Leadership
400 N. Ingalls, Suite 4350
Ann Arbor, MI 48109-5482
Email: clayshu@umich.edu
Phone: 734-615-0251

Co-Principle Investigator
Marita G. Titler, PhD, FAAN, RN
Professor and Chair
Rhetaugh G. Dumas Endowed Chair
Department of Systems, Populations, and Leadership
400 N. Ingalls, Suite 4170
Ann Arbor, MI 48109-5482
Email: mtitler@umich.edu
Phone: 734-763-1188

II. STUDY SYNOPSIS

The purpose of this study is to:

(1) Describe nurse manager evidence-based practice competencies, nurse manager evidence-based practice leadership behaviors, and unit climates for evidence-based practice implementation; and

(2) Explore the relationships among nurse manager evidence-based practice competencies, nurse manager evidence-based practice leadership behaviors, unit climates for evidence-based practice implementation and unit-level patient outcomes.

We will work with you to identify study units and participants. We will also provide you with data collection spreadsheets to assist in collecting the data from the study units and your organization.

<u>Expectations of the Study Sites</u>

- To obtain approval from the study site's Institutional Review Board (IRB)
- To facilitate data collection (see below)
  - To identify all nursing units meeting eligibility criteria.
  - To provide a site coordinator to be the primary point of contact for the research team and to assist with recruitment and data collection.

<u>Participant Recruitment and Data Collection</u>

On the next few pages you will find a summary of the recruitment process and data that will be collected from your hospital. To help facilitate data collection, we have organized the data collection manual according to the potential source of the data at your hospital. The source of the data may vary across participating hospitals and you are encouraged to identify the most appropriate source of data at your hospital.

The following sections (III-VII) are organized by data source and contain detailed directions for collecting and submitting the data from each source. Submission timelines and dates are also detailed in each section.

Participant Recruitment and Data Collection Summary

A. **Site Coordinator - Recruitment**

1. Provide a list of units meeting the eligibility criteria.
2. Provide the email address of each unit director/assistant director.
3. Provide a blinded list of work email addresses of all eligible nurses meeting inclusion criteria for each participating unit. The investigative team will randomly select *30 nurses from each unit to participate*. In the event that there are less than 30 nurses available, all eligible nurses will be invited to participate.

B. **Chief Nursing Officer or Nursing Administration Office**

Organization characteristics of the hospital for 6 months (April 2016 – September 2016) will be collected using an Excel data collection form to collect information on:

1. Acute care bed capacity for each of the 6 months;
2. Type of hospital;
3. Average daily hospital census for each of the 6 months;
4. Magnet designation status (as of September 1, 2016); and
5. Case Mix Index for each of the 6 months.

C. **Unit Director/Assistant Director of Each Participating Unit**

Unit characteristics for the designated months (July 2016, August 2016, and September 2016) will be collected using a provided Excel data collection form to facilitate electronic submission of the following data:

1. Acute care bed capacity of unit by month;
2. Average daily unit census by month;
3. Total number of nursing care hours for each designated month;
4. Total number of registered nurse care hours for each designated month; and
5. Total number of hours worked by Clinical Nurse Specialist on unit per week as of September 1, 2016.

D. **Medical Records/EHR Department**

1. *Patient characteristics* of each unit for the designated months (July 2016, August 2016, and September 2016) will be collected from a **designated individual from the medical records/EHR department**. These data will be *aggregated* at the unit level and will not include individual patient data. An Excel data collection form will facilitate electronic submission of data.
    - **a.** Average patient age by month;
    - **b.** Severity of illness by month;
    - **c.** Primary medical diagnosis of patients cared for in the study unit by month;
    - **d.** Total number of discharges from the study unit by month; and
    - **e.** Total number of inpatient days by month.

2. *Hospital Acquired Pressure Ulcers data* for the designated months (July 2016, August 2016, and September 2016) will be collected from the **designated individual from the medical records/EHR department**. This patient outcome is aggregated at the unit level. An Excel data collection form will facilitate electronic submission of data.
   - **a.** Number of each of the specified ICD-10 codes with "present on admission" (POA) flags by month (described in Section VI below).

E. **Risk Management / Performance Improvement / Infection Control**
Inpatient falls and catheter-associated urinary tract infections data for the designated months (July 2016, August 2016, and September 2016) will be collected from the **designated individual from the risk management/performance improvement/infection control department**. These patient outcomes are aggregated at the unit level. An Excel data collection form will facilitate electronic submission of data.

1. *Inpatient Falls* on each study unit by month
   - **a.** Number of inpatient falls;
   - **b.** Number of injuries from inpatient falls; and
   - **c.** Type of injuries from inpatient falls;

2. *Catheter-Associated Urinary Tract Infections* on each study unit by month
   - **a.** Number of CAUTIs (both asymptomatic bacteremic UTI (ASUTI) and symptomatic UTI (SUTI) according to CDC definition); and
   - **b.** Number of catheter days.

SCHOOL OF NURSING
UNIVERSITY OF MICHIGAN

Addressing the Practice Context in EBP Implementation: Leadership and Climate

Principle Investigators:
Clayton Shuman, MSN, RN, PhD(c)
Marita G. Titler, PhD, RN, FAAN

EXAMPLE

III. SITE COORDINATOR - RECRUITMENT

OVERVIEW:

A. Unit Selection:
   Provide a blinded list of units meeting the eligibility criteria from each site.
   Provide email addresses for the director/assistant director of each selected unit.

B. Staff Nurse Selection:
   Provide a blinded list of work email addresses of all eligible nurses meeting inclusion criteria for each participating unit. The investigative team will randomly select *30 nurses from each unit to participate*.

A. Directions for Unit Selection

The **Site Coordinator** at each study site will be asked to provide a list of the units that meet eligibility criteria. The process for unit identification and selection, along with anticipated due dates are described below.

Unit Inclusion Criteria:

✓	Cares for patients older than 21 years of age.
✓	Designated as a medical, surgical, or specialty unit (e.g., oncology, orthopedics, cardiac step-down).
✓	Has an eligible nurse unit director/assistant director (manager): ☐ Licensed as a registered nurse. ☐ Responsibility and accountability for unit-level operations (not interim). ☐ Direct supervisor of nursing staff on the designated unit. ☐ Responsible for the quality of care patients receive on the unit.

Note: For unit directors/assistant directors who oversee multiple units, we will randomly select *one* of their *eligible* units.

Unit Exclusion Criteria:

- ☐ Mother-baby, pediatric, neonatal, psychiatric, or critical/intensive care unit.
- ☐ Does not have an eligible nurse clinical leader.

Clayton Shuman will send the site coordinator an Excel spreadsheet to facilitate the selection of units and collection of nurse clinical leader email addresses. The site coordinator will need to enter into the Excel spreadsheet all units meeting the eligibility criteria at the study site and code them alphabetically as indicated below. Also include the director/assistant director email addresses. **This list is for your records. Do not send it to Clayton Shuman.**

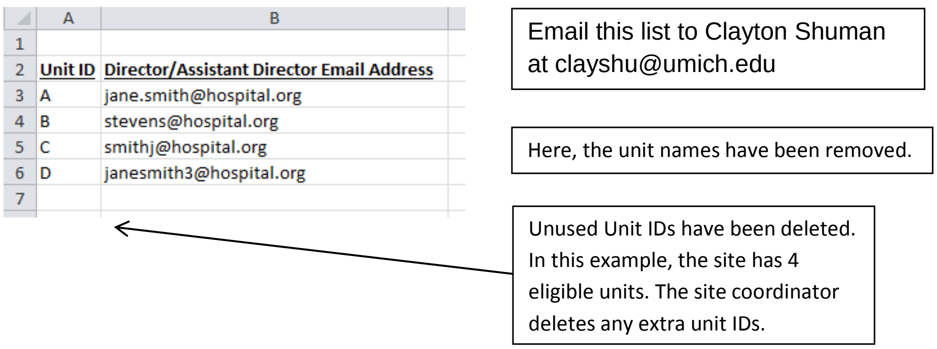
SAVE THIS SPREADSHEET FOR YOUR RECORDS!

	A	B	C
1			
2	Unit ID	Unit Name	Director/Assistant Director Email Address
3	A	9 West	jane.smith@hospital.org
4	B	Cardiac step-down	stevens@hospital.org
5	C	1 East General Medicine	smithj@hospital.org
6	D	4th floor oncology	janesmith3@hospital.org
7			

The site coordinator enters the name of each eligible unit and the director/assistant director email address here.

Unit IDs will be provided for you.

The site coordinator will save the Excel spreadsheet. Then the site coordinator will remove the ***names*** of the eligible units, leaving just the unit ID codes and director/assistant director email addresses. The unit IDs not needed (e.g. E-H) should be deleted. For example if the site has 4 eligible units, then the codes A, B, C, and D will be used. The site coordinator will delete codes E-H. The site coordinator will then email the Excel spreadsheet, **without** the unit names, to Clayton Shuman at clayshu@umich.edu, as illustrated below.



	A	B
1		
2	Unit ID	Director/Assistant Director Email Address
3	A	jane.smith@hospital.org
4	B	stevens@hospital.org
5	C	smithj@hospital.org
6	D	janesmith3@hospital.org
7		

Note: All eligible units will be included. For hospitals with more than 10 eligible units, we will randomly select 10 to include in this study.

Please notify Clayton Shuman (clayshu@umich.edu) if you hospital has more than 10 eligible units.

B. Directions for Staff Nurse Selection

The **<u>Site Coordinator</u>** at each site will be asked to provide a list of all nurses that meet eligibility requirements for each participating study unit at each site. If assistance is needed, you may consider contacting Human Resources. The steps and due dates are described below.

<u>Staff Nurse Inclusion Criteria</u>:

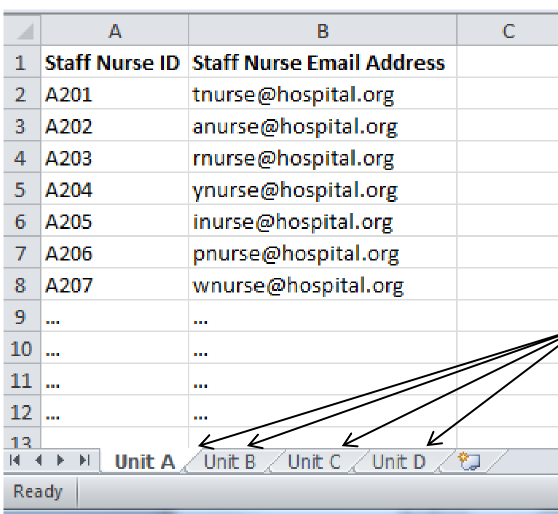
✓	Licensed as a registered nurse.
✓	Works a minimum of .40 FTE.
✓	Provides direct patient care.
✓	Works primarily on the selected unit.

Note: if an eligible staff nurse works on two participating units, we will include them with the unit on which they work most.

<u>Staff Nurse Exclusion Criteria</u>:

- Works less than .40 FTE.
- Designated as contingent or agency staff.
- Floats among units (in a float pool).

Clayton Shuman will send each Site Coordinator an Excel spreadsheet to facilitate input of the information. The Site Coordinator will enter email addresses into the spreadsheet for all nurses meeting the eligibility criteria on each study unit and code them as indicated below. If you have less than 30 eligible nurses on *ALL* study units, you may send this list to Clayton Shuman. Otherwise, **<u>this list is for your records. Do not send it to Clayton Shuman.</u>** After random selection is completed by Clayton Shuman, you will identify which nurses were selected from each unit at your site using this list.

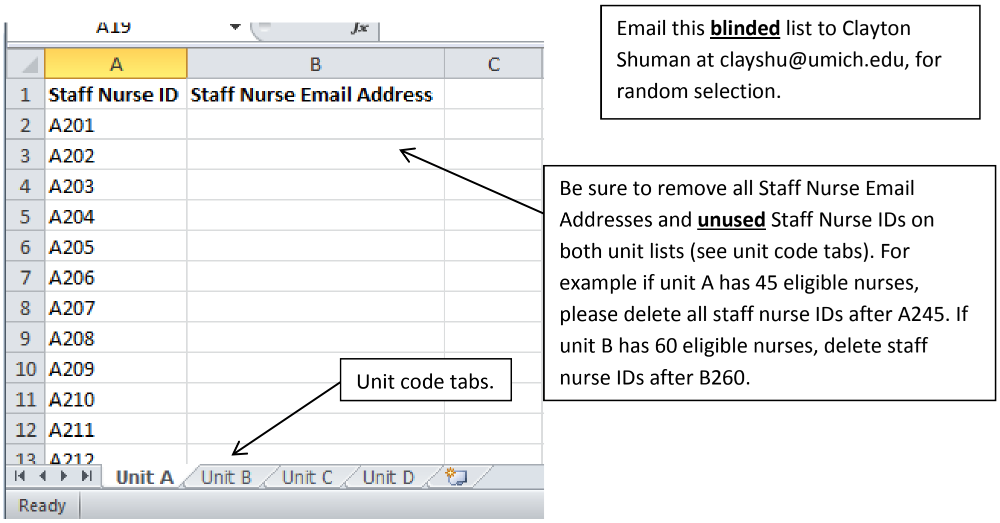


	A	B	C
1	Staff Nurse ID	Staff Nurse Email Address	
2	A201	tnurse@hospital.org	
3	A202	anurse@hospital.org	
4	A203	rnurse@hospital.org	
5	A204	ynurse@hospital.org	
6	A205	inurse@hospital.org	
7	A206	pnurse@hospital.org	
8	A207	wnurse@hospital.org	
9	...	...	
10	...	...	
11	...	...	
12	...	...	
13			

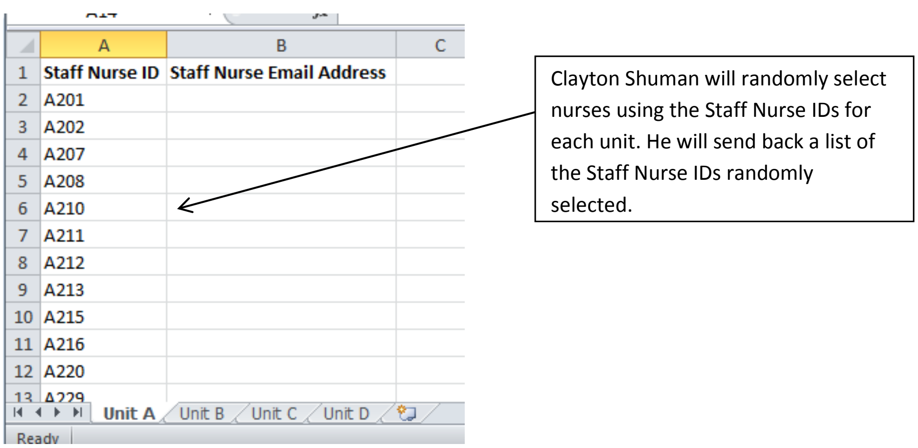
<u>Save this spreadsheet for your records!</u>

Unit Codes. Click on the tab of each unit to enter nurse email addresses for each study unit.

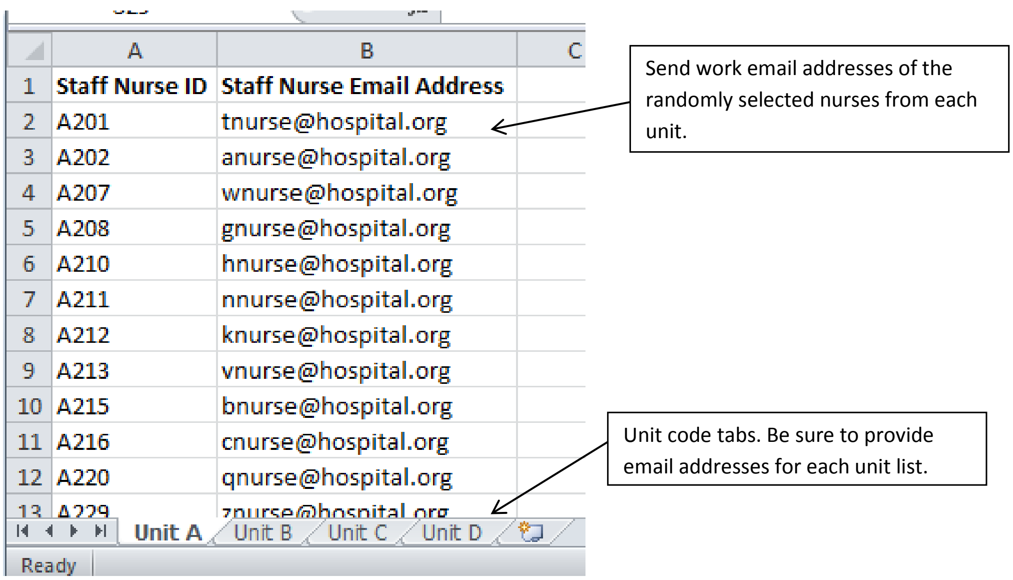
The Site Coordinator will then email the Excel spreadsheet to Clayton Shuman at clayshu@umich.edu, **without** the nurse email addresses, for each participating study unit as illustrated below.



Clayton Shuman will then randomly select 30 nurses from each unit and return to the site coordinator the Excel spreadsheet illustrated below. This indicates which nurses were randomly selected.



The Site Coordinator from each site will then match the randomly selected Staff Nurse IDs to the staff nurse email addresses from your **original list** and email Clayton Shuman (clayshu@umich.edu) the selected staff nurses work email addresses as indicated in the illustration below.



Additional Information:

Email Addresses

Sites should send the work email address of each randomly selected nurse. Please **do not** send personal email addresses.

Coding

The work email addresses will not be entered into the data set. They will only be used to send out the questionnaires to staff. The researchers will use unique code identifiers in all data sets.

Dates and Time Frames

The blinded unit lists and director/assistant director email addresses are due from the site coordinators**.** Send via email to Clayton Shuman, clayshu@umich.edu	**September 2, 2016**
The blinded staff nurse lists are due from the site coordinators**.** Send via email to Clayton Shuman, clayshu@umich.edu	**September 2, 2016**
Clayton Shuman will send the lists of randomly selected staff nurses from each unit to site coordinators.	September 7, 2016
Email addresses of the selected Staff Nurses from each participating unit are due from the site coordinator. Send via email to Clayton Shuman, clayshu@umich.edu	**September 14, 2016**

SCHOOL OF NURSING
UNIVERSITY OF MICHIGAN

Addressing the Practice Context in EBP Implementation: Leadership and Climate

Principle Investigators:
Clayton Shuman, MSN, RN, PhD(c)
Marita G. Titler, PhD, RN, FAAN

EXAMPLE

IV. CHIEF NURSING OFFICER / NURSING ADMINISTRATION OFFICE

OVERVIEW:

Organization characteristics of the hospital over 6 months (April 2016 – September 2016) will be collected using an Excel data collection form that gathers information on:

1. Acute care bed capacity for each of the 6 months;
2. Type of hospital (defined below);
3. Average daily hospital census for each of the 6 months;
4. Magnet designation status (as of September 1, 2016); and
5. Case Mix Index for each of the 6 months.

A. Directions for Data Collection of Organization Characteristics

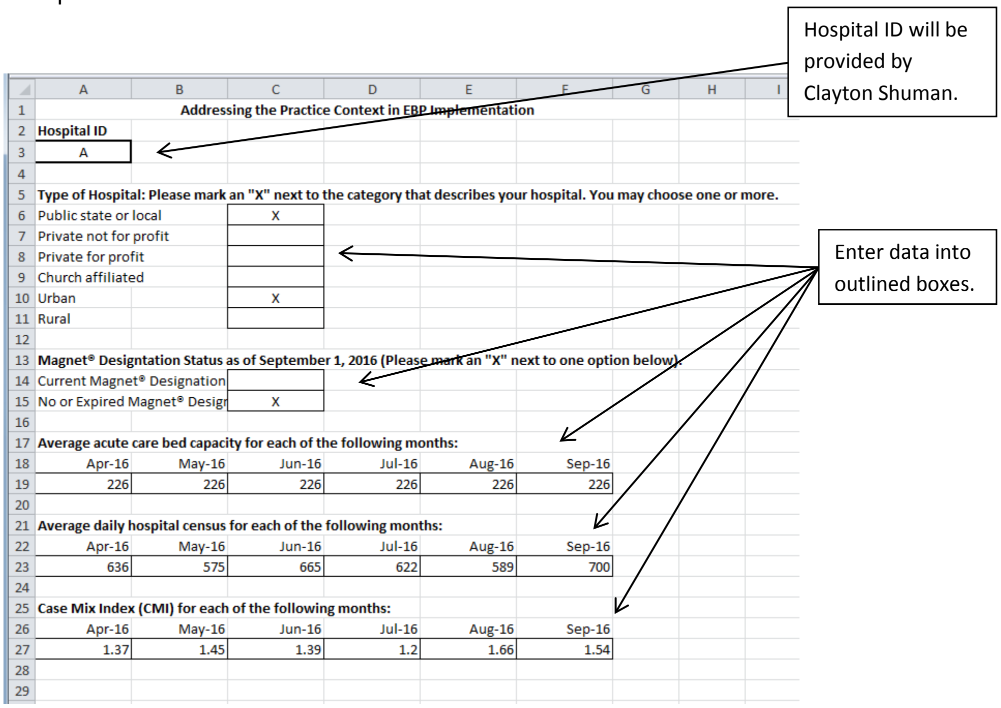
The **Site Coordinator** will receive a formatted Excel spreadsheet to facilitate electronic data submission of specific organization characteristics. Data on organization characteristics can be obtained from the Chief Nursing Officer or Nursing Administration Office. The deadlines for submitting data to Clayton Shuman are detailed below.

1. Definitions and Calculations

Variable	Definition	Data Requested
Acute care bed capacity	The total number of acute care inpatient beds available in the hospital.	For each of the designated months (April 2016-September 2016), provide the total number of available acute care inpatient beds in the hospital.
Type of Hospital	The classification of hospitals using a combination of provided categories.	As of September 1, 2016, describe the hospital using one or more of the following categories: public state or local, private not for profit, private for profit, church affiliated, urban, rural.
Average daily hospital census by month	The average number of acute care patients in the hospital during each of the designated months.	The sum of each day's census divided by the number of days during that month for each of the designated months (April 2016-September 2016).
Magnet designation status	The hospital's current status regarding the Magnet Recognition Program®.	As of September 1, 2016, define the hospital's current Magnet® designation status as: Current Magnet® Recognition or No Magnet® designation/expired Magnet® designation.
Case Mix Index (CMI)	CMI is the average diagnosis-related group (DRG) weight for all of a hospital's Medicare volume.	For each of the designated months (April 2016-September 2016), provide the CMI.

2. Example of Data Submission

The **Site Coordinator** can forward the Excel spreadsheet with the name "**OrgCharacteristics**" to the CNO or designated individual from the Nursing Administration Office. Once completed, the form can be returned to the **Site Coordinator** who will submit it to Clayton Shuman. The following is an example of what the spreadsheet looks like.



	A	B	C	D	E	F
1	Addressing the Practice Context in EBP Implementation					
2	Hospital ID					
3	A					
4						
5	Type of Hospital: Please mark an "X" next to the category that describes your hospital. You may choose one or more.					
6	Public state or local		X			
7	Private not for profit					
8	Private for profit					
9	Church affiliated					
10	Urban		X			
11	Rural					
12						
13	Magnet® Designtation Status as of September 1, 2016 (Please mark an "X" next to one option below).					
14	Current Magnet® Designation					
15	No or Expired Magnet® Desigr		X			
16						
17	Average acute care bed capacity for each of the following months:					
18	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
19	226	226	226	226	226	226
20						
21	Average daily hospital census for each of the following months:					
22	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
23	636	575	665	622	589	700
24						
25	Case Mix Index (CMI) for each of the following months:					
26	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
27	1.37	1.45	1.39	1.2	1.66	1.54
28						
29						

Dates and Time Frames

Clayton Shuman emails an Excel data collection spreadsheet titled "OrgCharacteristics" to the site coordinator at each hospital.	September 1, 2016
DATA DUE. The site coordinators submit data via email to Clayton Shuman, clayshu@umich.edu	**October 14, 2016**

SCHOOL OF NURSING
UNIVERSITY OF MICHIGAN

Addressing the Practice Context in EBP Implementation: Leadership and Climate

Principle Investigators:
Clayton Shuman, MSN, RN, PhD(c)
Marita G. Titler, PhD, RN, FAAN

EXAMPLE

V. UNIT DIRECTOR / ASSISTANT DIRECTOR

OVERVIEW:

Unit characteristics for the designated months (July 2016, August 2016, and September 2016) will be collected using a provided Excel data collection form to facilitate electronic submission of the following data:

1. Acute care bed capacity for each study unit by month;
2. Average daily unit census for each study unit by month;
3. Total number of nursing care hours for each study unit by month;
4. Total number of registered nurse care hours for each study unit by month; and
5. Total number of hours worked by Clinical Nurse Specialist on unit per week as of September 1, 2016.

A. Directions for Data Collection of Unit Characteristics

1. Data Source

The **Site Coordinator** will receive Excel spreadsheets (1 for each unit) to facilitate electronic data submission of specific unit characteristics. Unit characteristics data can be obtained from the unit director/assistant director who manage each participating unit. The deadlines for submitting data to Clayton Shuman are detailed below.

2. Definitions and Calculations

Variable	Definition	Data Requested
Bed capacity	The total number of inpatient beds available in the unit for each of the designated months.	Count the number of inpatient beds available in the unit for each of the designated months: July 2016, August 2016, and September 2016.
Average daily census	The average number of acute care patients in the unit for each of the designated months. *Based on midnight census.*	The sum of each day's census at midnight divided by the number of days during that month for each of the designated months: July 2016, August 2016, and September 2016.
Total Nursing Care Hours for Each Designated Month	The number of productive hours worked by nursing staff (RN, LPN/LVN, and UAP) with direct patient care responsibilities for each in-patient unit in a calendar month.	For each of the designated months (July 2016, August 2016, and September 2016), provide the following: Total number of productive hours worked by all nursing staff with direct patient care responsibilities for each participating unit during the calendar month.
RN Hours for Each Designated Month	The number of productive hours worked by RNs with direct patient care responsibilities for each in-patient unit in a calendar month.	For each of the designated months (July 2016, August 2016, and September 2016), provide the following: Total number of productive hours worked by registered nurses with direct patient care responsibilities for each participating unit during the calendar month.

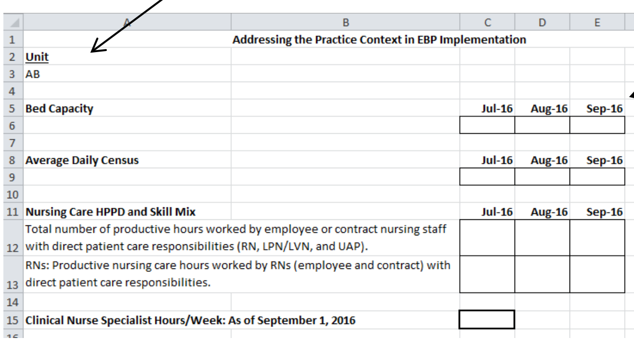
Variable	Definition	Data Requested
Clinical Nurse Specialist Hours on Unit per Week	The number of hours per week a Clinical Nurse Specialist is appointed to the study unit	As of September 1, 2016, provide the number of hours a Clinical Nurse Specialist works on the unit per week.

3. Example of Data Submission

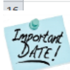
The **site coordinator** will forward the Excel spreadsheets with the name "**UnitCharacteristics_Unit#**" to each of the participating unit nurse managers. Each unit will have a specifically formatted spreadsheet. The following is an example of what the spreadsheet looks like.

Unit Code will be provided by Clayton Shuman. Refer to your original unit list to determine which unit is represented by this code and forward the spreadsheet to the director/assistant director of the unit. You will receive 1 spreadsheet per unit with unique unit codes.

Data collection months.



	A	B	C	D	E
1		Addressing the Practice Context in EBP Implementation			
2	Unit				
3	AB				
4					
5	Bed Capacity		Jul-16	Aug-16	Sep-16
6					
7					
8	Average Daily Census		Jul-16	Aug-16	Sep-16
9					
10					
11	Nursing Care HPPD and Skill Mix		Jul-16	Aug-16	Sep-16
12	Total number of productive hours worked by employee or contract nursing staff with direct patient care responsibilities (RN, LPN/LVN, and UAP).				
13	RNs: Productive nursing care hours worked by RNs (employee and contract) with direct patient care responsibilities.				
14					
15	Clinical Nurse Specialist Hours/Week: As of September 1, 2016				



Dates and Time Frames

Clayton Shuman emails Excel data collection spreadsheets titled "UnitCharacteristics_Unit#" to the site coordinators.	September 1, 2016
DATA DUE. The site coordinators submit data via email to Clayton Shuman, clayshu@umich.edu	**October 14, 2016**

SCHOOL OF NURSING
UNIVERSITY OF MICHIGAN

Addressing the Practice Context in EBP Implementation: Leadership and Climate

<u>Principle Investigators</u>:
Clayton Shuman, MSN, RN, PhD(c)

EXAMPLE

VI. MEDICAL RECORDS / EHR DEPARTMENT

OVERVIEW:

1. *Patient characteristics* of each unit for the designated months (July 2016, August 2016, and September 2016) will be collected from a **<u>designated individual from the medical records/EHR department</u>**. These data will be aggregated at the unit level and will not include individual patient data. An Excel data collection form will facilitate electronic submission of data.
    a. Average patient age and standard deviation of patients cared for in the study units by month;
    b. Severity of illness by month;
    c. Primary medical diagnosis - the number and percent of primary diagnoses of patients cared for on the study units during the specified month;
    d. Total number of patient discharges from the study unit by month; and
    e. Total number of inpatient days for the study unit by month.

2. *Hospital Acquired Pressure Ulcers data* for the designated months (July 2016, August 2016, and September 2016) will be collected from the **<u>designated individual from the medical records/EHR department</u>**. This patient outcome is aggregated at the unit level. An Excel data collection form will facilitate electronic submission of data.
    a. Number of each of the specified ICD-10 codes with a present on admission indicator of “N”, by month for each of the designated months.

A. Directions for Data Collection of Patient Characteristics

1. Data Sources

The **site coordinator** at each site will receive a formatted Excel spreadsheet to facilitate electronic data submission of specific patient characteristics for each unit. A representative from the **medical records/EHR department** can assist the site coordinators in obtaining these data for each unit. The deadlines for submitting data to Clayton Shuman are detailed below.

2. Definitions and Calculations

Variable & Definition	Specific Variable Constructs	Data Requested
Patient Age- Based on birth date of each patient. Age in years when patient was discharged from study unit.	Mean Age of all patients discharged from each of the study units for each of the designated months.	Sum the ages for all patients discharged from each study unit during each of the designated months (July 2016, August 2016, and September 2016).
	Standard Deviation for the age of patients discharged from each of the study units for each of the designated months.	$SD=\sqrt{\frac{\sum(x-\bar{x})^2}{n}}$ Provide the standard deviation of patient age for each unit during each of the designated study months (July 2016, August 2016, and September 2016).
Patient Discharges for Unit	Total Number of Patient Discharges for each study unit for each of the designated months.	Count the total number of unit discharges from each study unit during each of the designated study months (July 2016, August 2016, and September 2016).

Variable & Definition	Specific Variable Constructs	Data Requested
Inpatient Days for Unit	Inpatient days: Total number of inpatient days on each study unit for each of the designated months. *Based on midnight census.*	Sum of each daily inpatient census for each unit for each of the designated months: July 2016, August 2016, and September 2016. *Based on midnight census.*
Severity of Illness- Extend of physiological decomposition or organ system loss of function. This is assigned by standardized retrospective grouping system such as the All Patient Refined Diagnosis Related Groups (APR-DRG) and is the number and percent of inpatient discharges from each study unit in each category of minor, moderate, major, and severe for each of the designated months.	Number of discharges (n) in each severity of illness category (minor, moderate, major, severe).	A count of the number of patients discharged from each study unit for each category of severity of illness category (minor, moderate, major, severe) for each of the designated months (July 2016, August 2016, and September 2016).
	Percent (%) of patients in severity of illness category (e.g. minor, moderate, major, severe).	Percent of inpatient discharges in each category of severity of illness category (minor, moderate, major, severe) for each study unit for each of the designated months (July 2016, August 2016, and September 2016).
Primary Medical Diagnosis- The International Classification of Diseases 10^{th} Revision (ICD-10-) diagnosis codes for the primary diagnosis of patients discharged, aggregated by unit for each of the designated months.	Number (n) of discharges in each primary medical diagnostic code.	A count of the number of patients discharged from each unit that were coded as having the *primary* medical diagnosis for each of the designated months (July 2016, August 2016, and September 2016).

Variable & Definition	Specific Variable Constructs	Data Requested
***Cont.,* Primary Medical Diagnosis-** The International Classification of Diseases 10th Revision (ICD-10-) diagnosis codes for the primary diagnosis of patients discharged, aggregated by unit for each of the designated months.	Percent (%) of discharges that were coded with the specific primary medical diagnosis.	The percent of each ICD-10 primary diagnosis code of patients discharged from each unit for each of the designated months (July 2016, August 2016, and September 2016).

B. Directions for Data Collection of Hospital Acquired Pressure Ulcers

1. Data Sources

Each study site should determine the best data source for this information. A representative from the **medical records/EHR department** can assist the site coordinators in obtaining these data for each unit.

2. Definitions and Calculations

Variable	Definition	Data Requested
Hospital acquired stage III and IV pressure ulcers	Data for pressure ulcers comes from the discharge administrative data of ICD-10 diagnosis codes with a not present on admission (POA) indicator (N). Stage III and IV pressure ulcer codes include all possible pressure ulcer sites with the POA indicator "N". Codes: L89.xx3 and L89.xx4, where L89= pressure ulcer, xx represents the site, 3= stage III, and 4= stage IV.	Count the number of each of the following ICD-10 codes that also have a POA indicator "N". ☐ L89.003 ☐ L89.004 ☐ L89.013 ☐ L89.014 ☐ L89.023 ☐ L89.024 ☐ L89.103 ☐ L89.104 ☐ L89.113 ☐ L89.114 ☐ L89.123 ☐ L89.124 ☐ L89.133 ☐ L89.134 ☐ L89.143 ☐ L89.144 ☐ L89.153 ☐ L89.154

		□ L89.203 □ L89.204 □ L89.213 □ L89.214 □ L89.223 □ L89.224 □ L89.303 □ L89.304 □ L89.313 □ L89.314 □ L89.323 □ L89.324 □ L89.43 □ L89.44 □ L89.503 □ L89.504 □ L89.513 □ L89.514 □ L89.523 □ L89.524 □ L89.603 □ L89.604 □ L89.613 □ L89.614 □ L89.623 □ L89.624 □ L89.813 □ L89.814 □ L89.893 □ L89.894 □ L89.93 □ L89.94 for each study unit for each of the designated months (July 2016, August 2016, and September 2016).

C. Data Submission

Each site coordinator will receive an Excel spreadsheet titled “Medical_Records” to send to the Medical Records/EHR department to enter specific data about patient characteristics and hospital acquired pressure ulcers. Data for three time periods (July 2016, August 2016, and September 2016) for all patients discharged from participating study units will be collected using a single Excel spreadsheet. The deadlines for submitting data to Clayton Shuman are detailed below. The following is an example of what this spreadsheet looks like.

Data collection months.

Addressing the Practice Context in EBP Implementation: Medical Records/EHR Department

	July 2016	August 2016	September 2016
Age			
Mean Age			
Standard Deviation			
Total Number of Unit Discharges			
Total Number of Inpatient Days			

	July 2016		August 2016		September 2016	
Severity of Illness (APR-DRG)	(n)	%	(n)	%	(n)	%
Minor						
Moderate						
Major						
Severe						

Hospital Acquired Pressure Ulcers	July 2016	August 2016	September 2016
ICD-10 CODE with POA="N"	(n)	(n)	(n)
L89.003			
L89.004			
L89.013			
L89.014			
L89.023			
L89.024			
L89.103			
L89.104			
L89.113			
L89.114			
L89.123			
L89.124			
L89.133			
L89.134			
L89.143			

Continued…

L89.893			
L89.894			
L89.93			
L89.94			

Primary Diagnostic Code

July 2016				August 2016				September 2016			
ICD-10 Code	**Diagnosis**	**%**	**(n)**	**ICD-10 Code**	**Diagnosis**	**%**	**(n)**	**ICD-10 Code**	**Diagnosis**	**%**	**(n)**

Unit code tabs. Be sure to enter information for each unit in the correct unit tab.

AA AB Sheet2

Dates and Time Frames

Clayton Shuman emails the Excel data collection forms, “Medical_Records” to the **site coordinators** at each site.	September 1, 2016
DATA DUE. Site Coordinators submit data via email to Clayton Shuman, clayshu@umich.edu	**October 14, 2016**

SCHOOL OF NURSING
UNIVERSITY OF MICHIGAN

Addressing the Practice Context in EBP Implementation: Leadership and Climate

Principle Investigators:
Clayton Shuman, MSN, RN, PhD(c)
Marita G. Titler, PhD, RN, FAAN

EXAMPLE

VII. RISK MANAGEMENT / PERFORMANCE IMPROVEMENT/ INFECTION CONTROL DEPARTMENT

(INCIDENT DATA REPORTING SYSTEM)

OVERVIEW:

Inpatient falls and catheter-associated urinary tract infection data for the designated months (July 2016, August 2016, and September 2016) will be obtained from the risk management/performance improvement/infection control department and entered into the Excel spread sheet by **site coordinators.** These patient outcomes are aggregated at the unit level. An Excel data collection form will facilitate electronic submission of data.

1. *Inpatient Falls* on each Study Unit by month
   - **a.** Number of inpatient falls;
   - **b.** Number of injuries from inpatient falls; and
   - **c.** Type of injuries from inpatient falls (minor, moderate, major, death).
2. *Catheter-Associated Urinary Tract Infections* on each Study Unit by month
   - **a.** Number of CAUTIs (both asymptomatic bacteremic UTI (ASUTI) and symptomatic UTI (SUTI) according to CDC definition);
   - **b.** Number of catheter days.

A. Directions for Data Collection of Inpatient Falls and Catheter-Associated Urinary Tract Infections

Each site coordinator will receive an Excel spreadsheet to enter specific date about falls, fall injuries, and catheter-associated urinary tract infections. One Excel spreadsheet will be used to collect data for three time periods (July 2016, August 2016, and September 2016) for all patients discharged from participating study units. The deadlines for submitting data to Clayton Shuman are detailed below.

1. Data Sources

Each study site should determine the best data source for this information. For most sites, this will be an incident data reporting system, risk management program, infection control program, or quality improvement program.

2. Inpatient Falls: Definitions and Calculations

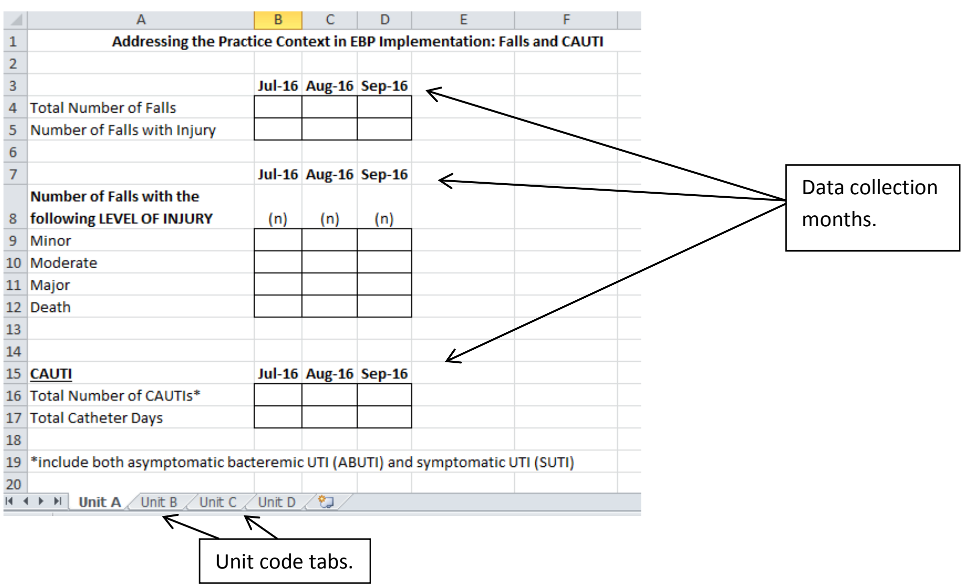
Variable	Definition	Data Requested
Total number of inpatient falls on each study unit for each of the designated months	A patient fall is defined as an unplanned descent to the floor or extension of the floor (e.g. trash can, other equipment) with or without injury. This includes both “assisted” and “unassisted” falls. Exclude falls from patients who are not in the unit at the time of the fall (e.g. while in radiology).	Count the number of falls on each study unit for each of the designated months: July 2016, August 2016, and September 2016.
Falls with injury (minor, moderate, major, death – see definitions below)	The total number of falls with any type of injury (minor, moderate, major, death) on each study unit for each of the designated months.	Count the number of falls with any type of injury on each study unit for each of the designated months: July 2016, August 2016, and September 2016.
Type of injury from a fall classified as minor, moderate, major, or death	Minor: results in application of a dressing, ice, cleaning of a wound, limb elevation, or topical medication. Moderate: results in suturing, steri-strips, fracture, or splinting. Major: results in surgery, casting, or traction. Death as a result of the fall.	Count of each of the types of injuries from a fall (minor, moderate, major, death) on each study unit for each of the designated months: July 2016, August 2016, and September 2016.

3. Catheter-Associated Urinary Tract Infections Data and Calculations

Variable	Definition	Calculation
Catheter-associated urinary tract infections	The total number of catheter associated urinary tract infections (both asymptomatic bacteremic UTI (ABUTI) and symptomatic UTI (SUTI)) on each study unit for each of the designated months.	Count the number of catheter-associated urinary tract infections (both asymptomatic bacteremic UTI (ABUTI) and symptomatic UTI (SUTI)) on each study unit for each of the designated months: July 2016, August 2016, and September 2016.
Catheter days	Total number of days patients had a catheter in place for each of the designated months. *Based on midnight census.*	Sum of all patient catheter days for each of the designated months (July 2016, August 2016, and September 2016). *Based on midnight census.*

B. Example of Data Submission

The Excel spreadsheet with the name “IncidentDataReporting” to facilitate data collection of the following: falls, fall injuries, and catheter-associated urinary tract infections. The following is an example of what this spreadsheet looks like.



	A	B	C	D	E	F
1	**Addressing the Practice Context in EBP Implementation: Falls and CAUTI**					
2						
3		**Jul-16**	**Aug-16**	**Sep-16**		
4	Total Number of Falls					
5	Number of Falls with Injury					
6						
7		**Jul-16**	**Aug-16**	**Sep-16**		
8	**Number of Falls with the following LEVEL OF INJURY**	(n)	(n)	(n)		
9	Minor					
10	Moderate					
11	Major					
12	Death					
13						
14						
15	**CAUTI**	**Jul-16**	**Aug-16**	**Sep-16**		
16	Total Number of CAUTIs*					
17	Total Catheter Days					
18						
19	*include both asymptomatic bacteremic UTI (ABUTI) and symptomatic UTI (SUTI)					
20						

Dates and Time Frames

Clayton Shuman emails an Excel data collection document titled “IncidentDataReporting” to the site coordinator at each site.	September 1, 2016
DATA DUE. The site coordinators submit data via email to Clayton Shuman, clayshu@umich.edu	**October 14, 2016**

Addressing the Practice Context in EBP Implementation: Leadership and Climate

Thank you for participating in this study. We are grateful for your assistance in collecting and submitting the data outlined above.

Warm Regards,
Clayton Shuman, MSN, RN, PhD(c)
Marita Titler, PhD, RN, FAAN

SCHOOL OF NURSING
UNIVERSITY OF MICHIGAN

APPENDIX D

Electronic Data Collection Forms

Electronic Data Collection Form: Hospital Characteristics

Addressing the Practice Context in EBP Implementation: Hospital Characteristics

Hospital ID

A

Type of Hospital: Please mark an "X" next to a category that describes your hospital. You may choose one or more.

Public state or local	
Private not for profit	
Private for profit	
Church affiliated	
Urban	
Rural	

Magnet® Designation Status as of September 1, 2016 (Please mark an X next to one option below)

Current Magnet® Designation	
No or expired Magnet® designation	

Average acute care bed capacity for each of the following months:

April 2016	May 2016	June 2016	July 2016	August 2016	September 2016

Average daily hospital census for each of the following months:

April 2016	May 2016	June 2016	July 2016	August 2016	September 2016

Case Mix Index for each of the following months:

April 2016	May 2016	June 2016	July 2016	August 2016	September 2016

Electronic Data Collection Form: Unit Characteristics

Addressing the Practice Context in EBP Implementation

Site: D
Unit: A

Bed Capacity

Aug-16	Sep-16	Oct-16

Average Daily Census

Aug-16	Sep-16	Oct-16

Nursing Care HPPD and Skill Mix

	Aug-16	Sep-16	Oct-16
Total number of productive hours worked by employee or contract nursing staff with direct patient care responsibilities (RN, LPN/LVN, and UAP).			
RNs: Productive nursing care hours worked by RNs (employee and contract) with direct patient care responsibilities.			

Clinical Nurse Specialist Hours/Week: As of October 1, 2016

Electronic Data Collection Form: Medical Records Data

Addressing the Practice Context in EBP Implementation: Patient Age, Severity of Illness, Nosocomial Pressure Injuries

SITE: D

UNIT A

Age	**August 2016**	**September 2016**	**October 2016**
Mean Age			
Standard Deviation			

	August 2016	**September 2016**	**October 2016**
Total Number of Unit Discharges			
Total Number of Inpatient Days			

Severity of Illness (APR-DRG)	**August 2016**		**September 2016**		**October 2016**	
	(n)	**%**	**(n)**	**%**	**(n)**	**%**
Minor						
Moderate						
Major						
Severe						

Hospital Acquired Pressure Injuries

ICD-10 CODE with POA="N"

	August 2016	**September 2016**	**October 2016**
	(n)	**(n)**	**(n)**
L89.003			
L89.004			
L89.013			
L89.014			
L89.023			
L89.024			

L89.103			
L89.104			
L89.113			
L89.114			
L89.123			
L89.124			
L89.133			
L89.134			
L89.143			
L89.144			
L89.153			
L89.154			
L89.203			
L89.204			
L89.213			
L89.214			
L89.223			
L89.224			
L89.303			
L89.304			
L89.313			
L89.314			
L89.323			
L89.324			
L89.43			
L89.44			

L89.503			
L89.504			
L89.513			
L89.514			
L89.523			
L89.524			
L89.603			
L89.604			
L89.613			
L89.614			
L89.623			
L89.624			
L89.813			
L89.814			
L89.893			
L89.894			
L89.93			
L89.94			

Electronic Data Collection Form: Incident Reporting Data

Addressing the Practice Context in EBP Implementation: Falls and CAUTI

SITE: D

UNIT A

	August 2016	September 2016	October 2016
Total Number of Falls			
Number of Falls with Injury			

	August 2016 (n)	September 2016 (n)	October 2016 (n)
Number of Falls with the following LEVEL OF INJURY:			
Minor			
Moderate			
Major			
Death			

CAUTI	August 2016	September 2016	October 2016
Total Number of CAUTIs *			
Total Catheter Days			

**include both asymptomatic bacteremic UTI (ABUTI) and symptomatic UTI (SUTI)*

APPENDIX E

Informed Consent Document

<u>**Consent to Participate in this Study**</u>

Welcome to this Evidence-Based Practice Study

What is this study about?
You are invited to be a part of a study that is interested in the practice context for evidence-based practice. This study is being conducted by Clayton Shuman and Dr. Marita Titler of the University of Michigan School of Nursing. The purpose of this study is to describe the relationships between perceptions of the practice context for evidence-based practice and patient outcomes.

What does my involvement look like?
You are asked to complete the following questionnaire about evidence-based practice. We expect this questionnaire to take approximately 10 minutes to complete. You will also be offered a chance to win a $100 cash gift card at the end of the questionnaire to thank you for your participation.

Will I receive any benefits for participating?
While you may not receive any direct benefit for participating, we hope that this study will contribute to understanding the practice context for evidence-based practice.

What potential risks does this study pose to me?
To avoid accidental disclosure of your identity, we will assign you and your unit a computer-generated number at the beginning of the study and the questionnaire that you fill out will be identified by numbers only.

Will my responses be kept confidential?
We plan to publish the results of this study, but will not include any information that would identify you or your unit. Information will be aggregated and no individual data will be published. Your privacy will be protected and your research records will be kept confidential.

How will my responses be stored and for how long?
Your responses will be stored for 3 years on a password-protected computer in a secured office and will contain only your study ID number, not your name or email. A separate, master list with both your email and study ID number will be kept on a password-protected computer.

Is my participation voluntary?
Participating in this study is completely voluntary. You may choose to not answer a question or you may skip any section of the questionnaire.

What if I have questions?
If you have questions about this study, you can contact:

Clayton Shuman, MSN, RN, PhD(c) University of Michigan School of Nursing 400 N. Ingalls, Suite 4170 Ann Arbor, MI 48109-5482 (734) 763-1188 clayshu@umich.edu	Marita Titler, PhD, RN, FAAN University of Michigan School of Nursing 400 N. Ingalls, Suite 4170 Ann Arbor, MI 48109-5482 (734) 763-1188 mtitler@med.umich.edu

If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researchers, please contact:

University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board
2800 Plymouth Rd., Building 520, Room 1169
Ann Arbor, MI 48109-2800
(734) 936-0933 [or toll free, (866) 936-0933]
irbhsbs@umich.edu

How do I consent?
By responding to the questionnaire items, you are consenting to participate in this study.

APPENDIX F

Nurse Manager Questionnaire

Nurse Manager Questionnaire

Addressing the Practice Context in EBP Implementation

Nurse Manager Questionnaire

Thank you for participating in this study. We are interested in your thoughts as a nurse leader (e.g. nurse manager; nurse director) regarding evidence-based practice. Directions for completing the questionnaire are provided in each part.

Please read all directions carefully and answer as accurately as possible. Your responses will be kept confidential.

Part I

Directions: Please **select one answer** from each item by circling the number that corresponds to the extent to which you agree with each item.

0	1	2	3	4
Not at all	**Slight extent**	**Moderate extent**	**Great extent**	**Very great extent**

1.	I am knowledgeable about evidence-based practice.	0 1 2 3 4
2.	I recognize and appreciate employee efforts toward successful implementation of evidence-based practice.	0 1 2 3 4
3.	I have established clear unit standards for the implementation of evidence-based practice.	0 1 2 3 4
4.	I support employee efforts to learn more about evidence-based practice.	0 1 2 3 4
5.	I react to critical issues regarding the implementation of evidence-based practice by openly and effectively addressing the problem(s).	0 1 2 3 4
6.	I know what I am talking about when it comes to evidence-based practice.	0 1 2 3 4
7.	I carry on through the challenges of implementing evidence-based practice.	0 1 2 3 4
8.	I have developed a plan to facilitate implementation of evidence-based practice.	0 1 2 3 4
9.	I support employee efforts to use evidence-based practice.	0 1 2 3 4
10.	I persevere through the ups and downs of implementing evidence-based practice.	0 1 2 3 4
11.	I have removed obstacles to the implementation of evidence-based practice.	0 1 2 3 4
12.	I am able to answer staff's questions about evidence-based practice.	0 1 2 3 4

Part II

Directions: Please **select one answer** from each item by circling the number that corresponds to the extent to which you agree with each item.

0 Not at all	1 Slight extent	2 Moderate extent	3 Great extent	4 Very great extent

13.	Clinicians who use evidence-based practices are held in high esteem in my unit.	0 1 2 3 4
14.	My unit provides the ability to accumulate compensated time for the use of evidence-based practices.	0 1 2 3 4
15.	Using evidence-based practices is a top priority in my unit.	0 1 2 3 4
16.	My unit provides financial incentives for the use of evidence-based practices.	0 1 2 3 4
17.	My unit provides evidence-based practice trainings or in-services.	0 1 2 3 4
18.	My unit hires staff who value evidence-based practice.	0 1 2 3 4
19.	Clinicians in my unit who use evidence-based practices are seen as clinical experts.	0 1 2 3 4
20.	My unit hires staff who have had formal education supporting evidence-based practice.	0 1 2 3 4
21.	Clinicians in my unit who use evidence-based practices are more likely to be promoted.	0 1 2 3 4
22.	My unit provides opportunities to attend conferences, workshops, or seminars focusing on evidence-based practice.	0 1 2 3 4
23.	My unit hires staff who are flexible.	0 1 2 3 4
24.	People in my unit think that the implementation of evidence-based practice is important.	0 1 2 3 4
25.	My unit hires staff who have previously used evidence-based practice.	0 1 2 3 4
26.	One of my unit's main goals is to use evidence-based practice effectively.	0 1 2 3 4
27.	My unit provides evidence-based practice training materials, journals, etc.	0 1 2 3 4
28.	My unit hires staff who are adaptable.	0 1 2 3 4
29.	The better you are at using evidence-based practices, the more likely you are to get a bonus or a raise.	0 1 2 3 4
30.	My unit hires staff open to new types of interventions.	0 1 2 3 4

Part III

Directions: Please **select one answer** from each item by circling the number that corresponds to your perceived level of competency.

0	1	2	3
Not competent	**Somewhat competent**	**Fully competent**	**Expertly competent**

0 – Not competent or familiar with the item; require assistance all of the time.
1 – Somewhat competent; familiar with the item but require assistance most of the time.
2 – Fully competent; individually accomplish item; may require minimal assistance at times.
3 – Expertly competent; require no additional assistance; teach others; role model item.

31. Define evidence-based practice in terms of evidence, expertise, and patient values.	0 1 2 3
32. Locate primary evidence in bibliographic databases using search terms.	0 1 2 3
33. Ensure the delivery of care aligns with evidence-based practice recommendations.	0 1 2 3
34. Evaluate processes and outcomes of evidence-based practice changes.	0 1 2 3
35. Using existing critical appraisal checklists, identify key criteria in well-developed evidence summary reports.	0 1 2 3
36. Use evidence to inform clinical decision-making.	0 1 2 3
37. Use criteria about evidence-based practice in screening and hiring staff.	0 1 2 3
38. Participate on a team to develop evidence-based practice recommendations for my agency.	0 1 2 3
39. Critically appraise original research reports for practice implications.	0 1 2 3
40. Assist in implementing evidence-based practice changes in my organization or unit.	0 1 2 3
41. Differentiate among primary evidence, systematic reviews, and evidence-based guidelines.	0 1 2 3
42. Recognize ratings of strength of evidence when reading systematic reviews and evidence summary reports.	0 1 2 3
43. Participate in resolving issues related to implementing evidence-based practice.	0 1 2 3
44. Use audit and feedback of data as an implementation strategy for evidence-based practice knowledge and use.	0 1 2 3
45. Use criteria about evidence-based practice in performance evaluation of staff.	0 1 2 3
46. Able to access clinical practice guidelines on various clinical topics	0 1 2 3

Part IV – Demographic Data

Directions: Please write in your answer or place an "X" in the box that correctly represents your answer.

47. What is your age? (Leave blank if you prefer not to respond)

	years

48. What is your gender?

	Female
	Male
	Prefer not to respond

49. What is your ethnicity/race? May select one or more.

	American Indian or Alaskan Native
	Asian
	Native Hawaiian or Other Pacific Islander
	Black or African American
	White or Caucasian
	Other
	Prefer not to respond

50. How long have you been working as a licensed registered nurse?

	years

51. How long have you consecutively worked as a nurse leader (e.g., nurse manager, nurse director)?

	years

52. How long have you consecutively worked as a nurse leader (e.g., nurse manager, nurse director) **in this hospital**?

	years

53. How long have you consecutively worked **on this unit** as a nurse leader (e.g., nurse manager, nurse director)?

	years

54. What is your highest degree earned?

	Diploma
	Associates
	Bachelors
	Masters
	Doctorate

You have completed the questionnaire. Thank you for participating in this study.

APPENDIX G

Staff Nurse Questionnaire

Staff Nurse Questionnaire

Addressing the Practice Context in EBP Implementation

Staff Nurse Questionnaire

Thank you for participating in this study. We are interested in your perceptions regarding evidence-based practice. Evidence-based practice is the "conscientious and judicious use of current best evidence in conjunction with clinical expertise and patient values to guide health care decisions" (Titler, 2014). Directions for completing the questionnaire are provided in each part.

Please read all directions carefully and answer as accurately as possible. Your responses will be kept confidential.

Part I

Directions: Please **select one answer** from each item by circling the number that corresponds to the extent to which you agree with each item.

For the purposes of this study, 'nurse managers' are registered nurses who oversee unit-level operations and care delivered by clinical staff. The nurse manager is the person you report to.

0 Not at all	1 Slight extent	2 Moderate extent	3 Great extent	4 Very great extent

1.	My manager is knowledgeable about evidence-based practice.	0 1 2 3 4
2.	My manager recognizes and appreciates employee efforts toward successful implementation of evidence-based practice.	0 1 2 3 4
3.	My manager has established clear unit standards for the implementation of evidence-based practice.	0 1 2 3 4
4.	My manager supports employee efforts to learn more about evidence-based practice.	0 1 2 3 4
5.	My manager reacts to critical issues regarding the implementation of evidence-based practice by openly and effectively addressing the problem(s).	0 1 2 3 4
6.	My manager knows what she/he is talking about when it comes to evidence-based practice.	0 1 2 3 4
7.	My manager carries on through the challenges of implementing evidence-based practice.	0 1 2 3 4
8.	My manager has developed a plan to facilitate implementation of evidence-based practice.	0 1 2 3 4
9.	My manager supports employee efforts to use evidence-based practice.	0 1 2 3 4
10.	My manager perseveres through the ups and downs of implementing evidence-based practice.	0 1 2 3 4
11.	My manager has removed obstacles to the implementation of evidence-based practice.	0 1 2 3 4
12.	My manager is able to answer staff's questions about evidence-based practice.	0 1 2 3 4

Part II

Directions: Please **select one answer** from each item by circling the number that corresponds to the extent to which you agree with each item.

0	1	2	3	4
Not at all	**Slight extent**	**Moderate extent**	**Great extent**	**Very great extent**

13.	Clinicians who use evidence-based practices are held in high esteem in my unit.	0 1 2 3 4
14.	My unit provides the ability to accumulate compensated time for the use of evidence-based practices.	0 1 2 3 4
15.	Using evidence-based practices is a top priority in my unit.	0 1 2 3 4
16.	My unit provides financial incentives for the use of evidence-based practices.	0 1 2 3 4
17.	My unit provides evidence-based practice trainings or in-services.	0 1 2 3 4
18.	My unit hires staff who value evidence-based practice.	0 1 2 3 4
19.	Clinicians in my unit who use evidence-based practices are seen as clinical experts.	0 1 2 3 4
20.	My unit hires staff who have had formal education supporting evidence-based practice.	0 1 2 3 4
21.	Clinicians in my unit who use evidence-based practices are more likely to be promoted.	0 1 2 3 4
22.	My unit provides opportunities to attend conferences, workshops, or seminars focusing on evidence-based practice.	0 1 2 3 4
23.	My unit hires staff who are flexible.	0 1 2 3 4
24.	People in my unit think that the implementation of evidence-based practice is important.	0 1 2 3 4
25.	My unit hires staff who have previously used evidence-based practice.	0 1 2 3 4
26.	One of my unit's main goals is to use evidence-based practice effectively.	0 1 2 3 4
27.	My unit provides evidence-based practice training materials, journals, etc.	0 1 2 3 4
28.	My unit hires staff who are adaptable.	0 1 2 3 4
29.	The better you are at using evidence-based practices, the more likely you are to get a bonus or a raise.	0 1 2 3 4
30.	My unit hires staff open to new types of interventions.	0 1 2 3 4

Part III – Demographic Information

Directions: Please write in your answer or place an "X" in the box that correctly represents your answer.

31. What is your age? (Leave blank if you prefer not to respond)

	years

32. What is your gender?

	Female
	Male
	Prefer not to respond

33. What is your ethnicity/race? May select one or more.

	American Indian or Alaskan Native
	Asian
	Native Hawaiian or Other Pacific Islander
	Black or African American
	White or Caucasian
	Other
	Prefer not to respond

34. What hours do you work most often? (Select one)

	Days
	Evenings
	Nights
	Rotate

35. How long have you been working as a licensed registered nurse?

	years

36. How long have you consecutively worked as a nurse **at this hospital**?

	years

37. How long have you consecutively worked as a nurse **in this unit**?

	years

38. What is your highest degree earned?

	Diploma
	Associates
	Bachelors
	Masters
	Doctorate

You have completed the questionnaire. Thank you for participating in this study.

APPENDIX H

Table A.1. NM-EBPC Scale Item Summaries

(N=22)

NM-EBPC Item ***I am able to…***	**Range**[1]	$\bar{x}$	***SD***	$\tilde{x}$	**Skew**	**Kurtosis**	**SE**
…define EBP.	1-3	2	0.62	2	0	-0.49	0.13
...locate primary evidence in bibliographic databases using search terms	0-3	1.68	0.78	2	-0.01	-0.68	0.17
…ensure that the delivery of care on my unit(s) aligns with EBP recommendations.	1-3	1.82	0.73	2	0.26	-1.2	0.16
…evaluate processes and outcomes of EBP changes.	1-3	1.82	0.73	2	0.26	-1.2	0.16
…identify key criteria in well-developed evidence summary reports using existing critical appraisal checklists.	0-2	1.41	0.59	1	-0.33	-0.95	0.13
…use evidence to inform clinical decision-making.	1-3	1.91	0.68	2	0.1	-0.97	0.15
…use criteria about EBP in screening and hiring staff.	0-3	1.09	0.87	1	0.26	-0.93	0.19
…participate on a team to develop EBP recommendations for my unit(s) and/or organization.	1-3	1.86	0.71	2	0.18	-1.11	0.15
…critically appraise original research reports for practical implications.	0-3	1.32	0.72	1	0.25	-0.29	0.15

NM-EBPC Item ***I am able to…***	Range[1]	$\bar{x}$	*SD*	$\tilde{x}$	Skew	Kurtosis	SE
…assist in implementing EBP changes in my unit(s) or organization.	1-3	2	0.62	2	0	-0.49	0.13
…differentiate among primary evidence, systematic reviews, and evidence-based guidelines.	0-3	1.41	0.67	1	0.32	-0.31	0.14
…recognize ratings of strength of evidence when reading systematic reviews and evidence summary reports.	0-3	1.27	0.83	1	-0.02	-0.89	0.18
…participate in resolving issues related to implementing EBP.	1-3	1.77	0.69	2	0.28	-1	0.15
…use audit and feedback of data as an implementation strategy for EBP knowledge and use.	0-3	1.36	0.73	1	0.1	-0.46	0.15
…use criteria about EBP in performance evaluation of staff.	0-2	1.32	0.72	1	-0.49	-1.05	0.15
…access clinical practice guidelines on various clinical topics.	1-3	1.86	0.64	2	0.1	-0.73	0.14

APPENDIX I

Table A.2. ILS Item Summaries by Role

ILS Item *I am/have…* (nurse manager) *My nurse manager is/has…* (staff nurse)	n	Range[1]	$\bar{x}$	*SD*	$\tilde{x}$	Skew	Kurtosis	SE	*t*-test
…knowledgeable about EBP.									
Staff Nurse	284	0-4	3.12	0.77	3	-0.62	0.30	0.05	*t* (28)= 2.75
Nurse Manager	23	2-4	2.74	0.62	3	0.18	-0.78	0.13	*p*= .01
…recognizes and appreciates employee efforts toward successful implementation of EBP									
Staff Nurse	284	0-4	3.02	0.85	3	-0.70	0.15	0.05	*t* (25)= 0.94
Nurse Manager	23	0-4	2.83	0.98	3	-1.04	1.00	0.21	*p*= .36
...established clear unit standards for the implementation of EBP.									
Staff Nurse	284	0-4	2.80	0.91	3	-0.53	0.15	0.05	*t* (25)= 2.40
Nurse Manager	23	0-4	2.22	1.13	2	-0.23	-0.64	0.23	*p*= .02
…supports employee efforts to learn more about EBP.									
Staff Nurse	284	0-4	2.98	0.95	3	-0.73	0	0.06	*t* (36)= -4.08
Nurse Manager	23	3-4	3.48	0.51	3	0.08	-2.08	0.11	*p*= .0002
…reacts to critical issues regarding the implementation of EBP by openly and effectively addressing the problem(s).									
Staff Nurse	284	0-4	2.88	0.91	3	-0.67	0.22	0.05	*t* (28)= -0.70
Nurse Manager	23	1-4	3	0.08	3	-0.51	-0.21	0.17	*p*= .49

ILS Item *I am/have…* (nurse manager) *My nurse manager is/has…* (staff nurse)	n	Range[1]	$\bar{x}$	*SD*	$\tilde{x}$	Skew	Kurtosis	SE	*t*-test
…knows what he/she is talking about when it comes to EBP.									
Staff Nurse	283	0-4	2.98	0.91	3	-0.81	0.52	0.05	$t\,(30)= 3.36$
Nurse Manager	23	1-4	2.48	0.67	2	0.08	-0.46	0.14	$p= .002$
…carries on through the challenges of implementing EBP.									
Staff Nurse	282	0-4	2.83	0.90	3	-0.68	0.34	0.05	$t\,(30)= -0.31$
Nurse Manager	23	2-4	2.87	0.63	3	0.07	-0.63	0.13	$p= .76$
…developed a plan to facilitate implementation of EBP.									
Staff Nurse	281	0-4	2.68	0.97	3	-0.47	-0.16	0.06	$t\,(27)= 2.48$
Nurse Manager	23	1-4	2.22	0.85	2	0.45	-0.43	0.18	$p= .02$
…supports employee efforts to use EBP.									
Staff Nurse	283	0-4	3.09	0.86	3	-0.87	0.59	0.05	$t\,(29)= -2.07$
Nurse Manager	23	2-4	3.39	0.66	3	-0.54	-0.84	0.14	$p= .05$
…perseveres through the ups and downs of implementing EBP.									
Staff Nurse	283	0-4	2.81	0.93	3	-0.63	0.16	0.06	$t\,(32)= 0.19$
Nurse Manager	23	2-4	2.78	0.60	3	0.08	-0.63	0.13	$p= .85$
…removed obstacles to the implementation of EBP.									
Staff Nurse	282	0-4	2.54	0.95	3	-0.41	-0.07	0.06	$t\,(30)= 1.47$
Nurse Manager	23	1-3	2.30	0.70	2	0.08	-1.02	0.15	$p= .15$
…able to answer staff's questions about EBP.									
Staff Nurse	283	0-4	2.89	0.92	3	-0.73	0.18	0.05	$t\,(29)= 3.09$
Nurse Manager	23	1-4	2.39	0.72	2	0.02	-0.49	0.15	$p= .004$

APPENDIX J

Table A.3. ICS Item Summaries by Role

ICS Item	n	Range[1]	$\bar{x}$	*SD*	$\tilde{x}$	Skew	Kurtosis	SE	*t*-test
Clinicians who use EBP are held in high esteem on my unit.									
Staff Nurse	272	0-4	2.77	0.86	3	-0.53	0.41	0.05	*t* (26)= 1.42
Nurse Manager	23	1-4	2.48	0.95	3	-0.09	-1.04	0.20	*p*= .17
My unit provides the ability to accumulate compensated time for the use of EBP.									
Staff Nurse	270	0-4	1.86	1.18	2	-0.06	-0.83	0.07	*t* (26)= 1.8
Nurse Manager	23	0-4	1.39	1.20	1	0.32	-1.01	0.25	*p*= .08
Using EBPs is a top priority in my unit.									
Staff Nurse	272	0-4	2.66	0.97	3	-0.40	-0.44	0.06	*t* (28)= -0.71
Nurse Manager	23	2-4	2.78	0.80	3	0.37	-1.40	0.17	*p*= .49
My unit provides financial incentives for the use of EBPs.									
Staff Nurse	272	0-4	1.06	1.21	1	0.91	-0.21	0.17	*t* (25)= 0.46
Nurse Manager	23	0-4	0.91	1.47	0	1.04	-0.68	0.31	*p*= .65
My unit provides EBP trainings or in-services.									
Staff Nurse	272	0-4	2.28	1.02	2	-0.67	0.22	0.05	*t* (28)= -0.70
Nurse Manager	23	1-4	3	0.08	3	-0.51	-0.21	0.17	*p*= .49

ICS Item	n	Range[1]	$\bar{x}$	*SD*	$\tilde{x}$	Skew	Kurtosis	SE	*t*-test
My unit hires staff who value EBP.									
Staff Nurse	272	0-4	2.35	1.01	2	-0.20	-0.53	0.06	*t* (27)= 0.21
Nurse Manager	23	0-4	2.3	0.97	2	-0.32	-0.33	0.20	*p*= .83
Clinicians in my unit who use EBPs are seen as clinical experts.									
Staff Nurse	271	0-4	2.51	0.98	3	-0.39	-0.23	0.06	*t* (26)= -0.43
Nurse Manager	23	1-4	2.61	1.03	3	-0.40	-1.12	0.22	*p*= .67
My unit hires staff who have had formal education supporting EBP.									
Staff Nurse	271	0-4	2.19	1.14	2	-0.29	-0.66	0.07	*t* (28)= 1.33
Nurse Manager	23	0-4	1.91	0.95	2	0.16	-0.63	0.20	*p*= .19
Clinicians in my unit who use EBPs are more likely to be promoted.									
Staff Nurse	271	0-4	1.86	1.17	2	-0.03	-0.83	0.07	*t* (28)= 0.90
Nurse Manager	23	0-3	1.65	1.03	2	-0.03	-1.29	0.21	*p*= .37
My unit provides opportunities to attend conferences, workshops, or seminars focusing on EBP.									
Staff Nurse	272	0-4	2.38	1.14	2	-0.18	-0.92	0.07	*t* (28)= -0.29
Nurse Manager	23	1-4	2.43	0.95	2	0.02	-1.04	0.20	*p*= .78
My unit hires staff who are flexible.									
Staff Nurse	270	0-4	2.51	0.89	3	-0.22	-0.18	0.05	*t* (30)= -2.66
Nurse Manager	23	1-4	2.91	0.67	3	-0.79	1.29	0.14	*p*= .01
People in my unit think that the implementation of EBP is important.									
Staff Nurse	272	0-4	2.64	0.87	3	-0.43	-0.17	0.05	*t* (26)= -0.26
Nurse Manager	23	1-4	2.70	0.93	3	-0.39	-0.78	0.19	*p*= .79
My unit hires staff who have previously used EBPs.									
Staff Nurse	271	0-4	2.19	0.99	2	-0.20	-0.41	0.06	*t* (26)= 1.47
Nurse Manager	23	0-3	1.87	1.01	2	-0.25	-1.29	0.21	*p*= .15

ICS Item	n	Range[1]	$\bar{x}$	*SD*	$\tilde{x}$	Skew	Kurtosis	SE	*t*-test
One of my unit's main goals is to use EBP effectively.									
Staff Nurse	271	0-4	2.68	0.97	3	-0.38	-0.52	0.06	*t* (26)= -0.70
Nurse Manager	23	1-4	2.52	1.04	2	0.06	-1.27	0.22	*p*= .49
My unit provides EBP training materials, journals, etc.									
Staff Nurse	272	0-4	2.14	1.08	2	-0.05	-0.65	0.07	*t* (28)= -0.60
Nurse Manager	23	1-4	2.26	0.92	2	0.18	-0.95	0.19	*p*= .55
My unit hires staff who are adaptable.	272	0-4	2.58	0.86	3	-0.35	0.07	0.05	*t* (26)= -1.09
Staff Nurse	23	1-4	2.78	0.85	3	-0.45	-0.43	0.18	*p*= .29
Nurse Manager									
The better you use EBPs, the more likely you are to get a bonus or raise.									
Staff Nurse	271	0-4	1.31	1.17	1	0.52	-0.66	0.07	*t* (28)= 2.24
Nurse Manager	23	0-3	0.83	0.98	1	0.88	-0.43	0.21	*p*= .03
My unit hires staff open to new types of interventions.									
Staff Nurse	271	0-4	2.37	0.92	2	-0.25	-0.31	0.06	*t* (27)= -0.56
Nurse Manager	23	0-4	2.48	0.90	3	-0.66	0.64	0.19	*p*= .58

References

2015 National Nursing Workforce Survey. (2016). Registered nurse results. *Journal of Nursing Regulation 7*(1 Suppl), S12-S53, http://dx.doi.org/10.1016/S2155-8256(16)31058-4.

3M. (2015). All Patient DRG Definitions Manual. Version 32. Retrieved from http://solutions.3m.com/wps/portal/3M/en_US/Health-Information-Systems/HIS/Products-and-Services/Products-List-A-Z/APR-DRG-Software/

Aarons, G. A., Ehrhart, M. G., & Farahnak, L. R. (2014). The implementation leadership scale (ILS): Development of a brief measure of unit level implementation leadership. *Implementation Science*, *9*(1), 45.

Aarons, G. A., Ehrhart, M. G., Farahnak, L. R., & Sklar, M. (2014). Aligning leadership across systems and organizations to develop a strategic climate for evidence-based practice implementation. *Annual Review of Public Health*, *35*, 255-274.

Aarons, G. A., Ehrhart, M. G., Torres, E. M., Finn, N. K., & Beidas, R. S. (2016). The humble leader: Association of discrepancies in leader and follower ratings of implementation leadership with organizational climate in mental health. *Psychiatric Services*, *68*(2), 115-122.

Aarons, G. A., Ehrhart, M. G., Torres, E. M., Finn, N. K., & Roesch, S. C. (2016). Validation of the Implementation Leadership Scale (ILS) in substance use disorder treatment organizations. *Journal of Substance Abuse Treatment*, *68*, 31-35.

Aaronson, K. D., Schwartz, J. S., Chen, T.-M., Wong, K.-L., Goin, J. E., & Mancini, D. M. (1997). Development and prospective validation of a clinical index to predict survival in ambulatory patients referred for cardiac transplant evaluation. *Circulation, 95*(12), 2660-2667.

Adams, A., Soumerai, S. B., Lomas, J., & Ross-Degnan, D. (1999). Evidence of self-report bias in assessing adherence to guidelines. *International Journal for Quality in Health Care, 11*(3), 187-192.

AHRQ. (2011). Are We Ready for This Change? Preventing Pressure Ulcers in Hospitals: A Toolkit for Improving Quality of Care. Retrieved from http://www.ahrq.gov/professionals/systems/hospital/pressureulcertoolkit/putool1.html

AHRQ. (2015). Pressure ulcer rate: Technical specifications. Retrieved from: https://www.qualityindicators.ahrq.gov/Downloads/Modules/PSI/V50/TechSpecs/PSI_03_Pressure_Ulcer_Rate.pdf

AHRQ. (2015). *2014 National Healthcare Quality and Disparities Report*. Retrieved from: https://www.ahrq.gov/research/findings/nhqrdr/nhqdr14/index.html

Aiken, L. H., Cimiotti, J. P., Sloane, D. M., Smith, H. L., Flynn, L., & Neff, D. F. (2011). The effects of nurse staffing and nurse education on patient deaths in hospitals with different nurse work environments. *Medical Care, 49*(12), 1047.

Aiken, L. H., Clarke, S. P., Sloane, D. M., Lake, E. T., & Cheney, T. (2008). Effects of hospital care environment on patient mortality and nurse outcomes. *The Journal of Nursing Administration, 38*(5), 223.

Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., … Lesaffre, E. (2014). Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study. *The Lancet, 383*(9931), 1824-1830.

Alexander, J. A., & Hearld, L. R. (2012). Methods and metrics challenges of delivery-system research. *Implementation Science, 7*(7), 15-26.

American Nurses Association. (2013). Competency model. ANA Leadership Institute. Retrieved from: https://learn.ana-nursingknowledge.org/template/ana/publications_pdf/leadershipInstitute_competency_model_brochure.pdf

AONE. (2015). *AONE Nurse Manager Competencies*. Chicago, IL: Author.

Armstrong, R., Waters, E., Crockett, B., & Keleher, H. (2007). The nature of evidence resources and knowledge translation for health promotion practitioners. *Health Promotion International*, *22*(3), 254-260.

Augustsson, H., Richter, A., Hasson, H., & von Thiele Schwarz, U. (2017). The need for dual openness to change: A longitudinal study evaluating the impact of employees' openness to organizational change content and process on intervention outcomes. *The Journal of Applied Behavioral Science*, 1-20. doi: 10.1177/0021886317691930

Augustsson, H., von Thiele Schwarz, U., Stenfors-Hayes, T., & Hasson, H. (2015). Investigating variations in implementation fidelity of an organizational-level occupational health intervention. *International Journal of Behavioral Medicine*, *22*(3), 345-355.

Aydin, C., Donaldson, N., Stotts, N. A., Fridman, M., & Brown, D. S. (2015). Modeling hospital- acquired pressure ulcer prevalence on medical- surgical units: Nurse workload, expertise, and clinical processes of care. *Health Services Research, 50*(2), 351-373.

Bååth, C., Engström, M., Gunningberg, L., & Athlin, Å. M. (2016). Prevention of heel pressure ulcers among older patients–from ambulance care to hospital discharge: A multi-centre randomized controlled trial. *Applied Nursing Research*, *30*, 170-175.

Bahtsevani, C., Willman, A., Khalaf, A., & Östman, M. (2008). Developing an instrument for evaluating implementation of clinical practice guidelines: A test- retest study. *Journal of Evaluation in Clinical Practice, 14*(5), 839-846.

Balas, M. C., Burke, W. J., Gannon, D., Cohen, M. Z., Colburn, L., Bevil, C., . . . Vasilevskis, E. E. (2013). Implementing the awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility bundle into everyday care: Opportunities, challenges, and lessons learned for implementing the ICU Pain, Agitation, and Delirium Guidelines. *Critical Care Medicine, 41*(9 Suppl 1), S116-127.

Balbale, S. N., Hill, J. N., Guihan, M., Hogan, T. P., Cameron, K. A., Goldstein, B., & Evans, C. T. (2015). Evaluating implementation of methicillin-resistant staphylococcus aureus (MRSA) prevention guidelines in spinal cord injury centers using the PARIHS framework: A mixed methods study. *Implementation Science, 10*(1), 130.

Ballini, L., Bero, L., Durieux, P., Eccles, M., Grimshaw, J., & Gruen, R. (2011). Cochrane effective practice and organisation of care group. *About Cochrane Collaboration (Cochrane Rev Groups (CRGs))*(3).

Baram, D., Daroowalla, F., Garcia, R., Zhang, G., Chen, J. J., Healy, E., . . . Richman, P. (2008). Use of the All Patient Refined-Diagnosis Related Group (APR-DRG) risk of mortality score as a severity adjustor in the medical ICU. *Clinical Medicine Insights. Circulatory, Respiratory and Pulmonary Medicine, 2*(1), 19.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173.

Baxter, C., & Warshawsky, N. (2014). Exploring the acquisition of nurse manager competence. *Nurse Leader*, *12*(1), 46-51.

Bell, A. J., Talbot-Stern, J. K., & Hennessy, A. (2000). Characteristics and outcomes of older patients presenting to the emergency department after a fall: A retrospective analysis. *The Medical Journal of Australia, 173*(4), 179-182.

Benner, P. (1982). From novice to expert. *AJN The American Journal of Nursing, 82*(3), 402-407.

Bennett, J. A. (2000). Mediator and moderator variables in nursing research: Conceptual and statistical differences. *Research in Nursing & Health*, *23*(5), 415-420.

Bero, L. A., Grilli, R., Grimshaw, J. M., Harvey, E., Oxman, A. D., & Thomson, M. A. (1998). Closing the gap between research and practice: An overview of systematic reviews of interventions to promote the implementation of research findings. *British Medical Journal, 317*(7156), 465-469.

Biai, S., Rodrigues, A., Gomes, M., Ribeiro, I., Sodemann, M., Alves, F., & Aaby, P. (2007). Reduced in-hospital mortality after improved management of children under 5 years admitted to hospital with malaria: Randomised trial. *BMJ*, *335*(7625), 862.

Birken, S. A., DiMartino, L. D., Kirk, M. A., Lee, S. Y. D., McClelland, M., & Albert, N. M. (2016). Elaborating on theory with middle managers' experience implementing healthcare innovations in practice. *Implementation Science*, *11*(1), 2.

Birken, S. A., Lee, S., & Weiner, B. J. (2012). Uncovering middle managers' role in healthcare innovation implementation. *Implementation Science, 7*(1), 28.

Bornbaum, C. C., Kornas, K., Peirson, L., & Rosella, L. C. (2015). Exploring the function and effectiveness of knowledge brokers as facilitators of knowledge translation in health-related settings: A systematic review and thematic analysis. *Implementation Science, 10*(1), 162.

Bouldin, E. D., Andresen, E. M., Dunton, N. E., Simon, M., Waters, T. M., Liu, M., . . . Shorr, R. I. (2013). Falls among adult patients hospitalized in the United States: Prevalence and trends. *Journal of Patient Safety, 9*(1), 13.

Brennan, C. W., Daly, B. J., & Jones, K. R. (2013). State of the science: The relationship between nurse staffing and patient outcomes. *Western Journal of Nursing Research*, *35*(6), 760-794.

Brosseau, L., Wells, G. A., Kenny, G. P., Reid, R., Maetzel, A., Tugwell, P., ... & Chen, L. (2012). The implementation of a community-based aerobic walking program for mild to moderate knee osteoarthritis (OA): A knowledge translation (KT) randomized controlled trial (RCT): Part I: The uptake of the Ottawa Panel clinical practice guidelines (CPGs). *BMC Public Health*, *12*(1), 871.

Brown, D., & McCormack, B. (2011). Developing the practice context to enable more effective pain management with older people: An action research approach. *Implementation Science, 6*(9), 1-14.

Brownson, R. C., Colditz, G. A., & Proctor, E. K. (2012). *Dissemination and implementation research in health: Translating science to Practice*: Oxford University Press.

Burnham, K. P., & Anderson, D. R. (2003). *Model selection and multimodel inference: a practical information-theoretic approach*. Springer Science & Business Media.

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193-213.

Caldwell, R. (2003). Models of change agency: A fourfold classification. *British Journal of Management*, *14*(2), 131-142.

Campbell, M. K., Fayers, P. M., & Grimshaw, J. M. (2005). Determinants of the intracluster correlation coefficient in cluster randomized trials: The case of implementation research. *Clinical Trials*, *2*(2), 99-107.

Campbell, T. D., & Profetto-McGrath, J. (2013). Skills and attributes required by clinical nurse specialists to promote evidence-based practice. *Clinical Nurse Specialist*, *27*(5), 245-254.

Carey, I. M., Shah, S. M., Harris, T., DeWilde, S., & Cook, D. G. (2013). A new simple primary care morbidity score predicted mortality and better explains between practice variations than the Charlson Index. *Journal of Clinical Epidemiology, 66*(4), 436-444.

Carney, M. (2006). Understanding organizational culture: The key to successful middle manager strategic involvement in health care delivery?. *Journal of Nursing Management, 14*(1), 23-33.

Catania, K., Huang, C., James, P., Madison, M., Moran, M., & Ohr, M. (2007). PUPPI: The pressure ulcer prevention protocol interventions. *AJN The American Journal of Nursing*, *107*(4), 44-52.

Catrambone, C., Johnson, M. E., Mion, L. C., & Minnick, A. F. (2009). The design of adult acute care units in US hospitals. *Journal of Nursing Scholarship*, *41*(1), 79-86.

CDC. (2017). Urinary tract infection (catheter-associated urinary tract infection [CAUTI] and non-catheter-associated urinary tract infection [UTI]) and other urinary system infection [USI]) events. Device-associated module: CAUTI. Retrieved from: https://www.cdc.gov/nhsn/pdfs/pscmanual/7psccauticurrent.pdf

Cella, D. F., Bonomi, A. E., Lloyd, S. R., Tulsky, D. S., Kaplan, E., & Bonomi, P. (1995). Reliability and validity of the Functional Assessment of Cancer Therapy—Lung (FACT-L) quality of life instrument. *Lung Cancer, 12*(3), 199-220.

Cella, D. F., Tulsky, D. S., Gray, G., Sarafian, B., Linn, E., Bonomi, A., . . . Brannon, J. (1993). The Functional Assessment of Cancer Therapy scale: Development and validation of the general measure. *Journal of Clinical Oncology, 11*(3), 570-579.

Champely, Stephane (2016). pwr: Basic Functions for Power Analysis. R package version 1.2-0. https://CRAN.R-project.org/package=pwr

Chambers, D. A., Glasgow, R. E., & Stange, K. C. (2013). The dynamic sustainability framework: Addressing the paradox of sustainment amid ongoing change. *Implementation Science*, *8*(1), 117.

Charlson, M., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases, 40*(5), 373-383.

Charlson, M., Szatrowski, T. P., Peterson, J., & Gold, J. (1994). Validation of a combined comorbidity index. *Journal of Clinical Epidemiology, 47*(11), 1245-1251.

Chaudoir, S. R., Dugan, A. G., & Barr, C. H. (2013). Measuring factors affecting implementation of health innovations: A systematic review of structural, organizational, provider, patient, and innovation level measures. *Implementation Science, 8*(1), 22.

Cheater, F. M., Baker, R., Reddish, S., Spiers, N., Wailoo, A., Gillies, C., . . . Cawood, C. (2006). Cluster randomized controlled trial of the effectiveness of audit and feedback and educational outreach on improving nursing practice and patient outcomes. *Medical Care, 44*(6), 542-551.

CIHR. (2016). Knowledge translation. Retrieved from: http://www.cihr-irsc.gc.ca/e/29418.html

Clarke, D. J., Godfrey, M., Hawkins, R., Sadler, E., Harding, G., Forster, A., ... & Farrin, A. (2013). Implementing a training intervention to support caregivers after stroke: A process evaluation examining the initiation and embedding of programme change. *Implementation Science*, *8*(1), 96.

CMS. (2017) Partnership for patients. Retrieved from: https://innovation.cms.gov/initiatives/Partnership-for-Patients/

CMS. (2009). Preventable Hospital-Acquired Conditions (HACs), Including Infections. In Medicare Program; Changes to the Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and Fiscal Year 2010 Rates; and Changes to the Long-Term Care Hospital Prospective Payment System and Rate Years 2010 and 2009 Rates. Federal Register, 74(165), 43782–43783.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences.* Hillsdale, NJ: Lawrence Earlbaum Associates.

Colquhoun, H., Leeman, J., Michie, S., Lokker, C., Bragge, P., Hempel, S., ... & Grimshaw, J. (2014). Towards a common terminology: A simplified framework of interventions to promote and integrate evidence into health practices, systems, and policies. Implementation Science, 9(1), 781.

Conway, L. J., Pogorzelska, M., Larson, E., & Stone, P. W. (2012). Adoption of policies to prevent catheter-associated urinary tract infections in United States intensive care units. *American Journal of Infection Control, 40*(8), 705-710.

Cook, J. M., O'Donnell, C., Dinnen, S., Coyne, J. C., Ruzek, J. I., & Schnurr, P. P. (2012). Measurement of a model of implementation for health care: Toward a testable theory. *Implementation Science, 7*(1), 59.

Cummings, G. G., Estabrooks, C. A., Midodzi, W. K., Wallin, L., & Hayduk, L. (2007). Influence of organizational characteristics and context on research utilization. *Nursing Research, 56*(4), S24-S39.

Cummings, G. G., MacGregor, T., Davey, M., Lee, H., Wong, C. A., Lo, E., . . . Stafford, E. (2010). Leadership styles and outcome patterns for the nursing workforce and work environment: A systematic review. *International Journal of Nursing Studies, 47*(3), 363-385.

Cummings, G. G., Midodzi, W. K., Wong, C. A., & Estabrooks, C. A. (2010). The contribution of hospital nursing leadership styles to 30-day patient mortality. *Nursing Research*, *59*(5), 331-339.

Currie, L. M. (2006). Fall and injury prevention. *Annual Review of Nursing Research, 24*(1), 39-74.

Damschroder, L., 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.

Damschroder, L., Banaszak-Holl, J., Kowalski, C. P., Forman, J., Saint, S., & Krein, S. (2009). The role of the "champion" in infection prevention: Results from a multisite qualitative study. *Quality and Safety in Health Care, 18*(6), 434-440.

Davies, P., Walker, A. E., & Grimshaw, J. M. (2010). A systematic review of the use of theory in the design of guideline dissemination and implementation strategies and interpretation of the results of rigorous evaluations. *Implementation Science*, *5*(1), 14.

de Groot, V., Beckerman, H., Lankhorst, G. J., & Bouter, L. M. (2003). How to measure comorbidity: A critical review of available methods. *Journal of Clinical Epidemiology, 56*(3), 221-229. http://dx.doi.org/10.1016/S0895-4356(02)00585-1

Delargy, K., & Leteney, F. (2005). Managing competencies during times of change. *Knowledge Management Review*, *8*(1), 12-15.

Deyo, R. A., Cherkin, D. C., & Ciol, M. A. (1992). Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of Clinical Epidemiology, 45*(6), 613-619.

Dobbins, M., Ciliska, D., Cockerill, R., Barnsley, J., & DiCenso, A. (2002). A framework for the dissemination and utilization of research for health-care policy and practice. *Worldviews on Evidence-Based Nursing*, *9*(1), 149-160.

Dobbins, M., Hanna, S. E., Ciliska, D., Manske, S., Cameron, R., Mercer, S. L., ... & Robeson, P. (2009). A randomized controlled trial evaluating the impact of knowledge translation and exchange strategies. *Implementation Science*, *4*(1), 61.

Donabedian, A. (1988). The quality of care: How can it be assessed?. *JAMA, 260*(12), 1743-1748.

Dopson, S. (2007). A view from organizational studies. *Nursing Research, 56*(4), S72-S77.

Dopson, S., & Fitzgerald, L. (2005). *Knowledge to action? Evidence-based health care in context*: Oxford University Press.

Dopson, S. & Fitzgerald, L. (2006). The role of the middle manager in the implementation of evidence-based health care. *Journal of Nursing Management*, *14*(1), 43-51.

Doran, D., Haynes, B. R., Estabrooks, C. A., Kushniruk, A., Dubrowski, A., Bajnok, I., ... & Bai, Y. Q. C. (2012). The role of organizational context and individual nurse characteristics in explaining variation in use of information technologies in evidence based practice. *Implementation Science*, *7*(1), 122.

Doran, D. M., Haynes, R. B., Kushniruk, A., Straus, S., Grimshaw, J., Hall, L. M., ... & Nguyen, H. (2010). Supporting evidence-based practice for nurses through information technologies. *Worldviews on Evidence-Based Nursing*, *7*(1), 4-15.

Drolet, B. C., & Lorenzi, N. M. (2011). Translational research: Understanding the continuum from bench to bedside. *Translational Research, 157*(1), 1-5.

Dubois, C. A., D'Amour, D., Pomey, M. P., Girard, F., & Brault, I. (2013). Conceptualizing performance of nursing care as a prerequisite for better measurement: A systematic and interpretive review. *BMC Nursing*, *12*(1), 7.

Duffield, C., Diers, D., O'Brien-Pallas, L., Aisbett, C., Roche, M., King, M., & Aisbett, K. (2011). Nursing staffing, nursing workload, the work environment and patient outcomes. *Applied Nursing Research, 24*(4), 244-255.

Duffield, C. M., Roche, M. A., Blay, N., & Stasa, H. (2011). Nursing unit managers, staff retention and the work environment. *Journal of Clinical Nursing*, *20*(1-2), 23-33.

Dunton, N., Gajewski, B., Taunton, R. L., & Moore, J. (2004). Nurse staffing and patient falls on acute care hospital units. *Nursing Outlook, 52*(1), 53-59.

Dzewaltowski, D. A., Glasgow, R. E., Klesges, L. M., Estabrooks, P. A., & Brock, E. (2004). RE-AIM: Evidence-based standards and a web resource to improve translation of research into practice. *Annals of Behavioral Medicine*, *28*(2), 75.

Eccles, M., Armstrong, D., Baker, R., Cleary, K., Davies, H., Davies, S., . . . Leng, G. (2009). An implementation research agenda. *Implementation Science, 4*(18), 1-7.

Eccles, M., Grimshaw, J., Walker, A., Johnston, M., & Pitts, N. (2005). Changing the behavior of healthcare professionals: The use of theory in promoting the uptake of research findings. *Journal of Clinical Epidemiology, 58*(2), 107-112.

Eccles, M., & Mittman, B. S. (2006). Welcome to implementation science. *Implementation Science, 1*(1), 1-3.

Ehrhart, M. G., Aarons, G. A., & Farahnak, L. R. (2014). Assessing the organizational context for EBP implementation: The development and validity testing of the Implementation Climate Scale (ICS). *Implementation Science, 9*, 157.

Elixhauser, A., Steiner, C., Harris, D. R., & Coffey, R. M. (1998). Comorbidity measures for use with administrative data. *Medical Care, 36*(1), 8-27.

Ellis, J. A., McCleary, L., Blouin, R., Dube, K., Rowley, B., MacNeil, M., & Cooke, C. (2007). Implementing best practice pain management in a pediatric hospital. *Journal for Specialists in Pediatric Nursing*, *12*(4), 264-277.

Elwyn, G., Légaré, F., van der Weijden, T., Edwards, A., & May, C. (2008). Arduous implementation: Does the Normalisation Process Model explain why it's so difficult to embed decision support technologies for patients in routine clinical practice. *Implementation Science*, *3*(1), 57.

Enns, E., Rhemtulla, R., Ewa, V., Fruetel, K., & Holroyd- Leduc, J. M. (2014). A controlled quality improvement trial to reduce the use of physical restraints in older hospitalized adults. *Journal of the American Geriatrics Society*, *62*(3), 541-545.

Estabrooks, C. A. (2007). Prologue: A program of research in knowledge translation. *Nursing Research, 56*(4), S4-S6.

Estabrooks, C. A., Midodzi, W. K., Cummings, G. G., & Wallin, L. (2007). Predicting research use in nursing organizations: A multilevel analysis. *Nursing Research, 56*(4), S7-S23.

Estabrooks, C. A., Scott, S., Squires, J. E., Stevens, B., O'Brien-Pallas, L., Watt-Watson, J., . . . Lander, J. (2008). Patterns of research utilization on patient care units. *Implementation Science, 3*(31), 1-16.

Estabrooks, C. A., Squires, J. E., Cummings, G. G., Birdsell, J. M., & Norton, P. G. (2009). Development and assessment of the Alberta Context Tool. *BMC Health Services Research, 9*(1), 1.

Estabrooks, C. A., Thompson, D. S., Lovely, J. J. E., & Hofmeyer, A. (2006). A guide to knowledge translation theory. *Journal of Continuing Education in the Health Professions, 26*(1), 25-36.

Estabrooks, C. A., Wallin, L., & Milner, M. (2003). Measuring knowledge utilization in health care. *Internanional Journal of Policy Evaluation & Management, 1*(1), 3-36.

Estrada, N. (2009). Exploring perceptions of a learning organization by RNs and relationship to EBP beliefs and implementation in the acute care setting. *Worldviews on Evidence- Based Nursing*, *6*(4), 200-209.

Everett, L. Q., & Sitterding, M. C. (2011). Transformational leadership required to design and sustain evidence-based practice: A system exemplar. *Western Journal of Nursing Research, 33*(3), 398-426.

Everhart, D., Schumacher, J. R., Duncan, R. P., Hall, A. G., Neff, D. F., & Shorr, R. I. (2014). Determinants of hospital fall rate trajectory groups: A longitudinal assessment of nurse staffing and organizational characteristics. *Health Care Management Review, 39*(4), 352.

Feeny, D., Furlong, W., Torrance, G. W., Goldsmith, C. H., Zhu, Z., DePauw, S., . . . Boyle, M. (2002). Multiattribute and single-attribute utility functions for the health utilities index mark 3 system. *Medical Care, 40*(2), 113-128.

Feldman, P. H., Murtaugh, C. M., Pezzin, L. E., McDonald, M. V., & Peng, T. R. (2005). Just-in-time evidence-based e-mail “reminders” in home health care: Impact on patient outcomes. *Health Services Research, 40*(3), 865-886.

Field, B., Booth, A., Ilott, I., & Gerrish, K. (2014). Using the Knowledge to Action Framework in practice: A citation analysis and systematic review. *Implementation Science, 9*(1), 172-186.

Finn, N. K., Torres, E. M., Ehrhart, M. G., Roesch, S. C., & Aarons, G. A. (2016). Cross-validation of the Implementation Leadership Scale (ILS) in child welfare service organizations. *Child Maltreatment*, *21*(3), 250-255.

Flodgren, G., Parmelli, E., Doumit, G., Gattellari, M., O'Brien, M. A., Grimshaw, J., & Eccles, M. P. (2011). Local opinion leaders: Effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews, 8*(8).

Förberg, U., Unbeck, M., Wallin, L., Johansson, E., Petzold, M., Ygge, B.-M., & Ehrenberg, A. (2016). Effects of computer reminders on complications of peripheral venous catheters and nurses' adherence to a guideline in paediatric care—a cluster randomised study. *Implementation Science, 11*(1), 10.

Forsetlund, L., Bjorndal, A., Rashidian, A., Jamtvedt, G., O'Brien, M. A., Wolf, F., . . . Oxman, A. D. (2009). Continuing education meetings and workshops: Effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews, 2*(2).

Foy, R., Eccles, M., Jamtvedt, G., Young, J., Grimshaw, J., & Baker, R. (2005). What do we know about how to do audit and feedback? Pitfalls in applying evidence from a systematic review. *BMC Health Services Research, 5*(1), 1.

French, B., Thomas, L. H., Baker, P., Burton, C. R., Pennington, L., & Roddam, H. (2009). What can management theories offer evidence-based practice? A comparative analysis of measurement tools for organisational context. *Implementation Science, 4*(1), 28.

Gagne, J. J., Glynn, R. J., Avorn, J., Levin, R., & Schneeweiss, S. (2011). A combined comorbidity score predicted mortality in elderly patients better than existing scores. *Journal of Clinical Epidemiology, 64*(7), 749-759.

Gale, B. V. P., & Schaffer, M. A. (2009). Organizational readiness for evidence-based practice. *Journal of Nursing Administration*, *39*(2), 91-97.

Garg, A. X., Adhikari, N. K., McDonald, H., Rosas-Arellano, M. P., Devereaux, P., Beyene, J., . . . Haynes, R. B. (2005). Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: A systematic review. *JAMA, 293*(10), 1223-1238.

Gask, L., Bower, P., Lovell, K., Escott, D., Archer, J., Gilbody, S., ... & Richards, D. A. (2010). What work has to be done to implement collaborative care for depression? Process evaluation of a trial utilizing the Normalization Process Model. *Implementation Science*, *5*(1), 15.

Gifford, W., Davies, B., Edwards, N., Griffin, P., & Lybanon, V. (2007). Managerial leadership for nurses' use of research evidence: An integrative review of the literature. *Worldviews on Evidence-Based Nursing, 4*(3), 126-145.

Gifford, W., Lefebre, N., & Davies, B. (2014). An organizational intervention to influence evidence-informed decision making in home health nursing. *Journal of Nursing Administration, 44*(7/8), 395-402.

Glasgow, R. E., McKay, H. G., Piette, J. D., & Reynolds, K. D. (2001). The RE-AIM framework for evaluating interventions: What can it tell us about approaches to chronic illness management?. *Patient Education and Counseling*, *44*(2), 119-127.

Glasgow, R. E., Vinson, C., Chambers, D., Khoury, M. J., Kaplan, R. M., & Hunter, C. (2012). National Institutes of Health approaches to dissemination and implementation science: Current and future directions. *American Journal of Public Health, 102*(7), 1274-1281.

Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: The RE-AIM framework. *American Journal of Public Health*, *89*(9), 1322-1327.

Goldstein, H. (2011). *Multilevel statistical models* (Vol. 922): John Wiley & Sons.

Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *Journal of Continuing Education in the Health Professions, 26*(1), 13-24.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4), 581-629.

Greiner, A. C., & Knebel, E. (2003). *Institute of Medicine Committee on the Health Professions Education Summit. Health professions education: A bridge to quality*: Washington, DC: National Academy Press.

Grilli, R., Ramsay, C., & Minozzi, S. (2002). Mass media interventions: Effects on health services utilisation. *Cochrane Database of Systematic Reviews, 1*(1).

Grimshaw, J., Eccles, M., Thomas, R., MacLennan, G., Ramsay, C., Fraser, C., & Vale, L. (2006). Toward evidence-based quality improvement. *Journal of General Internal Medicine, 21*(S2), S14-S20.

Grimshaw, J., Eccles, M. P., Greener, J., Maclennan, G., Ibbotson, T., Kahan, J. P., & Sullivan, F. (2006). Is the involvement of opinion leaders in the implementation of research findings a feasible strategy. *Implementation Science, 1*(3), 1-12.

Grimshaw, J., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L., . . . O'Brien, M. A. (2001). Changing provider behavior: An overview of systematic reviews of interventions. *Medical Care*, II2-II45.

Grol, R. (2001). Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Medical Care, 39*(8), II-46-II-54.

Grol, R., & Grimshaw, J. (2003). From best evidence to best practice: Effective implementation of change in patients' care. *The Lancet, 362*(9391), 1225-1230.

Grosskopf, S., & Valdmanis, V. (1993). Evaluating hospital performance with case-mix-adjusted outputs. *Medical Care, 31*(6), 525-532.

Grudniewicz, A., Kealy, R., Rodseth, R. N., Hamid, J., Rudoler, D., & Straus, S. E. (2015). What is the effectiveness of printed educational materials on primary care physician knowledge, behaviour, and patient outcomes: A systematic review and meta-analyses. *Implementation Science, 10*(1), 164.

Gunningberg, L., Brudin, L., & Idvall, E. (2010). Nurse Managers’ prerequisite for nursing development: A survey on pressure ulcers and contextual factors in hospital organizations. *Journal of Nursing Management*, *18*(6), 757-766.

Halm, E. A., Lee, C., & Chassin, M. R. (2002). Is volume related to outcome in health care? A systematic review and methodologic critique of the literature. *Annals of Internal Medicine, 137*(6), 511-520.

Harvey, G., & Kitson, A. (2015a). *Implementing Evidence-Based Practice in Healthcare: A Facilitation Guide*: Routledge.

Harvey, G., & Kitson, A. (2015b). Translating evidence into healthcare policy and practice: Single versus multi-faceted implementation strategies–is there a simple answer to a complex question? *International Journal of Health Policy and Management, 4*(3), 123.

Harvey, G., Loftus-Hills, A., Rycroft-Malone, J., Titchen, A., Kitson, A., McCormack, B., & Seers, K. (2002). Getting evidence into practice: The role and function of facilitation. *Journal of Advanced Nursing, 37*(6), 577-588.

He, J., Dunton, N., & Staggs, V. (2012). Unit-level time trends in inpatient fall rates of US hospitals. *Medical Care, 50*(9), 801-807.

He, J., Staggs, V. S., Bergquist- Beringer, S., & Dunton, N. (2013). Unit-level time trends and seasonality in the rate of hospital-acquired pressure ulcers in US acute care hospitals. *Research in Nursing & Health, 36*(2), 171-180.

Helfrich, C. D., Damschroder, L. J., Hagedorn, H. J., Daggett, G. S., Sahay, A., Ritchie, M., . . . Stetler, C. B. (2010). A critical synthesis of literature on the promoting action on research implementation in health services (PARIHS) framework. *Implementation Science, 5*(1), 82.

Helfrich, C. D., Li, Y.-F., Sharp, N. D., & Sales, A. E. (2009). Organizational readiness to change assessment (ORCA): Development of an instrument based on the Promoting Action on Research in Health Services (PARIHS) framework. *Implementation Science, 4*(38), 38.

Hempel, S., Newberry, S., Wang, Z., Booth, M., Shanman, R., Johnsen, B., . . . Ganz, D. A. (2013). Hospital fall prevention: A systematic review of implementation, components, adherence, and effectiveness. *Journal of the American Geriatrics Society, 61*(4), 483-494.

Henly, S. J., McCarthy, D. O., Wyman, J. F., Heitkemper, M. M., Redeker, N. S., Titler, M. G., . . . Alt-White, A. C. (2015). Emerging areas of science: Recommendations for nursing science education from the Council for the Advancement of Nursing Science Idea Festival. *Nursing Outlook, 63*(4), 398-407.

Henly, S. J., McCarthy, D. O., Wyman, J. F., Stone, P. W., Redeker, N. S., McCarthy, A. M., . . . Moore, S. M. (2015). Integrating emerging areas of nursing science into PhD programs. *Nursing Outlook, 63*(4), 408-416.

Herr, K., Titler, M., Fine, P. G., Sanders, S., Cavanaugh, J. E., Swegle, J., . . . Forcucci, C. (2012). The effect of a translating research into practice (TRIP) cancer intervention on cancer pain management in older adults in hospice. *Pain Medicine, 13*(8), 1004-1017.

Heslop, L., & Lu, S. (2014). Nursing-sensitive indicators: A concept analysis. *Journal of Advanced Nursing*, *70*(11), 2469-2482.

Howell, E., Bessman, E., Marshall, R., & Wright, S. (2010). Hospitalist bed management effecting throughput from the emergency department to the intensive care unit. *Journal of Critical Care, 25*(2), 184-189.

Huang, W. C., Wann, S. R., Lin, S. L., Kunin, C. M., Kung, M. H., Lin, C. H., ... & Lai, K. H. (2004). Catheter-associated urinary tract infections in intensive care units can be reduced by prompting physicians to remove unnecessary catheters. *Infection Control & Hospital Epidemiology*, *25*(11), 974-978.

Hutchinson, A. M., & Johnston, L. (2006). Beyond the BARRIERS Scale: Commonly reported barriers to research use. *Journal of Nursing Administration, 36*(4), 189-199.

Hysong, S. J., Best, R. G., & Pugh, J. A. (2006). Audit and feedback and clinical practice guideline adherence: Making feedback actionable. *Implementation Science, 1*(9), 5-3.

Iezzoni, L. I. (2013). *Risk adjustment for measuring health care outcomes*. Chicago, Ill.; Arlington, VA: Health Administration Press; AUPHA.

IHI. (2017). Protecting 5 Million Lives from Harm: Overview. Retrieved from: http://www.ihi.org/offerings/Initiatives/PastStrategicInitiatives/5MillionLivesCampaign/Pages/default.aspx.

IOM. (2001). *Crossing the quality chasm: a new health system for the 21st century*. Washington, DC: The National Acadamies Press.

IOM. (2009). *Initial national priorities for comparative effectiveness research.* Washington, DC: The National Acadamies Press.

IOM. (2013). *The CTSA program at NIH: Opportunities for advancing clinical and translational research*. Washington, DC: The National Academies Press.

ITHS. (2016). T-Phases of Translational Health Research. Retrieved from https://www.iths.org/investigators/definitions/translational-research/

Ivers, N. M., Grimshaw, J. M., Jamtvedt, G., Flottorp, S., O'Brien, M. A., French, S. D., . . . Odgaard-Jensen, J. (2014). Growing literature, stagnant science? Systematic review, meta-regression and cumulative analysis of audit and feedback interventions in health care. *Journal of General Internal Medicine, 29*, 1534-1541.

Ivers, N. M., Jamtvedt, G., Flottorp, S., Young, J. M., Odgaard-Jensen, J., French, S. D., . . . Oxman, A. D. (2012). Audit and feedback: Effects on professional practice and healthcare outcomes. *Cochrane Database of Systematic Reviews, 6*(6).

Ivers, N. M., Sales, A., Colquhoun, H., Michie, S., Foy, R., Francis, J. J., & Grimshaw, J. M. (2014). No more 'business as usual'with audit and feedback interventions: Towards an agenda for a reinvigorated intervention. *Implementation Science, 9*(1), 1-8.

Jack, S., Dobbins, M., Tonmyr, L., Dudding, P., Brooks, S., & Kennedy, B. (2010). Research evidence utilization in policy development by child welfare administrators. *Child Welfare*, *89*(4), 83.

Jacob, E. R., McKenna, L., & D'amore, A. (2015). The changing skill mix in nursing: Considerations for and against different levels of nurse. *Journal of Nursing Management*, *23*(4), 421-426.

Jacobs, S. R., Weiner, B. J., & Bunger, A. C. (2014). Context matters: Measuring implementation climate among individuals and groups. *Implementation Science, 9*, 46.

James, L. R., Demaree, R. G., & Wolf, G. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology*, *69*(1), 85.

James, L. R., Demaree, R. G., & Wolf, G. (1993). r wg: An assessment of within-group interrater agreement. *Journal of Applied Psychology*, *78*(2), 306.

Jeffs, L., Beswick, S., Lo, J., Campbell, H., Ferris, E., & Sidani, S. (2013). Defining what evidence is, linking it to patient outcomes, and making it relevant to practice: Insight from clinical nurses. *Applied Nursing Research, 26*(3), 105-109.

Jeffs, L., Sidani, S., Rose, D., Espin, S., Smith, O., Martin, K., . . . Ferris, E. (2013). Using theory and evidence to drive measurement of patient, nurse and organizational outcomes of professional nursing practice. *International Journal of Nursing Practice, 19*(2), 141-148.

Johansson, B., Fogelberg-Dahm, M., & Wadensten, B. (2010). Evidence-based practice: The importance of education and leadership. *Journal of Nursing Management*, *18*(1), 70-77.

Kahn, R. L., Goldfarb, A. I., Pollack, M., & Peck, A. (1960). Brief objective measures for the determination of mental status in the aged. *American journal of Psychiatry, 117*(4), 326-328.

Kajermo, K. N., Boström, A.-M., Thompson, D. S., Hutchinson, A. M., Estabrooks, C. A., & Wallin, L. (2010). Systematic Review The BARRIERS scale--the barriers to research utilization scale: A systematic review. *Implementation Science, 5*, 32.

Kane, R., & Radosevich, D. M. (2010). *Conducting Health Outcomes Research.* Jones & Bartlett Learning.

Katz, D. A., Vander Weg, M. W., Holman, J., Nugent, A., Baker, L., Johnson, S., ... & Titler, M. (2012). The Emergency Department Action in Smoking Cessation (EDASC) trial: Impact on delivery of smoking cessation counseling. *Academic Emergency Medicine*, *19*(4), 409-420.

Katz, S., Ford, A. B., Moskowitz, R. W., Jackson, B. A., & Jaffe, M. W. (1963). Studies of illness in the aged: the index of ADL: A standardized measure of biological and psychosocial function. *JAMA, 185*(12), 914-919.

Kawamoto, K., Houlihan, C. A., Balas, E. A., & Lobach, D. F. (2005). Improving clinical practice using clinical decision support systems: A systematic review of trials to identify features critical to success. *BMJ, 330*(7494), 765.

Kelley, K. (2007a). Methods for the Behavioral, Educational, and Social Sciences (MBESS)[Computer software and manual]. Retrievable from www. cran. r-project. org.

Kelley, K. (2007b). Methods for the behavioral, educational, and social sciences: An R package. *Behavior Research Methods*, *39*(4), 979-984.

Kelley, K., & Maxwell, S. E. (2008). Sample size planning with applications to multiple regression: Power and accuracy for omnibus and targeted effects. *The Sage Handbook of Social Research Methods*, 166-192.

Kelly, L. A., McHugh, M. D., & Aiken, L. H. (2011). Nurse outcomes in Magnet® and non-Magnet hospitals. *The Journal of Nursing Administration, 41*(10), 428.

Kendall-Gallagher, D., Aiken, L. H., Sloane, D. M., & Cimiotti, J. P. (2011). Nurse specialty certification, inpatient mortality, and failure to rescue. *Journal of Nursing Scholarship, 43*(2), 188-194.

Kennedy, E. H., Greene, M. T., & Saint, S. (2013). Estimating hospital costs of catheter-associated urinary tract infection. *Journal of Hospital Medicine, 8*(9), 519-522.

Kerr, P., Shever, L., Titler, M. G., Qin, R., Kim, T., & Picone, D. M. (2010). The unique contribution of the nursing intervention pain management on length of stay in older patients undergoing hip procedures. *Applied Nursing Research, 23*(1), 36-44.

Khoury, M. J., Gwinn, M., Yoon, P. W., Dowling, N., Moore, C. A., & Bradley, L. (2007). The continuum of translation research in genomic medicine: How can we accelerate the appropriate integration of human genome discoveries into health care and disease prevention? *Genetics in Medicine, 9*(10), 665-674.

Kilpatrick, K., Reid, K., Carter, N., Donald, F., Bryant-Lukosius, D., Martin-Misener, R., ... & DiCenso, A. (2015). A systematic review of the cost effectiveness of clinical nurse specialists and nurse practitioners in inpatient roles. *Canadian Journal of Nursing Leadership*, *28*(3), 56-76.

King, D. K., Glasgow, R. E., & Leeman-Castillo, B. (2010). Reaiming RE-AIM: Using the model to plan, implement, and evaluate the effects of environmental change approaches to enhancing population health. *American Journal of Public Health*, *100*(11), 2076-2084.

Kiss, T. L., O'Malley, M., & Hendrix, T. J. (2010). Self-efficacy-based training for research literature appraisal: a competency for evidence-based practice. *Journal for Nurses in Professional Development, 26*(4), 170-177.

Kitson, A., Harvey, G., & McCormack, B. (1998). Enabling the implementation of evidence based practice: a conceptual framework. *Quality in Health Care, 7*(3), 149-158.

Kitson, A., Rycroft-Malone, J., Harvey, G., McCormack, B., Seers, K., & Titchen, A. (2008). Evaluating the successful implementation of evidence into practice using the PARiHS framework: Theoretical and practical challenges. *Implementation Science, 3*(1), 1.

Kitson, A., Silverston, H., Wiechula, R., Zeitz, K., Marcoionni, D., & Page, T. (2011). Clinical nursing leaders', team members' and service managers' experiences of implementing evidence at a local level. *Journal of Nursing Management*, *19*(4), 542-555.

Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review, 21*(4), 1055-1080.

Koh, S. L., Hafizah, N., Lee, J. Y., Loo, Y. L., & Muthu, R. (2009). Impact of a fall prevention programme in acute hospital settings in Singapore. *Singapore Medical Journal*, *50*(4), 425-432.

Krein, S. L., Damschroder, L. J., Kowalski, C. P., Forman, J., Hofer, T. P., & Saint, S. (2010). The influence of organizational context on quality improvement and patient safety efforts in infection prevention: A multi-center qualitative study. *Social Science & Medicine*, *71*(9), 1692-1701.

Kueny, A., Shever, L. L., Mackin, M. L., & Titler, M. G. (2015). Facilitating the implementation of evidence-based practice through contextual support and nursing leadership. *Journal of Healthcare Leadership*, *7*, 29-39.

Kuster, S. P., Ruef, C., Bollinger, A. K., Ledergerber, B., Hintermann, A., Deplazes, C., . . . Weber, R. (2008). Correlation between case mix index and antibiotic use in hospitals. *Journal of Antimicrobial Chemotherapy, 62*(4), 837-842.

Kuznetsova, A., Brockhoff, P.B., and Christensen, R.H.B. (2016). lmerTest: Tests in linear mixed effects models. R package version 2.0-33. https://CRAN.R-project.org/package=lmerTest

Lamb, G. S. (1997). Outcomes across the care continuum. *Medical Care, 35*(11), NS106-NS114.

Lang, T. A., Hodge, M., Olson, V., Romano, P. S., & Kravitz, R. L. (2004). Nurse–patient ratios: A systematic review on the effects of nurse staffing on patient, nurse employee, and hospital outcomes. *Journal of Nursing Administration, 34*(7-8), 326-337.

Lauer, M. S., & Collins, F. S. (2010). Using science to improve the nation's health system: NIH's commitment to comparative effectiveness research. *JAMA, 303*(21), 2182-2183.

Lee, D. S., Austin, P. C., Rouleau, J. L., Liu, P. P., Naimark, D., & Tu, J. V. (2003). Predicting mortality among patients hospitalized for heart failure: Derivation and validation of a clinical model. *JAMA, 290*(19), 2581-2587.

Lefcheck, J. S. (2015). piecewiseSEM: Piecewise structural equation modelling in r for ecology, evolution, and systematics. *Methods in Ecology and Evolution*, *7*(5), 573-579.

Leslie, J.B. (2016). The leadership gap: What you need, and still don't have when it comes to leadership talent. Retrieved 2/25/16 from: https://www.ccl.org/wp-content/uploads/2015/09/Leadership-Gap-What-You-Need.pdf

Lewis, C. C., Fischer, S., Weiner, B. J., Stanick, C., Kim, M., & Martinez, R. G. (2015). Outcomes for implementation science: An enhanced systematic review of instruments using evidence-based rating criteria. *Implementation Science, 10*(1), 155.

Li, B., Evans, D., Faris, P., Dean, S., & Quan, H. (2008). Risk adjustment performance of Charlson and Elixhauser comorbidities in ICD-9 and ICD-10 administrative databases. *BMC Health Services Research, 8*(1), 1.

Lieffers, J. R., Baracos, V. E., Winget, M., & Fassbender, K. (2011). A comparison of Charlson and Elixhauser comorbidity measures to predict colorectal cancer survival using administrative health data. *Cancer, 117*(9), 1957-1965.

Linton, M. J., & Prasun, M. A. (2013). Evidence- based practice: Collaboration between education and nursing management. *Journal of Nursing Management*, *21*(1), 5-16.

Lo, E., Nicolle, L. E., Coffin, S. E., Gould, C., Maragakis, L. L., Meddings, J., ... & Yokoe, D. S. (2014). Strategies to prevent catheter-associated urinary tract infections in acute care hospitals: 2014 update. *Infection Control & Hospital Epidemiology*, *35*(S2), S32-S47.

Lokker, C., McKibbon, K. A., Colquhoun, H., & Hempel, S. (2015). A scoping review of classification schemes of interventions to promote and integrate evidence into practice in healthcare. Implementation Science, 10(1), 27.

Lugtenberg, M., Burgers, J., & Westert, G. (2009). Effects of evidence-based clinical practice guidelines on quality of care: A systematic review. *Quality and Safety in Health Care, 18*(5), 385-392.

Maas, M. L., Johnson, M., & Moorhead, S. (1996). Classifying Nursing-Sensitive Patient Outcomes. *Image: The Journal of Nursing Scholarship, 28*(4), 295-302.

Magill, S. S., Hellinger, W., Cohen, J., Kay, R., Bailey, C., Boland, B., ... & Goraczewski, L. (2012). Prevalence of healthcare-associated infections in acute care hospitals in Jacksonville, Florida. *Infection Control & Hospital Epidemiology*, *33*(03), 283-291.

Martsolf, G. R., Auerbach, D., Benevent, R., Stocks, C., Jiang, H. J., Pearson, M. L., ... & Gibson, T. B. (2014). Examining the value of inpatient nurse staffing: An assessment of quality and patient care costs. *Medical Care*, *52*(11), 982-988.

May, C. (2006). A rational model for assessing and evaluating complex interventions in health care. *BMC Health Services Research*, *6*(1), 86.

May, C. (2013). Towards a general theory of implementation. *Implementation Science, 8*(1), 18.

May, C., & Finch, T. (2009). Implementing, embedding, and integrating practices: An outline of normalization process theory. *Sociology, 43*(3), 535-554.

Maxwell, S. E. (2000). Sample size and multiple regression analysis. *Psychological Methods*, *5*(4), 434.

McCarthy, G., & Fitzpatrick, J. J. (2009). Development of a competency framework for nurse managers in Ireland. *The Journal of Continuing Education in Nursing*, *40*(8), 346-350.

McCluskey, A., & Lovarini, M. (2005). Providing education on evidence-based practice improved knowledge but did not change behaviour: A before and after study. *BMC Medical Education, 5*(1), 1.

McCormack, B., Kitson, A., Harvey, G., Rycroft- Malone, J., Titchen, A., & Seers, K. (2002). Getting evidence into practice: The meaning of context. *Journal of Advanced Nursing, 38*(1), 94-104.

McCormack, B., McCarthy, G., Wright, J., & Coffey, A. (2009). Development and testing of the Context Assessment Index (CAI). *Worldviews on Evidence-Based Nursing, 6*(1), 27-35.

McCormack, B., Rycroft-Malone, J., DeCorby, K., Hutchinson, A. M., Bucknall, T., Kent, B., . . . Titler, M. (2013). A realist review of interventions and strategies to promote evidence-informed healthcare: A focus on change agency. *Implementation Science, 8*(1), 107.

McHugh, M., Van Dyke, K. J., Yonek, J., & Moss, D. (2012). Time and expenses associated with the implementation of strategies to reduce emergency department crowding. *Journal of Emergency Nursing, 38*(5), 420-428.

McKibbon, K. A., Lokker, C., Wilczynski, N. L., Ciliska, D., Dobbins, M., Davis, D. A., . . . Straus, S. E. (2010). A cross-sectional study of the number and frequency of terms used to refer to knowledge translation in a body of health literature in 2006: A Tower of Babel. *Implementation Science, 5*(1), 16.

McLeod, R. S., Aarts, M. A., Chung, F., Eskicioglu, C., Forbes, S. S., Conn, L. G., ... & Okrainec, A. (2015). Development of an enhanced recovery after surgery guideline and implementation strategy based on the knowledge-to-action cycle. *Annals of Surgery*, *262*(6), 1016-1025.

Melnyk, B. M. (2014). Speeding the translation of research into evidence-based Practice and conducting projects that impact healthcare quality, patient outcomes and costs: The “so what” outcome factors. *Worldviews on Evidence-Based Nursing, 11*(1), 1-4.

Melnyk, B. M., Fineout-Overholt, E., Gallagher-Ford, L., & Kaplan, L. (2012). The state of evidence-based practice in US nurses: Critical implications for nurse leaders and educators. *Journal of Nursing Administration*, *42*(9), 410-417.

Melnyk, B. M., Fineout-Overholt, E., & Mays, M. Z. (2008). The evidence-based practice beliefs and implementation scales: Psychometric properties of two new instruments. *Worldviews on Evidence-Based Nursing, 5*(4), 208-216.

Melnyk, B. M., Gallagher-Ford, L., Long, L. E., & Fineout-Overholt, E. (2014). The establishment of evidence-based practice competencies for practicing registered nurses and advanced practice nurses in real-world clinical settings: Proficiencies to improve healthcare quality, reliability, patient outcomes, and costs. *Worldviews on Evidence-Based Nursing*, *11*(1), 5-15.

Mendez, C. M., Harrington, D. W., Christenson, P., & Spellberg, B. (2014). Impact of hospital variables on case mix index as a marker of disease severity. *Population Health Management, 17*(1), 28-34.

Menendez, M. E., Neuhaus, V., van Dijk, C. N., & Ring, D. (2014). The Elixhauser comorbidity method outperforms the Charlson index in predicting inpatient death after orthopaedic surgery. *Clinical Orthopaedics and Related Research®, 472*(9), 2878-2886.

Michie, S., Abraham, C., Eccles, M. P., Francis, J. J., Hardeman, W., & Johnston, M. (2011). Strengthening evaluation and implementation by specifying components of behaviour change interventions: A study protocol. *Implementation Science, 6*(10), 10.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology*, *57*(4), 660-680.

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., . . . Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine, 46*(1), 81-95.

Mitchell, P. H., & Lang, N. M. (2004). Framing the problem of measuring and improving healthcare quality: Has the Quality Health Outcomes Model been useful?. *Medical Care*, *42*(2), II-4.

Mitchell, P., & Shortell, S. M. (1997). Adverse outcomes and variations in organization of care delivery. *Medical Care, 35*(11), NS19-NS32.

Mitchell, S., Fisher, C. A., Hastings, C. E., Silverman, L. B., & Wallen, G. R. (2010). A thematic analysis of theoretical models for translational science in nursing: Mapping the field. *Nursing Outlook, 58*(6), 287-300.

Mittman, B. S., Weiner, B. J., Proctor, E. K., & Handley, M. A. (2015). Expanding D&I science capacity and activity within NIH Clinical and Translational Science Award (CTSA) Programs: guidance and successful models from national leaders. *Implementation Science, 10*(Suppl 1), A38.

Montalvo, I. (2007). The National Database of Nursing Quality IndicatorsTM (NDNQI®). *OJIN: The Online Journal of Issues in Nursing, 12*(3).

Moorhead, S. (2013). *Nursing Outcomes Classification (NOC), Measurement of Health Outcomes, 5: Nursing Outcomes Classification (NOC)*: Elsevier Health Sciences.

Moser, L. L., DeLuca, N. L., Bond, G. R., & Rollins, A. L. (2004). Implementing evidence-based psychosocial practices: Lessons learned from statewide implementation of two practices. *CNS Spectrums, 9*(12), 926-936,942.

Moullin, J. C., Sabater-Hernández, D., Fernandez-Llimos, F., & Benrimoj, S. I. (2015). A systematic review of implementation frameworks of innovations in healthcare and resulting generic implementation framework. *Health Research Policy and Systems, 13*(1), 5.

Nagy, S., Lumby, J., McKinley, S., & Macfarlane, C. (2001). Nurses' beliefs about the conditions that hinder or support evidence-based nursing. *International Journal of Nursing Practice*, *7*(5), 314-321.

Nakagawa, S., & Schielzeth, H. (2013). A general and simple method for obtaining R2 from generalized linear mixed-effects models. *Methods in Ecology and Evolution, 4*(2), 133-142.

NDNQI. (2016). Nursing Quality (NDNQI). Retrieved from http://www.pressganey.com/solutions/clinical-quality/nursing-quality

Needham, D. M., Scales, D. C., Laupacis, A., & Pronovost, P. J. (2005). A systematic review of the Charlson comorbidity index using Canadian administrative databases: A perspective on risk adjustment in critical care research. *Journal of Critical Care, 20*(1), 12-19.

Needleman, J., Buerhaus, P. I., Stewart, M., Zelevinsky, K., & Mattke, S. (2006). Nurse staffing in hospitals: Is there a business case for quality?. *Health Affairs*, *25*(1), 204-211.

Newhouse, R. (2007). Creating infrastructure supportive of evidence-based nursing practice: Leadership strategies. *Worldviews on Evidence-Based Nursing, 4*(1), 21-29.

Newhouse, R., Bobay, K., Dykes, P. C., Stevens, K. R., & Titler, M. (2013). Methodology issues in implementation science. *Medical Care, 51*, S32-S40.

NIH. (2013a). Dissemination and Implementation Research in Health (R01). Retrieved from http://grants.nih.gov/grants/guide/pa-files/PAR-13-055.html

NIH. (2013b). Glossary and acronym list. Retrieved from http://grants.nih.gov/grants/glossary.htm

Nilsen, P. (2015). Making sense of implementation theories, models and frameworks. *Implementation Science, 10*(1), 53.

NINR. (2016). NINR Strategic Plan 2016. Retrieved from https://www.ninr.nih.gov/newsandinformation/newsandnotes/stratplan2016#.VwE0K2PYnjI

NPUAP. (2016). "NPUAP Pressure Injury Stages." Retrieved from http://www.npuap.org/resources/educational-and-clinical-resources/npuap-pressure-injury-stages/

NQF. (2004). National voluntary consensus standards for nursing-sensitive care: An initial performance measure set—a consensus report.

NQF. (2011). Serious Reportable Events - 2011 Update. Retrieved from http://www.qualityforum.org/topics/sres/serious_reportable_events.aspx

NQF. (2016). NQF's Mission and Vision. Retrieved from http://www.qualityforum.org/Mission_and_Vision.aspx

O'Brien, M. A., Rogers, S., Jamtvedt, G., Oxman, A. D., Odgaard-Jensen, J., Kristoffersen, D. T., . . . Davis, D. (2007). Educational outreach visits: Effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews, 4*(4).

Oman, K. S., Makic, M. B. F., Fink, R., Schraeder, N., Hulett, T., Keech, T., & Wald, H. (2012). Nurse-directed interventions to reduce catheter-associated urinary tract infections. *American Journal of Infection Control*, *40*(6), 548-553.

Pancorbo-Hidalgo, P. L., Garcia-Fernandez, F. P., Lopez-Medina, I. M., & Alvarez-Nieto, C. (2006). Risk assessment scales for pressure ulcer prevention: A systematic review. *Journal of Advanced Nursing*, *54*(1), 94-110.

Parahoo, K., & McCaughan, E. (2001). Research utilization among medical and surgical nurses: a comparison of their self reports and perceptions of barriers and facilitators. *Journal of Nursing Management, 9*(1), 21-30.

Patrick, D. L., & Deyo, R. A. (1989). Generic and disease-specific measures in assessing health status and quality of life. *Medical Care*, S217-S232.

Patrician, P. A., & Brosch, L. R. (2009). Medication error reporting and the work environment in a military setting. *Journal of Nursing Care Quality*, *24*(4), 277-286.

Patterson, M. G., West, M. A., Shackleton, V. J., Dawson, J. F., Lawthom, R., Maitlis, S., . . . Wallace, A. M. (2005). Validating the organizational climate measure: Links to managerial practices, productivity and innovation. *Journal of Organizational Behavior, 26*(4), 379-408.

Pettengill, J., & Vertrees, J. (1982). Reliability and validity in hospital case-mix measurement. *Health Care Financing Review, 4*(2), 101-128.

Pfadenhauer, L. M., Gerhardus, A., Mozygemba, K., Lysdahl, K. B., Booth, A., Hofmann, B., ... & Rehfuess, E. (2017). Making sense of complexity in context and implementation: The Context and Implementation of Complex Interventions (CICI) framework. *Implementation Science*, *12*(1), 21.

Piccirillo, J. F. (2000). Importance of comorbidity in head and neck cancer. *The Laryngoscope, 110*(4), 593-602.

Ploeg, J., Davies, B., Edwards, N., Gifford, W., & Miller, P. E. (2007). Factors influencing best-practice guideline implementation: Lessons learned from administrators, nursing staff, and project leaders. *Worldviews on Evidence-Based Nursing, 4*(4), 210-219.

Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins.

Poon, S. J., Zuckerman, S. L., Mainthia, R., Hagan, S. L., Lockney, D. T., Zotov, A., . . . France, D. J. (2013). Methodology and bias in assessing compliance with a surgical safety checklist. *The Joint Commission Journal on Quality and Patient Safety, 39*(2), 77-77.

Potempa, K., Daly, J., & Titler, M. G. (2012). Building the clinical bridge to support nursing effectiveness science. *Nursing Research and Practice, 2012*, 194147. doi:10.1155/2012/194147

Proctor, E. (2014). Dissemination and implementation research. In *Encyclopedia of social work*. Retrieved from: http://socialwork.oxfordre.com/view/10.1093/acrefore/9780199975839.001.0001/acrefore-9780199975839-e-900

Proctor, E., & Brownson, R. C. (2012). Measurement issues in dissemination and implementation research. In R. C. Brownson, G. A. Colditz, & E. Proctor (Eds.), *Dissemination and implementation research in health: Translating science to practice.* (pp. 261-280). New York: Oxford University Press.

Proctor, E., Silmere, H., Raghavan, R., Hovmand, P., Aarons, G., Bunger, A., . . . Hensley, M. (2011). Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda. *Administration and Policy in Mental Health and Mental Health Services Research, 38*(2), 65-76.

Pryse, Y., McDaniel, A., & Schafer, J. (2014). Psychometric analysis of two new scales: The Evidence-Based Practice Nursing Leadership and Work Environment Scales. *Worldviews on Evidence-Based Nursing*, *11*(4), 240-247.

Qualtrics Software (2015). Version 60816 of the Qualtrics Research Suite. Copyright © 2015 Qualtrics. http://www.qualtrics.com

Quan, H., Li, B., Couris, C. M., Fushimi, K., Graham, P., Hider, P., . . . Sundararajan, V. (2011). Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. *American Journal of Epidemiology, 173*(6), 676-682.

Quan, H., Sundararajan, V., Halfon, P., Fong, A., Burnand, B., Luthi, J.-C., . . . Ghali, W. A. (2005). Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Medical Care*, 1130-1139.

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Rabin, B. A., Purcell, P., Naveed, S., Moser, R. P., Henton, M. D., Proctor, E. K., . . . Glasgow, R. E. (2012). Advancing the application, quality and harmonization of implementation science measures. *Implementation Science, 7*(1), 119.

Reilly, B. M., & Evans, A. T. (2006). Translating clinical research into clinical practice: impact of using prediction rules to make decisions. *Annals of Internal Medicine, 144*(3), 201-209.

Reimers, M., & Miller, C. (2014). Clinical nurse specialist as change agent: Delirium prevention and assessment project. *Clinical Nurse Specialist*, *28*(4), 224-230.

Rich, R. F. (1997). Measuring knowledge utilization: Processes and outcomes. *Knowledge and Policy, 10*(3), 11-24.

Rogers, E. M. (2010). *Diffusion of innovations*: Simon and Schuster.

Rycroft-Malone, J. (2004). The PARIHS Framework—A framework for guiding the implementation of evidence-based practice. *Journal of Nursing Care Quality, 19*(4), 297-304.

Rycroft-Malone, J., Kitson, A., Harvey, G., McCormack, B., Seers, K., Titchen, A., & Estabrooks, C. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality and Safety in Health Care, 11*(2), 174-180.

Rycroft-Malone, J., Seers, K., Chandler, J., Hawkes, C. A., Crichton, N., Allen, C., . . . Strunin, L. (2013). The role of evidence, context, and facilitation in an implementation trial: Implications for the development of the PARIHS framework. *Implementation Science, 8*(1), 28.

Rycroft-Malone, J., & Bucknall, T. (2010). Using theory and frameworks to facilitate the implementation of evidence into practice. *Worldviews on Evidence-Based Nursing, 7*(2), 57-58.

Saint, S., Kaufman, S. R., Thompson, M., Rogers, M. A., & Chenoweth, C. E. (2005). A reminder reduces urinary catheterization in hospitalized patients. *The Joint Commission Journal on Quality and Patient Safety*, *31*(8), 455-462.

Saint, S., Kowalski, C. P., Kaufman, S. R., Hofer, T. P., Kauffman, C. A., Olmsted, R. N., ... & Krein, S. L. (2008). Preventing hospital-acquired urinary tract infection in the United States: A national study. *Clinical Infectious Diseases*, *46*(2), 243-250.

Sandström, B., Borglin, G., Nilsson, R., & Willman, A. (2011). Promoting the implementation of evidence-based practice: A literature review focusing on the role of nursing leadership. *Worldviews on Evidence-Based Nursing, 8*(4), 212-223.

Saunders, H., & Vehviläinen-Julkunen, K. (2016). The state of readiness for evidence-based practice among nurses: An integrative review. *International Journal of Nursing Studies*, *56*, 128-140.

Savitz, L. A., Jones, C. B., & Bernard, S. (2005). Quality indicators sensitive to nurse staffing in acute care settings. Retrieved from: https://www.ncbi.nlm.nih.gov/books/NBK20600/?report=printable

Schaik, K., Vinichenko, D., & Rühli, F. (2014). Health is not always written in bone: Using a modern comorbidity index to assess disease load in paleopathology. *American Journal of Physical Anthropology, 154*(2), 215-221.

Schein, E. H. (2010). *Organizational culture and leadership* (Vol. 2). John Wiley & Sons.

Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organizational climate and culture. *Annual Review of Psychology, 64*, 361-388.

Schultz, T. J., & Kitson, A. L. (2010). Measuring the context of care in an Australian acute care hospital: A nurse survey. *Implementation Science*, *5*(1), 60.

Scott, R. (2009). *The direct medical costs of healthcare-associated infections in US hospitals and the benefits of prevention*: Division of Healthcare Quality Promotion National Center for Preparedness, Detection, and Control of Infectious Diseases, Centers for Disease Control and Prevention.

Scott, S., VandenBeld, B., & Cummings, G. G. (2011). Optimizing clinical environments for knowledge translation: Strategies for nursing leaders. *Nursing Leadership (Toronto, Ont.), 24*(3), 73-85.

Shaw, E. K., Howard, J., West, D. R., Crabtree, B. F., Nease, D. E., Tutt, B., & Nutting, P. A. (2012). The role of the champion in primary care change efforts: From the State Networks of Colorado Ambulatory Practices and Partners (SNOCAP). *The Journal of the American Board of Family Medicine, 25*(5), 676-685.

Shever, L., & Titler, M. G. (2012). Multidisciplinary treatments, patient characteristics, context of care, and adverse incidents in older, hospitalized adults. *Nursing Research and Practice, 2012*, 1-14. doi:10.1155/2012/350830

Shever, L. L., Titler, M. G., Mackin, M. L., & Kueny, A. (2011). Fall prevention practices in adult medical-surgical nursing units described by nurse managers. *Western Journal of Nursing Research*, *33*(3), 385-397.

Shirey, M. R. (2013). Lewin's theory of planned change as a strategic resource. *Journal of Nursing Administration*, *43*(2), 69-72.

Shirey, M. R., McDaniel, A. M., Ebright, P. R., Fisher, M. L., & Doebbeling, B. N. (2010). Understanding nurse manager stress and work complexity: Factors that make a difference. *Journal of Nursing Administration*, *40*(2), 82-91.

Shuman, C.J., Ploutz-Snyder, R.J., and Titler, M.G. (in press). Development and testing of the Nurse Manager EBP Competency Scale. *Western Journal of Nursing Research.*

Slattery, C., Freund, M., Gillham, K., Knight, J., Wolfenden, L., Bisquera, A., & Wiggers, J. (2016). Increasing smoking cessation care across a network of hospitals: An implementation study. *Implementation Science*, *11*(1), 28.

Snijders, T.A.B., & Bosker, R.J. (2011). *Multilevel analysis*. Thousand Oaks, CA: Sage Publications Inc.

Soumerai, S. B., McLaughlin, T. J., Gurwitz, J. H., Guadagnoli, E., Hauptman, P. J., Borbas, C., . . . Willison, D. J. (1998). Effect of local medical opinion leaders on quality of care for acute myocardial infarction: A randomized controlled trial. *JAMA, 279*(17), 1358-1363.

Sox, H. C., & Greenfield, S. (2009). Comparative effectiveness research: A report from the Institute of Medicine. *Annals of Internal Medicine, 151*(3), 203-205.

Spence Lashinger, H. K., & Finegan, J. (2008). Situational and dispositional predictors of nurse manager burnout: A time-lagged analysis. *Journal of Nursing Management*, *16*(5), 601-607.

Squires, J. E., Graham, I. D., Hutchinson, A. M., Michie, S., Francis, J. J., Sales, A., . . . Lavis, J. (2015). Identifying the domains of context important to implementation science: A study protocol. *Implementation Science, 10*(1), 1-9.

Squires, J. E., Hayduk, L., Hutchinson, A. M., Mallick, R., Norton, P. G., Cummings, G. G., & Estabrooks, C. A. (2015). Reliability and validity of the Alberta Context Tool (ACT) with professional nurses: Findings from a multi-study analysis. *PloS One, 10*(6), e0127405.

Steinberg, E., Greenfield, S., Mancher, M., Wolman, D. M., & Graham, R. (2011). *Clinical practice guidelines we can trust*: National Academies Press.

Stetler, C. B. (2002). Role of the organization in translating research into evidence-based practice. *Outcomes Management, 7*(3), 97-103.

Stetler, C. B., Ritchie, J. A., Rycroft-Malone, J., Schultz, A. A., & Charns, M. P. (2009). Institutionalizing evidence-based practice: An organizational case study using a model of strategic change. *Implementation Science, 4*(78), 1-19.

Stetler, C. B., Ritchie, J. A., Rycroft-Malone, J., & Charns, M. P. (2014). Leadership for evidence-based practice: Strategic and functional behaviors for institutionalizing EBP. *Worldviews on Evidence-Based Nursing, 11*(4), 219-226.

Stevens, K. R. (2009). *Essential competencies for evidence-based practice in nursing*. Academic Center for Evidence-Based Practice, University of Texas Health Science Center at San Antonio.

Stevens, J. A., Corso, P. S., Finkelstein, E. A., & Miller, T. R. (2006). The costs of fatal and non-fatal falls among older adults. *Injury Prevention, 12*(5), 290-295.

Stevens, B. J., Yamada, J., Estabrooks, C. A., Stinson, J., Campbell, F., Scott, S. D., & Cummings, G. (2014). Pain in hospitalized children: Effect of a multidimensional knowledge translation strategy on pain process and clinical outcomes. *PAIN*®, *155*(1), 60-68.

Suidan, R. S., Leitao, M. M., Zivanovic, O., Gardner, G. J., Roche, K. C. L., Sonoda, Y., . . . Abu-Rustum, N. R. (2015). Predictive value of the Age-Adjusted Charlson Comorbidity Index on perioperative complications and survival in patients undergoing primary debulking surgery for advanced epithelial ovarian cancer. *Gynecologic Oncology, 138*(2), 246-251.

Sullivan, N., & Schoelles, K. M. (2013). Preventing in-facility pressure ulcers as a patient safety strategy: A systematic review. *Annals of Internal Medicine*, *158*(5_Part_2), 410-416.

Sving, E., Gunningberg, L., Högman, M., & Mamhidir, A. G. (2012). Registered nurses' attention to and perceptions of pressure ulcer prevention in hospital settings. *Journal of Clinical Nursing, 21*(9-10), 1293-1303.

Tabak, R. G., Khoong, E. C., Chambers, D. A., & Brownson, R. C. (2012). Bridging research and practice: Models for dissemination and implementation research. *American Journal of Preventive Medicine, 43*(3), 337-350.

Templ, M., Alfons, A., Kowarik, A., & Prantner, B. (2011). VIM: Visualization and imputation of missing values. *R Package Version*, *2*(3).

Thiel, L., & Ghosh, Y. (2008). Determining registered nurses' readiness for evidence‐based practice. *Worldviews on Evidence‐Based Nursing*, *5*(4), 182-192.

Thygesen, S. K., Christiansen, C. F., Christensen, S., Lash, T. L., & Sørensen, H. T. (2011). The predictive value of ICD-10 diagnostic coding used to assess Charlson comorbidity index conditions in the population-based Danish National Registry of Patients. *BMC Medical Research Methodology, 11*(1), 83.

Tinkle, M., Kimball, R., Haozous, E. A., Shuster, G., & Meize-Grochowski, R. (2013). Dissemination and implementation research funded by the US National Institutes of Health, 2005–2012. *Nursing Research and Practice, 2013*, 1-15.

Titler, M. G. (2004). Methods in translation science. *Worldviews on Evidence-based Nursing*, *1*(1), 38-48.

Titler, M.G. (2008). The evidence for evidence-based practice. In R.G. Hughes (Ed.), *Patient safety and quality: An evidence-based handbook for nurses* (Chapter 7). Rockville, MD: Agency for Healthcare Research and Quality.

Titler, M. G. (2010). Translation science and context. *Research and Theory for Nursing Practice, 24*(1), 35-55.

Titler, M. G. (2014). Overview of evidence-based practice and translation science. *Nursing Clinics of North America, 49*(3), 269-274.

Titler, M. G., Conlon, P., Reynolds, M. A., Ripley, R., Tsodikov, A., Wilson, D. S., & Montie, M. (2016). The effect of a translating research into practice intervention to promote use of evidence-based fall prevention interventions in hospitalized adults: A prospective pre–post implementation study in the US. *Applied Nursing Research*, *31*, 52-59.

Titler, M. G., Dochterman, J., Kim, T., Kanak, M., Shever, L., Picone, D. M., . . . Budreau, G. (2007). Cost of care for seniors hospitalized for hip fracture and related procedures. *Nursing Outlook, 55*(1), 5-14. e14.

Titler, M. G., Dochterman, J., Picone, D. M., & Everett, L. (2005). Cost of hospital care for elderly at risk of falling. *Nursing Economics, 23*(6), 290.

Titler, M. G., & Everett, L. Q. (2001). Translating research into practice. Considerations for critical care investigators. *Critical Care Nursing Clinics of North America, 13*(4), 587-604.

Titler, M. G., Everett, L. Q., & Adams, S. (2007). Implications for implementation science. *Nursing Research, 56*(4), S53-S59.

Titler, M. G., Herr, K., Brooks, J. M., Xie, X. J., Ardery, G., Schilling, M. L., . . . Clarke, W. R. (2009). Translating research into practice intervention improves management of acute pain in older hip fracture patients. *Health Services Research, 44*(1), 264-287.

Titler, M. G., Jensen, G. A., Dochterman, J. M., Xie, X. J., Kanak, M., Reed, D., & Shever, L. L. (2008). Cost of hospital care for older adults with heart failure: medical, pharmaceutical, and nursing costs. *Health Services Research, 43*(2), 635-655.

Titler, M. G., & Pressler, S. J. (2011). Advancing effectiveness science: An opportunity for nursing. *Research and Theory for Nursing Practice, 25*(2), 75.

Titler, M. G., Shever, L. L., Kanak, M. F., Picone, D. M., & Qin, R. (2011). Factors associated with falls during hospitalization in an older adult population. *Research and Theory for Nursing Practice, 25*(2), 127-152.

Titler, M. G., Wilson, D. S., Resnick, B., & Shever, L. L. (2013). Dissemination and implementation: INQRI's potential impact. *Medical Care, 51*, S41-S46.

Torres, E. M., Ehrhart, M. G., Beidas, R. S., Farahnak, L. R., Finn, N. K., & Aarons, G. A. (2017). Validation of the Implementation Leadership Scale (ILS) with supervisors' self-ratings. *Community Mental Health Journal*, 1-5.

Twigg, D., Duffield, C., Bremner, A., Rapley, P., & Finn, J. (2012). Impact of skill mix variations on patient outcomes following implementation of nursing hours per patient day staffing: A retrospective study. *Journal of Advanced Nursing, 68*(12), 2710-2718.

Udod, S. A., & Care, W. D. (2004). Setting the climate for evidence-based nursing practice: What is the leader's role? *Age, 30*(39), 16.

Van Achterberg, T., Schoonhoven, L., & Grol, R. (2008). Nursing implementation science: How evidence-based nursing requires evidence-based implementation. *Journal of Nursing Scholarship, 40*(4), 302-310.

Van den Heede, K., Lesaffre, E., Diya, L., Vleugels, A., Clarke, S. P., Aiken, L. H., & Sermeus, W. (2009). The relationship between inpatient cardiac surgery mortality and nurse numbers and educational level: Analysis of administrative data. *International Journal of Nursing Studies, 46*(6), 796-803.

Van den Heede, K., Sermeus, W., Diya, L., Clarke, S. P., Lesaffre, E., Vleugels, A., & Aiken, L. H. (2009). Nurse staffing and patient outcomes in Belgian acute hospitals: Cross-sectional analysis of administrative data. *International Journal of Nursing Studies, 46*(7), 928-939.

van der Laan, A. L., & Boenink, M. (2012). Beyond bench and bedside: Disentangling the concept of translational research. *Health Care Analysis, 23*(1), 32-49.

Van Gaal, B. G., Schoonhoven, L., Mintjes, J. A., Borm, G. F., Hulscher, M. E., Defloor, T., ... & van Achterberg, T. (2011). Fewer adverse events as a result of the SAFE or SORRY? programme in hospitals and nursing homes. Part I: Primary outcome of a cluster randomised trial. *International Journal of Nursing Studies*, *48*(9), 1040-1048.

Van Gaal, B. G., Schoonhoven, L., Vloet, L. C., Mintjes, J. A., Borm, G. F., Koopmans, R. T., & van Achterberg, T. (2010). The effect of the SAFE or SORRY? programme on patient safety knowledge of nurses in hospitals and nursing homes: a cluster randomised trial. *International Journal of Nursing Studies*, *47*(9), 1117-1125.

van Walraven, C., Austin, P. C., Jennings, A., Quan, H., & Forster, A. J. (2009). A modification of the Elixhauser comorbidity measures into a point system for hospital death using administrative data. *Medical Care*, 626-633.

Wald, H., Richard, A., Dickson, V. V., & Capezuti, E. (2012). Chief nursing officers' perspectives on Medicare's hospital-acquired conditions non-payment policy: Implications for policy design and implementation. *Implementation Science, 7*, 78.

Wallen, G. R., Mitchell, S. A., Melnyk, B., Fineout-Overholt, E., Miller-Davis, C., Yates, J., & Hastings, C. (2010). Implementing evidence-based practice: Effectiveness of a structured multifaceted mentorship programme. *Journal of Advanced Nursing, 66*(12), 2761-2771.

Ward, M. M., Baloh, J., Zhu, X., & Stewart, G. L. (2017). Promoting Action on Research Implementation in Health Services framework applied to TeamSTEPPS implementation in small rural hospitals. *Health Care Management Review*, *42*(1), 2-13.

Ware, J. E., Kosinski, M., Dewey, J. E., & Gandek, B. (2000). *SF-36 health survey: manual and interpretation guide*: Quality Metric Inc.

Warshawsky, N., & Havens, D. S. (2014). Nurse manager job satisfaction and intent to leave. *Nursing Economic$, 32*(1), 32.

Warshawsky, N., Rayens, M. K., Stefaniak, K., & Rahman, R. (2013). The effect of nurse manager turnover on patient fall and pressure ulcer rates. *Journal of Nursing Management, 21*(5), 725-732.

Weiner, B. J., Belden, C. M., Bergmire, D. M., & Johnston, M. (2011). The meaning and measurement of implementation climate. *Implementation Science, 6*(1), 1-12.

Welch, B. M., & Kawamoto, K. (2013). Clinical decision support for genetically guided personalized medicine: A systematic review. *Journal of the American Medical Informatics Association, 20*(2), 388-400.

Westfall, J. M., Mold, J., & Fagnan, L. (2007). Practice-based research—"Blue Highways" on the NIH roadmap. *JAMA, 297*(4), 403-406.

White-Williams, C., Patrician, P., Fazeli, P., Degges, M. A., Graham, S., Andison, M., . . . McCaleb, K. A. (2013). Use, knowledge, and attitudes toward evidence-based practice among nursing staff. *The Journal of Continuing Education in Nursing, 44*(6), 246-254.

WHO. (1995). The World Health Organization quality of life assessment (WHOQOL): position paper from the World Health Organization. *Social Science & Medicine, 41*(10), 1403-1409.

Wilkinson, J. E., Nutley, S. M., & Davies, H. T. (2011). An exploration of the roles of nurse managers in evidence-based practice implementation. *Worldviews on Evidence-Based Nursing, 8*(4), 236-246.

Wilson, D. S., Montie, M., Conlon, P., Reynolds, M., Ripley, R., & Titler, M. G. (2016). Nurses' perceptions of implementing fall prevention interventions to mitigate patient-specific fall risk factors. *Western Journal of Nursing Research*, *38*(8), 1012-1034.

Wong, C. A., Cummings, G. G., & Ducharme, L. (2013). The relationship between nursing leadership and patient outcomes: A systematic review update. *Journal of Nursing Management, 21*(5), 709-724.

Wong, C. A., & M Giallonardo, L. (2013). Authentic leadership and nurse-assessed adverse patient outcomes. *Journal of Nursing Management, 21*(5), 740-752.

Woolf, S. H. (2008). The meaning of translational research and why it matters. *JAMA*, *299*(2), 211-213.

Yang, P. H., Hung, C. H., Chen, Y. M., Hu, C. Y., & Shieh, S. L. (2012). The impact of different nursing skill mix models on patient outcomes in a respiratory care center. *Worldviews on Evidence‐ Based Nursing*, *9*(4), 227-233.

Yong, P. L., Saunders, R. S., & Olsen, L. A. (2010). Institute of Medicine Roundtable on Evidence-Based Medicine.

Yurkovich, M., Avina-Zubieta, J. A., Thomas, J., Gorenchtein, M., & Lacaille, D. (2015). A systematic review identifies valid comorbidity indices derived from administrative health data. *Journal of Clinical Epidemiology, 68*(1), 3-14.

Zerhouni, E. A. (2005). Translational and clinical science—time for a new vision. *New England Journal of Medicine, 353*(15), 1621-1623.

Zerhouni, E. A., & Alving, B. (2006). Clinical and translational science awards: A framework for a national research agenda. *Translational Research, 148*(1), 4-5.

Zhu, X., Baloh, J., Ward, M. M., & Stewart, G. L. (2016). Deliberation makes a difference: Preparation strategies for TeamSTEPPS implementation in small and rural hospitals. *Medical Care Research and Review*, *73*(3), 283-307.

Zhu, H., & Hill, M. D. (2008). Stroke: The Elixhauser Index for comorbidity adjustment of in-hospital case fatality. *Neurology, 71*(4), 283-287.