EVALUATION OF SELECTED COMPONENTS OF THE NURSING WORKLIFE MODEL

PATHWAYS AND ASSOCIATION WITH CATHETER ASSOCIATED URINARY TRACT

INFECTIONS

By

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Submitted to the graduate degree program in Nursing
and the Graduate Faculty of the University of Kansas
in partial fulfillment of the requirements for the degree
of
Doctor of Philosophy.

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Date approved: <u>May 11, 2015</u>_____

ABSTRACT

Identification of elements of the practice environment that influence both nurse satisfaction and patient outcomes is an important area for nursing research. While several valid and reliable tools to measure the components of the practice environment have been developed by nurse researchers with two measures, , the Practice Environment Scale and Job Enjoyment Scale, are included in the National Database of Nursing Quality Indicators® (NDNQI®) RN Satisfaction Survey. Leiter and Lachinger (2006) posited the Nursing Worklife Model (NWLM) to explain how the elements identified are interrelated in the complex system of the nurse practice environment with subsequent work that extended the model to include association of nurse perception of patient adverse events. Further exploration of the impact of the specific elements of the practice environment on patient adverse events is needed. To date, researchers have primarily evaluated the impact of clinical outcomes using administrative data at the hospital or individual nurse level using nurse perceived adverse patient outcomes. In addition to RN Survey data, the NDNQI® provides a database of nurse-sensitive clinical outcomes (e.g., urinary tract infections rates) at the unit level. The purpose of this study was to evaluate the association of elements of the NWLM on a measured nurse-sensitive outcome, catheter associated urinary tract infection (CAUTI) at the unit level.

Hospital acquired conditions (HACs) related to nosocomial infection are adverse patient events that have a significant impact on financial, morbidity and mortality outcomes. Catheter associated urinary tract infections (CAUTI) has been identified as one of the nurse sensitive indicators that is the most commonly occurring HACs (CDC, 2010).

Specifically this study used a secondary analysis to fit the NWLM to unit level data from the 2011 NDNQI® RN Survey using structural equation modelling and resulted in a modified

NWLM of job enjoyment. Additional significant paths were added to job enjoyment, staffing and resource adequacy, and foundations for quality care (*CFI*=.999; *RMSEA*=.059 [*95% CI*=.034-.089]; *SRMR*= .002). A second study followed that confirmed the modified NWLM of job enjoyment using 2012 NDNQI® RN Survey data. The model was extended to include data from the Quality Outcome database from which CAUTI rate was calculated to evaluate the NWLM path to CAUTI using structural equation modelling (*CFI*=.995; *RMSEA*= .04 [*95% CI*=.028-.056]; *SRMR*=.020). This study will add to the literature about the impact of the nurse practice environment on clinical outcomes at the unit level using a measured clinical outcome.

Acknowledgements

I would like to acknowledge and thank my Committee Chair, Dr. Marjorie Bott who mentored and encouraged me to accomplish more than I thought was possible. In addition I would like to thank my committee Dr. Byron Gajewski, Dr. Sue Popkess-Vawter, Dr. Peggy Miller, and Dr. Shin Hye Park. Each brought a perspective and expertise that facilitated the development and completion of the dissertation with outcomes important to nursing practice.

I would also like to acknowledge my family, in particular my mother, Glenna Medley who has provided encouragement and accompanied me on this journey as I traveled to Kansas to accomplish this goal; my husband, Bo Ballard, who never complained when study took priority and picked up the slack at home without being asked; and my younger sister Sue Carroll who is my strongest cheerleader as well as an excellent nurse leader in her field. Without their support this would have been a more difficult journey. I want to thank my daughter-in-law Elle Ballard for sharing her expertise in statistics by helping me set up the variables for SEM, saving much time and stress that facilitated completion of my data analyses.

Friends along with family can make a difference. All of my fellow students enriched the courses and learning of the program. In particular two I want to thank two colleagues and friends, Adrienne Platt and Barbara Adkins for the moral support, humor and friendship that have enriched my doctoral experience. Sharing this journey has provided a bond that will continue beyond the academic experience.

Lastly I want to thank my colleagues at WellStar Health System and Kennesaw State University who have encouraged me to initiate and complete my PhD. I plan to repay the investment from WellStar and the University of Kansas with research that makes a difference to clinical nurses and most importantly the patient, the main focus of nursing practice.

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CHAPTER ONE

Introduction

Patient outcomes in acute care settings have become a focal point as indicators of quality and drivers of reimbursement. Policy changes in the United States (U.S.) by the Centers for Medicare and Medicaid (CMS) reward good outcomes and penalize hospitals for less desirable outcomes, such as hospital acquired conditions (HAC) often referred to as *never events*. According to the Institute of Medicine (IOM), *Patient Safety*, ". . . care that is free from unintended injury from acts of commission or omission (p. *ix*)," should be a new standard (IOM, 2004). Failure to follow best practices has been identified by the IOM (IOM, 2004) as an error of omission that leads to increases in mortality and morbidity. Recommendation Six from the report identified a need for a research agenda that includes identification of patients at high risk for nosocomial infection and prevention strategies.

Hospitals in the U.S., where the majority of acute care occurs, are complex systems comprised of multiple disciplines, practice environments, varied socio-economic factors, and cultures that may or may not be conducive to providing the high quality of care that in turn reduces hospital acquired conditions (HACs), i.e., hospital-acquired pressure ulcers, falls resulting in injury, wrong-site surgery, retained foreign object after surgery, air embolism, and nosocomial infections [i.e., catheter associated urinary tract infections (CAUTI), catheter associated blood stream infections , ventilator associated pneumonia, surgical site infections, and Clostridium Difficile infection]. Consequently, understanding the association of the complex environment where care occurs and the various outcomes that have been identified as HACs is an important area for study.

Hospital acquired conditions (HACs). HACs related to nosocomial infection have a significant impact on financial, morbidity and mortality outcomes (Umscheid et al., 2011; Zimlichman et al., 2013). After adjusting for other demographic and clinical factors, Emerson et al. (2012) found that a positive culture for infection within 48 hours of admission significantly increased the risk of readmission to the hospital. In an evaluation of the 2008 CMS data reporting HACs in California, McNair, Luft, Andrew, and Bindman (2013) found that CAUTI along with in-hospital falls/traumas were the most commonly coded of the six definable HACs. In evaluating the impact, McNair and colleagues posited that the reduction in costs associated with decreased HACs might outweigh the impact of any penalties assessed for occurrence reporting. According to Zimlichman et al. (2013) in a meta-analysis evaluating costs to healthcare organizations, the top five preventable nosocomial infections (i.e., catheter associated urinary tract infection [CAUTI], surgical site infection, Clostridum Difficile Infection, ventilator associated infection , and central line bloodstream infection) resulted in total costs of $9.8 billion (*95% CI*, $8.3-$11.5 billion) in 2012 dollars. Among nosocomial infections, CAUTI has the lowest per case cost (Zimlichman et al., 2013), and according to Center for Disease Control (CDC, 2010), the highest frequency, comprising 30% of reported infections.

CAUTI has been associated with increased morbidity, mortality and higher hospital length of stay (LOS) (CDC, 2010), and is considered one of the *never events* for acute care. Over-all, with the increased attention to prevention, the incidence of CAUTI has decreased between 1990 and 2007 (Burton, Edwards, Srinivasan, Fridkin, & Gould, 2011). In spite of the trend in decreased catheter usage, the CDC (2010) reported that deaths attributable to urinary tract infections were 13,000 in the available 2002 survey data. While specific data on mortality

related to CAUTI are difficult to parse out, 80% of reported hospital urinary tract infections (UTIs) are associated with catheters (Conway & Larson, 2011). Daniels, Lee, and Frei (2014) reported that in a nationalized cohort of hospitalized adults, the mortality odds were greater for patients with a CAUTI than for patients without a CAUTI (3.9% vs 2.0%; $p < .0001$). In addition, according to the CDC (2010), 17% of hospital-acquired bacteremias (reported mortality rate of 10%) have a urinary source. Additional concerns identified by the CDC were the antimicrobial use for asymptomatic bacturia, and the use of urinary drainage bags that provide a reservoir for multidrug-resistant bacteria.

Hospital length of stay was identified as another important outcome associated with CAUTI. Length of stay added to the over-all increase in cost that was estimated to be between $1,200 and $4,700 (Umscheid, et al. 2011). The variation in cost identified by Umscheid and colleagues was due to inclusion of different factors (e.g., laboratory tests, medications, additional LOS) by different authors in calculating the cost of CAUTI. It is clear that the potential for harm and economic impact of CAUTI warrant study on areas of practice that can impact the incidence of CAUTI, the most common preventable nosocomial infections.

CAUTI prevention. Researchers to date have studied different types of catheters, practices, and comorbidities that are associated with prevention or incidence of CAUTI. No specific catheter type has been found to be a major factor in prevention (CDC, 2010). Monitoring of two important measures has been identified for CAUTI reduction: (a) decreasing catheter use or decreasing catheter days, and (b) if an indwelling catheter is in place, use of a standardized measure of CAUTI incidence per 1000 catheter days (Fakih, Rey, Pena, Szpunar, & Saravolatz, 2013; Fuchs, Sexton, Thornlow, & Champagne, 2011; Simon, Klaus, & Dunton, 2009).

Preventative clinical practices reported in the literature included use of screening tools for catheter use decisions, standardized catheter cleaning protocols, and nurse-driven protocols for catheter removal. The demonstrated success in reducing CAUTI rates include recognized care standards: (a) attention to maintenance of sterility, (b) using securement devices, and (c) avoiding retention. All are considered best practice in the prevention of CAUTI (Simon et al., 2009).

With the addition of CAUTI as a nurse-sensitive indicator of quality by National Database of Nursing Quality Indicators® (NDNQI®), nursing has a recognized role in prevention and reduction of CAUTI (Simon et al., 2009). While standardized practice and prevention have been studied, there has been limited study of the relationship of practice environment and CAUTI rates. Cimiotti, Aiken, Sloane, and Wu (2012) described an association between nurse staffing and the presence of urinary tract infections (UTIs), although no other aspects of the practice environment were included and CAUTI incidence was not addressed.

Nurse practice environment. The evidence supporting the association of both the nurse practice environment with patient outcomes along with the impact of nurse leadership on the nurse practice environment has been mounting. Aiken, Clarke, Sloane, Sochalski, and Silber (2002) identified the impact of nurse-to-patient ratios on mortality in post-surgical patients; they found that an increase in the ratio beyond four patients per RN was associated with an increased risk of 30-day mortality, an increased risk of failure to rescue, and an increase in nurse burnout and job dissatisfaction. Needleman, Beurhaus, Mattke, Stewart, and Alevinsky (2002) found an association between higher nurse hours per patient day (fewer patients/nurse) and better outcomes for both medical conditions (e.g., urinary tract infections, upper gastro-intestinal

bleeding, and shorter length of stay) and surgical conditions (e.g., pneumonia, shock/cardiac arrest, and failure to rescue).

Aiken, et al. (2011) extended their earlier work by evaluating the impact of nurse-rated practice environments on the outcomes associated with nurse-to-patient ratios. Findings indicated that in average or good practice environments the impact of lower patient/nurse ratios and higher percentage of baccalaureate-prepared nurses produced the highest impact on reduction in 30-day mortality and failure to rescue. However, in poor practice environments the impact of decreased nurse-to-patient ratios was nil. Kalisch, Tschannen, and Lee (2012) reported that both missed nursing care (e.g., ambulation, turning, discharge planning, teaching) and higher fall rates were associated with lower nursing hours per patient day (i.e., higher number of patients per nurse).

Lake and Freise (2006) described the practice environment as a continuum ranging from bureaucratic (centralized and hierarchical) to professional (decentralized and collegial). Variability between and within organizations can be substantial. Leadership style as noted by Avolio and Bass (2004) is important in providing a work environment that is the most productive and satisfying to employees. At the unit level leadership style can vary from unit to unit.

The Magnet designation program recognizes the importance of nurse leadership with transformational leadership at all levels important to development of exemplary nursing practice (American Nurses Credentialing Center, 2013). Laschinger (2008) identified that empowering working conditions are fundamental to providing a positive professional work environment. Providing nurse control over both practice and the work environment was described by Weston

(2008), as a process that supports such a practice environment. It is clear from the literature that the nurse manager is the cornerstone of an excellent work environment.

Recognition of the strong support for an association between the practice environment and patient outcomes led to the inclusion of nurse-sensitive measures of the practice environment by National Quality Forum (NQF), The Joint Commission (TJC), Agency for Healthcare Research and Quality (AHRQ), and the Centers for Medicare and Medicaid Services (CMS), validating a wider recognition of the importance of the practice environment to the quality of care delivery (Buerhaus, 2008). Providing care as noted above by Aiken, et al. (2011) is more than just the numbers of nurses caring for the patients, but also is influenced by the practice environment. The next step is designing studies that focus on the specific elements of the practice environment and the potential association with specific nursing quality indicators (e.g., CAUTI, falls with injury, failure to rescue) at the unit level in addition to the hospital level.

The Original Nursing Worklife Model

The theoretical framework for this study is the Nursing Worklife Model (NWLM) first posited by Leiter and Laschinger (2006). In preliminary studies the elements of the practice environment were used to determine causal pathways to elements of burnout (i.e., emotional exhaustion and depersonalization) or personal accomplishment (e.g., job satisfaction). Specifically, Leiter and Laschinger described the relationship of the interrelated elements of the nurse practice environment (i.e., strong nursing leadership, Registered Nurse (RN)-Medical Doctor (MD) collegial relationship, involvement in policy development, adequate staffing, and support for a nursing model of care) to elements of burnout or personal accomplishment. In the NWLM the complex relationships involved in the practice environment impact nurse emotional

exhaustion (burnout) or personal accomplishment via direct and indirect pathways that start with strong leadership.

In the explanatory NWLM, leadership of the nurse manager is considered essential as the nurse manager is responsible for the development and enculturation of the other elements of the model (Leiter & Laschinger, 2006). A strong nursing leader sets the tone for the nursing model of care and has the accountability to obtain the necessary resources to provide for high quality care. Collaboration between disciplines is supported and encouraged by strong leadership and expectations for nursing practice are commensurate with the education and skills of the direct care nursing staff.

Results from work by Schmalenberg and Kramer (2009), conclusions that a supportive nurse manager is important to a healthy work environment, align with the work by Laschinger and Leiter. Adding to this body of work, Aiken et al. (2011) and McHugh et al. (2013) provide further support for the impact of the work environment and staffing levels on quality outcomes. Laschinger (2008) posited that the sense of empowerment supported by strong leadership was important to providing the work conditions essential to a positive practice environment that enabled nurses to provide high quality care.

The structural model (see Figure 1.1) posited by Leiter and Laschinger (2006), starts with strong leadership that provides a direct influence on policy involvement, collegial RN-MD relationship, and staffing adequacy. Through these direct relationships, strong leadership exerts indirect influence on nursing model of care and emotional exhaustion (burnout) or the opposite pole of the scale, personal accomplishment.

To test this causal model, subscales of Lake's (2002) Practice Environment Scale (PES) were used to measure the comparable elements in the NWLM, and the Maslach Burnout

Inventory- Human Services Scale (MBI-HSS) (Maslach & Jackson, 1981) was used to measure emotional exhaustion (i.e., burnout) and personal accomplishment. Using a large sample of Canadian nurses, Leiter and Laschinger (2006) confirmed the domains of the practice environment identified by Lake (2002) and posited the domains as elements of the NWLM: (a) nurse manager ability, leadership, and support (strong leadership); (b) nurse participation in hospital affairs (policy involvement); (c) staffing and resource adequacy (staffing adequacy); (d) collegial nurse-physician relationships (RN-MD collaboration); and (e) nursing foundations for quality care (nursing model of care).The paths to emotional exhaustion (burnout) and personal accomplishment were confirmed. The nurse manager leadership role was pervasive throughout the analyses either by direct relationships with RN-MD collaboration, staffing adequacy, and policy involvement or indirect relationships with nursing model of care, emotional exhaustion and personal accomplishment.

Figure 1.1. Original Theoretical Model: Nursing Worklife Model (NWLM)
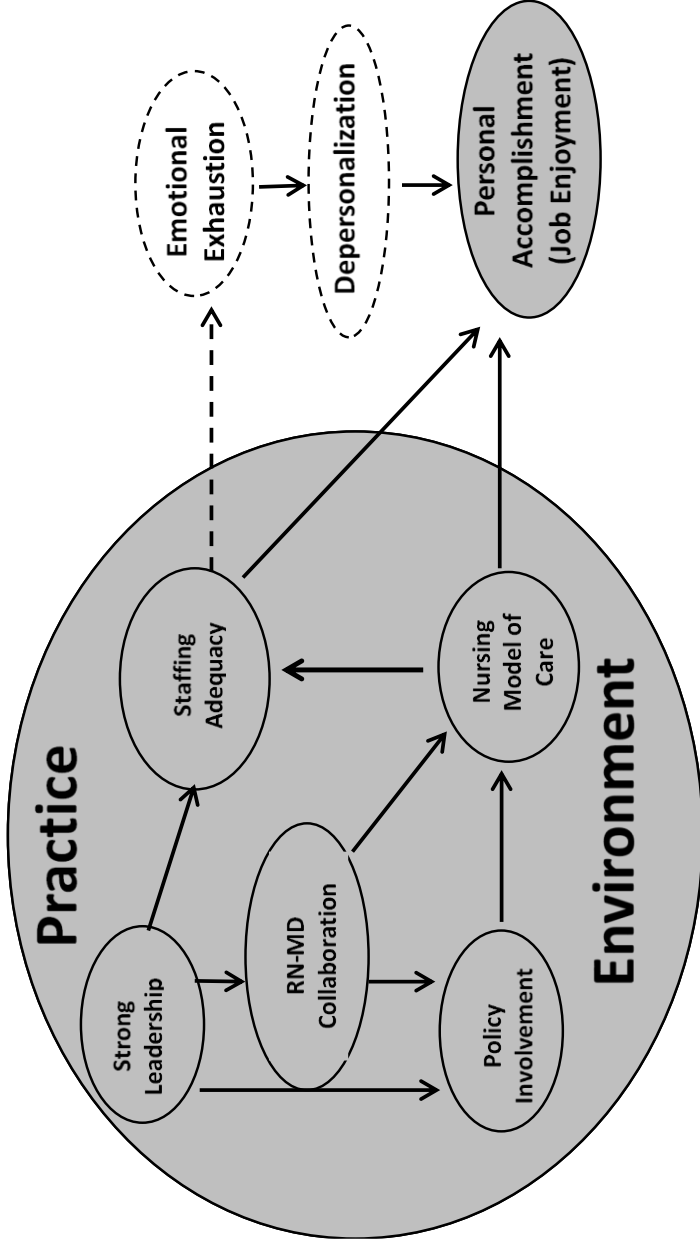
Figure 1.1. Original Theoretical Model: Nursing Worklife Model (NWLM). Adapted from "The Impact of Nursing Work Environments on Patient Safety Outcomes," by K. Laschinger and M. Leiter, 2006, *Journal of Nursing Administration*. Copyright 2006 by Lippincott Williams & Wilkins.

Note: The elements and relationships to be measured in this study are shaded. Emotional exhaustion and depersonalization (i.e., burnout) will not be measured in this study.

The impact of staffing on patient outcomes has been well supported in the literature (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Frith, Anderson, & Fong, 2012; Needleman, Buerhaus, Mattke, Stewart, Zelevinsky, 2002). However, there have been limited studies that examined the impact of the practice environment elements on measured patient outcomes at the unit level. Laschinger and Leiter (2006), in a subsequent study, found strong leadership was supported as pivotal to the other domains within the practice environment as noted by Leiter and Laschinger (2006). Staffing adequacy had a direct effect on emotional exhaustion, and the use of a nursing model of care had a direct effect on nurse's sense of personal accomplishment. Both had a direct effect on nurse-reported frequency of patient safety outcomes (i.e., nursing model of care had a positive association; emotional exhaustion had a negative association). Based on this work, there is support for the influence of the practice environment on patient outcomes, but no study has used a direct measurement of an identified outcome.

Studies to date of the Nursing Worklife Model (NWLM) have been done using data collected and analyzed at the individual nurse level (Laschinger, 2008; Laschinger & Leiter, 2006; Leiter & Laschinger, 2006; Manojlovich & Laschinger, 2007). The importance of using unit level data was recommended by Kramer, Maguire, and Brewer (2011) based on the premise that studies at the unit level are essential to reflect the aggregate of the conditions on the work unit in which practice occurs. The practice environment may vary between units resulting in lack of attention to units with poor outcomes if the data are aggregated at the hospital level. The purpose of the proposed studies was to address the fit of the NWLM to unit level data and extend the findings to include a measured patient outcome (i.e., CAUTI) at the unit level.

Study Aims

Using the Nursing Worklife Model as the guiding framework, there were two aims underpinning the two studies: (a) to examine the fit of the Nursing Worklife Model posited by Leiter and Laschinger (2006) using elements of the practice environment with unit level data from the 2011 National Database for Nursing Quality Indicators® (NDNQI®); and (b) to confirm NWLM fit at the unit level and evaluate the relationships of elements of the nurse practice environment with CAUTI rate using 2012 data from the NDNQI®.

Planned Manuscripts

Manuscript One

Design and study aim. Previous studies of the NWLM had been done with individual nurse survey data. Prior to introducing an outcome measure into the model the *a priori* structure identified by Leiter and Laschinger (2006) needed to be validated with unit level data. A secondary analysis using a correlational design was planned in order to address the first study aim, fit of the Nursing Worklife Model posited by Leiter and Laschinger (2006) using elements of the practice environment scale (PES) and job enjoyment scale (JES) with unit level data from the 2011NDNQI®.

Setting and sample. A data extract that included a subset of the 2011 NDNQI RN satisfaction survey data from adult in-patient medical, surgical, combined medical-surgical, step-down, and critical care unit types. The criteria were as follows: (a) date range January 1 through December 31, 2011; (b) hospital demographics as described below; (c) Job Enjoyment items and PES subscales aggregated to the unit level.

Hospital demographics were characterized by bed size (i.e., <100 beds, 101-200, 201-300, 301-400, 401-500, and >500 beds), Magnet ® status, teaching status (i.e., academic,

teaching, and nonteaching), and geographic description (i.e., metropolitan area, micropolitan area, and neither micropolitan nor metropolitan). RN demographics were evaluated using percentage for gender, ethnicity, mean age, education level, and specialty certification by unit type.

Human subject approval. Approval to use the data was obtained from the primary investigators and the Institutional Review Board (IRB) at the Midwestern academic medical center that managed the database. All data were de-identified and determined to be non-human subject research by the IRB.

Measures. The Practice Environment Scale (PES) was used to operationalize the elements of the NWLM practice environment as follows: (a) *Nurse Manager Ability, Leadership, and Support* (5 items); (b) *RN-MD Collaboration* (3 items) (c) *Nurse Participation in Hospital Affairs (9 items)*; (d) *Staffing and Resource Adequacy (4 items)*; and (e) *Nursing Foundations for Quality of Care (10 items)* (see Appendix A for all items). The Job Enjoyment Scale (JES) was used as a proxy measure for Personal Accomplishment. Table 1.1 provides the conceptual and operational definitions as well as reliability of the variables.

Table 1.1.

Theoretical definitions and psychometric properties of the PES subscale and Job Enjoyment

Scale

Variable	Definition	Items	*Cronbach's Alpha*
PES-Collegial RN-MD Relations	Presence of collaborative working relationship (NWLM RN-MD Collaboration)	3	.87
PES-Nurse Participation in Hospital Affairs	Policy development and decisions about practice (NWLM Policy Involvement)	9	.90
PES-Staffing and resource adequacy	Staffing level is adequate to provide the care needed (NWLM Staffing Adequacy)	4	.88
PES-Nurse manager ability, leadership, and support	Nursing manger viewed as a leader who provides strong support (NWLM Strong Leadership)	5	.90
PES-Nursing Foundations for Quality Care	Nursing practice is supported by high standards, professional nursing philosophy, education, expectation of competency, and measurement of quality (NWLM Nursing Model of Care)	10	.88
Job Enjoyment Scale	Measurement of nurse perception of happiness with the job (NWLM Personal Accomplishment)	7	.92

Note: Items description and reliability adapted from Ballard, Boyle, & Bott (2015)" Evaluation of selected components of the nurse work life model", *Western Journal of Nursing Research*

Procedures. Using case selection, the de-identified data extract was refined based on the following criteria: (a) unit types identified above, (b) 40% or greater unit participation (Kramer, Schmalenberg, Brewer, Verran, & Keller-Unger, 2009) and (c) PES survey option. Data were aggregated to the unit level using SPSS, version 18.

Data analysis. Analysis of variance (ANOVA) was used to determine if hospital characteristics or unit type had a significant effect on job enjoyment with no significant

differences noted. Structural equation modeling (SEM) using MPlus version 7 was used to fit the data to the *a priori* model from Leiter and Laschinger (2006) with job enjoyment as the outcome variable (see Figure 3.1, p. 54). Model fit was evaluated using the following fit indices, Comparative Fit Index (*CFI*), Root Mean Square Error of Approximation (*RMSEA*), and Standardized Root Mean Square Residual (*SRMR*). Ranges for acceptable fit of the hypothesized model to the data are *CFI* > .90, *RMSEA* < .08, and *SRMR* < .08 (Hooper, Couglan & Mullen, 2008).

Results of this study were accepted for publication in March of 2015 by the *Western Journal of Nursing Research.* The completed study with findings are found in Chapter Three (see p. 64)

Manuscript Two

Design and study aims. This study was a secondary analysis using a correlational design to test the associations of the elements of the NWLM with *Job Enjoyment* and CAUTI incidence. In order to test the previously identified paths comprising the modified NWLM (Ballard, Boyle, & Bott, 2015) using 2011 NDNQI® data, structural equation modeling (SEM) was conducted using unit level data from the 2012 NDNQI® RN Satisfaction Survey for hospitals that selected the PES survey option, participated in the NDNQI® Quality Outcomes data-base, and reported Catheter Associated Urinary Tract Infection (CAUTI) data (catheter days and UTIs per quarter). Inclusion criteria were: (a) inpatient nursing units that had a 40% or higher RN participation rate on the RN survey, and (b) reported CAUTI rates for at least two quarters of 2012. A unit sample with at least 40% participation is adequate to measure psychometric properties for unit specific scales (Kramer, Schmalenberg, Brewer, Verran, & Keller-Unger, 2009).

Setting and sample. A subset of unit level data was obtained from the 2012 NDNQI®

RN satisfaction survey from adult in-patient medical, surgical, and medical-surgical using the

following criteria: (a) date range January 1 through December 31, 2012; (b) hospital

demographics as described below; (c) *Job Enjoyment* items and PES subscales aggregated to the

unit level. Step-down and critical care units were not used for this study due to the differences

in: (a) acuity of patients that tend to be higher, and (b) nurse-to-patient ratios that tend to be

lower than the medical, surgical, or combined medical-surgical units.

Hospital demographics were characterized by bed size (<100 beds, 101-200, 201-300,

301-400, 401-500, and >500 beds). In addition, hospitals were categorized by Magnet® status,

teaching versus non-teaching status, and geographic description (i.e., metropolitan area,

micropolitan area, and neither micropolitan nor metropolitan). The RN sample demographics

were evaluated using percentage for gender, ethnicity, mean age, education level, and specialty

certification for each unit in order to compare across unit characteristics.

Human subject approval. Approval to use the data was obtained from the primary

investigators and the Institutional Review Board (IRB) at the Midwestern academic medical

center that manages the database. All data received for analysis were aggregated at the unit level

and de-identified to qualify for non-human subject determination.

Measures. The Practice Environment Scale (PES) subscales used in the analysis were as

follows: (a) *Nurse Manager Ability, Leadership, and Support* (5 items); (b) *RN-MD*

Collaboration (3 items) (c) *Nurse Participation in Hospital Affairs (9 items)*; (d) *Staffing and*

Resource Adequacy (4 items); and (e) *Nursing Foundations for Quality of Care (10 items)* (see

Appendix A for all items). Table 1.1 provides the conceptual and operational definitions of the

variables .

All PES subscales contain Likert-type items with four response options ranging from strongly disagree (1) to strongly agree (4). Item scores were summed and averaged to calculate the mean subscale score. All subscales have demonstrated reliability ranging from .87 to.90 for the PES subscales (see Table 1.1, p. 13).

Personal accomplishment was measured by the *Job Enjoyment Scale* (JES), a 7-item scale that uses 6-point Likert-type response options ranging from strongly disagree (1) to strongly agree (6). The JES items were adapted from the Index for Job Satisfaction developed by Brayfield and Rothe (1951) and adapted by Taunton et al. (2004). The stem is phrased, "Nurses with whom I work would say . . ." in order to obtain work group job satisfaction indicators (see Appendix B for all items). The JES reliabilities reported Cronbach's alpha ranging from .87 to .97 at the workgroup level from previous studies (Boyle et al., 2006; Taunton et al., 2004). While the JES is not a direct measure of personal accomplishment as described by the eight item subscale of the MBI (Maslach & Jackson, 1981), both the scales measure perceptions associated with a positive feelings about the work unit (JES) or the job accomplishments (MBI).

Catheter Acquired Urinary Tract Infection (CAUTI) incidence is entered into the NDNQI® database as the total number of CAUTIs (based on Center for Disease Control/ National Healthcare Safety Network [NHSN] definition) (see Chapter 1, definition of terms, p. 17) in a month at the unit level (NDNQI®, 2013). CAUTI rates were calculated based on the reported number of catheter days divided by number of infections multiplied by 1000 as recommended by the CDC (2015) for calculating standardized CAUTI rates.

Data analysis. Structural Equation Modeling (SEM) using MPlus version 7 software tested the hypothesized model (see Figure 4.1, p. 88) elements of the NWLM's represented by

the PES-subscales relationships to *Job Enjoyment* and CAUTI incidence controlling for significant hospital characteristics. One way analysis of variance (ANOVA) using SPSS version18.0 was used to evaluate differences related to hospital characteristics (i.e., bed size, hospital type, teaching status, and Magnet ® status) and unit type.

Fit indices identified by Raykov and Marcoulides (2006) were used to evaluate the fit of the model to the data: Comparative Fit Index (*CFI*), Root Mean Square Error of Approximation (*RMSEA*), and Standardized Root Mean Square Residual (*SRMR*). Acceptable fit of the hypothesized model to the data was identified as *CFI*>.90, *RMSEA*< .08, and *SRMR* < .08 (Hooper, Couglan & Mullen, 2008). A sample size of 1,106 exceeds the minimum of 100 cases recommended as a minimum for SEM by Raykov & Marcoulides (2006).

The second study findings and results can be found in with planned submission for this manuscript is to *Nursing Research*.

Definition of Terms

Asymptomatic Bacteremia (AB) Urinary Tract Infection (UTI): A UTI with or without an indwelling urinary catheter with no signs or symptoms (i.e., for any age patient, no fever (>38°C), urgency, frequency, dysuria, supra-pubic tenderness, or costo-vertebral angle pain or tenderness, and a positive urine culture of $\geq 10^5$ CFU/ml with no more than two species of uropathogen microorganisms (National Healthcare Safety Network, 2012).

Catheter Associated Urinary Tract Infect (CAUTI): A UTI where an indwelling urinary catheter was in place for >2 calendar days when all elements of the UTI criterion were first present together or occurs no later than day two following catheter removal counting day of removal as day one (National Healthcare Safety Network, 2012).

Centers for Medicare and Medicaid (CMS): An agency of the United States Federal Government that includes a consortium of business lines that oversee health plans supported by the government.

Hospital Acquired Conditions (HAC): Conditions that could have reasonably been prevented during the course of hospitalization through the application of evidence-based guidelines (Centers for Medicare and Medicaid, 2006).

Hospital Acquired Infection (HAI): An infection is considered a HAI if all the elements of a CDC/HSN site specific infection criterion were present together on or after the 3rd calendar day of admission to a facility (the day of hospital admission is considered day 1 (Center for Disease Control, 2013).

National Database for Nursing Quality Indicators® (NDNQI®): A national nursing quality measurement program sponsored and developed by the American Nurses Association and subsequently sold to Press Ganey Associates, Inc. in 2014.

Nurse Sensitive Indicator: Nursing-sensitive indicators are defined measures that reflect the structure, process and outcomes of nursing care.

National Quality Forum (NQF): An organization that reviews, endorses, and recommends use of standardized healthcare performance measures.

The Joint Commission (TJC): An independent, not-for-profit organization that accredits and certifies health care organizations and programs in the United States. Accreditation is considered a symbol of quality that reflects an organization's commitment to meeting certain performance standards.

Symptomatic Urinary Tract Infection (SUTI): A UTI with the presence of a fever (>38℃), supra-pubic tenderness (for which no other cause is identified), or costo-vertebral

angle pain or tenderness and at least one of the following findings: (a) positive dipstick for leukocyte esterase and/or nitrite; (b) pyuria (urine specimen with ≥10 white blood cells [WBC]/mm3 of unspun urine or >5 WBC/high power field of spun urine); or (c) microorganisms seen on Gram stain of unspun urine and a positive urine culture of $\geq 10^3$ and $< 10^5$ CFU/ml with no more than 2 species of microorganisms (national Healthcare Safety Network, 2012).

Work/Practice Environment: The organizational characteristics of a nursing unit comprised of leadership, workload, interdisciplinary as well as intra-disciplinary relationships, and decision making processes. Defined by Lake (2002) as ". . . the organizational characteristics of a work setting that facilitate or constrain professional nursing practice" (p. 178).

Summary

The current focus on quality outcomes provides the impetus for acute care hospitals to identify and prevent hospital-acquired infections (HAIs) of which CAUTI is the most common. Care occurs in a complex setting with multiple factors that impact patient outcomes and the nurses' perceptions of job enjoyment. In chapter one, the importance of the problem was identified. Based on Laschinger and Leiter's (2006) NWLM and current literature on the impact of CAUTI and prevention strategies, the impact of the practice environment elements on patient outcomes was explored, and the planned strategy for two manuscripts to evaluate the impact on CAUTI rate was outlined. Variables for study were identified and defined.

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CHAPTER TWO

Literature Review

The purpose of this chapter is to provide a review of the literature related to the practice environment and how the Nursing Worklife Model (NWLM) has been tested in research. According to the IOM report, failure to follow best practices is an error of omission that leads to increases in mortality and morbidity (Institute of Medicine, 2004). One of the recommendations (Six) from the IOM report identified that a research agenda was needed that includes identification of patients at high risk for nosocomial infection along with prevention strategies. The associations of nurse-sensitive indicators with the elements of the practice environment along with a critical appraisal of the relationship to CAUTI are discussed. In addition, the literature on influences of the nurse practice environment and CAUTI incidence and prevention are summarized. The identified gap in the literature addressed by this study is outlined and recommendations for future research are discussed.

Practice Environment

Beginning with identification of the characteristics of hospitals deemed Magnet Hospital in the early 1980s, measurement and research regarding the characteristics and impact of the practice environment have become a research focus (McClure & Hinshaw, 2002). Initial identification of the 39 reputational Magnet hospitals resulted in a body of research regarding the composition and impact of the elements of the practice environment. According to McClure and Hinshaw (2002), the initial Magnet study was the forerunner of the American Nurses Credentialing Center (ANCC) Magnet® designation program that is credited by Buerhaus (2008) as one of the drivers of the improvement in the work environment noted in the biennial national registered nurse (RN) survey.

The associations of nurse staffing to quality outcomes has been studied using large data sets focusing attention on the important role that nurse staffing levels have in the prevention of hospital acquired conditions (HACs) (Aiken, Smith, & Lake, 1994; Aiken et al., 2002; Aiken et al., 2011; Lucero, Lake, & Aiken, 2010; McHugh et al., 2013; Needleman et al., 2002; Sales et al., 2008; and Spetz, Harless, Hemera, & Mark, 2013). It is clear that there is an association of nurse-to-patient staffing levels with HACs.

Prompted by a nursing shortage, Lake and Friese (2006) completed the first study exploring nurse practice environments across a large sample of hospitals. A secondary analysis was done comparing large samples from three cross-sectional studies using surveys that included the Practice Environment Scale (PES): (a) nurses (n=11,629) from 156 Pennsylvania hospitals (Aiken et al., 2001), (b) nurses (n=1,610) from 16 of the original reputational magnet hospitals (Kramer & Hafner, 1989), and (c) nurses (n= 1,054) from seven Magnet®-designated hospitals (Aiken, Havens, & Sloane, 2000). Comparing the scores on the PES, Lake and Friese (2006) found a wide variation in practice environments across hospitals. Only 17% of the Pennsylvania hospitals demonstrated favorable environments for staffing adequacy (i.e., a lower RN-to-bed ratio). Differences in the practice environment were not associated with hospital characteristics or location. Hospitals designated as Magnet® scored significantly higher (p=.01) than other hospitals on three of the PES subscales: (a) nurse participation in hospital affairs (M=2.96; SD=.18 and M=2.30; SD=.23, respectively); (b) nursing foundations for quality of care (M=3.32; SD=.15 and M=2.81; SD=.20, respectively); and (c) nurse, manager ability to lead (M=2.91; SD=.14 and M=2.36; SD=.24, respectively).

Instruments to measure the practice environment. Interest in the practice environment has stimulated development of instruments to measure the practice environment elements. Several instruments, such as the Practice Environment Scale (Lake, 2002), Conditions of Work Effectiveness-II (Laschinger, Finegan, Shamian, & Wilk, 2001), and Essentials of Magnetism-II (Kramer & Schmalenberg, 2008)), have been developed to measure practice environment characteristics with good evidence of reliability and validity.

The Practice Environment Scale (PES) was developed by Lake (2002) from the Nursing Work Index (NWI); this was done in response to a need to develop an empirically-based tool to study the nursing shortage. The tool has been widely used in the U. S. as well as internationally (Warshawsky & Havens, 2011). A full description of the tool is provided in manuscript one (see Chapter Three). In August 2009, the PES was endorsed by the National Quality Forum (NQF) as a nurse-sensitive indicator to be used as a quality measure of the practice environment (NQF, 2013).

Kramer in collaboration with other researchers (Schmalenberg & Kramer, 2009; Kramer, Maguire, & Brewer, 2011) identified the importance of a healthy work environment (HWE) to nurse perception of staffing adequacy and perception of practice quality. Following development of a tool—Essentials of Magnetism II (EOMII; 58 items with eight subscales)— to measure the work environment, researchers (Kramer & Schmalenberg, 2004, 2005) from subsequent studies have supported the importance of nurse manager leadership in the nurse's perception of staffing adequacy in creating a HWE. Kramer, Maguire, and Brewer (2011) completed a study using EOMII from 534 clinical units of 34 Magnet® hospitals to evaluate the association of a range of variables with a HWE. Contextual data of hospitals and demographics of nurses were used to investigate potential confounding variables in a study of the work

environment. Multivariate analysis was used to investigate hospital contextual variables (e.g., geographic location, size, academic, community); nurse demographic variables (e.g., age, education, certification); work variables (e.g., shift worked, unit type); and the elements of the EOMII. Kramer et al. (2011) found that a HWE was not predicted by hospital type, geographical region, or work variables. However, they did find that a HWE developed due to qualities intrinsic to the unit and the hospital; two of the strongest influences found were nursing leadership and an empowered or collaborative decision-making process. Kramer and colleagues identified that the work environment is an aggregate of multiple influences at the work unit and proposed that study was needed that focused on data aggregated at the unit level. Using intra-class correlation coefficients (*ICC*) and the within-group inter-rater reliability to establish reliability of the aggregated unit level measures, Kramer and colleagues confirmed that the aggregated nurse data measuring elements of the work environment of the unit were representative of the group when there was at least a 40% response rate of the nurses. Eighty-two percent of the clinical units were classified as having either a healthy work environment or a very healthy work environment. This further supports the impact of the Magnet® framework for professional nursing practice that promotes accountability, nurse involvement in decision making, promotion of interdisciplinary collaboration, and the use of evidence.

Laschinger, Finegan, Shamian, and Wilk (2001) developed a tool to measure elements of the practice environment, *Conditions of Work Effectiveness II*, to elaborate on Kanter's theory of structural empowerment. According to Laschinger and colleagues, the elements from Kanter's theory—access to information, resources support, and opportunities for professional development—are important in fostering a sense of empowerment, reducing job strain, and improving job satisfaction.

In a study of U.S. Army Medical Department hospitals, Patrician, Shang, and Lake (2010) examined the relationships of the practice environment using the PES scores to represent a composite score of the practice environment, emotional exhaustion using the 9-item scale from the Maslach Burnout Inventory (MBI), and single item questions to evaluate intent to leave, quality of care, and job satisfaction. For example, quality of care was assessed by one question, "Overall, how would you rate the quality of patient care on your unit?" Response options were a four point Likert-type scale that was dichotomized to fair/poor and good/excellent for analysis. Scores on the both the PES and the MBI were converted to categorical variables for analysis. PES was categorized as favorable if scores exceeded 2.5 (theoretical mid-point) on four to five of the subscales; mixed if exceeded 2.5 on two to three of the subscales; and unfavorable if scores were less than or equal to 2.5 on at least four of the five scales. Scores on the MBI of 27 or more were categorized as high emotional exhaustion, and scores less than 27 were categorized as average to low emotional exhaustion. Using logistic regression Patrician, et al. reported that an unfavorable practice environment was associated with the following: (a) job dissatisfaction ($OR =13.75$, $p < .01$); (b) intent to leave ($OR =3.03$, $p < .01$); (c) development of emotional exhaustion ($OR=12.70$, $p < .01$); and (d) perception of only fair to poor quality of care ($OR =10.66$, $p < .01$).

In summary, it is well supported that elements of the work environment are important to staff satisfaction (job enjoyment). Environments that provide strong leadership support and a sense of empowerment through shared decision making, as well as adequate resources, lead to staff that are satisfied and less likely to leave.

Outcomes related to the practice environment. In a comprehensive review of the literature reporting on use of the PES in nursing research, Warshawsky and Havens (2011) identified 16 studies in which the relationship of PES to patient outcomes was explored. Nurse-rated quality of care was the most common outcome measure studied. They identified studies: (a) in which there was a positive association between PES and higher nurse-reported quality of care (McCusker, Dendukuri, Cardinal, Laplante, & Bambonye, 2004; Manojlovich, & DeCicco, 2007; Gunnarsdottir, Clarke, Rafferty, & Nutbeam, 2009); (b) in which the practice environment was categorized as favorable/unfavorable for analysis of the relationship to quality of care (Patrician, Shang, & Lake, 2010; Friese, 2005); and (c) that demonstrated mixed results of the five PES subscales with patient outcomes (e.g., patient satisfaction, nurse perceived frequency of catheter associated infections, ventilator associated pneumonia, or medication errors). Only three studies were found published between 2002 and 2010 by Warshawsky and Havens that evaluated the practice environment elements with direct measurement of clinical outcome variables.

Gardner, Thomas-Hawkins, Fogg, and Latham (2007) studied the relationship of the practice environment on patient satisfaction and readmission rates in 46 outpatient dialysis center with nurse surveys (*N*=199) using three subscales of the PES (i.e., nursing foundations for quality care, staffing and resource adequacy, and collegial nurse-physician relations). Gardner and colleagues found a significant negative relationship with the hospital re-admission rate for patients in the first 90 days (*r*= -.36, *p*<.05) as well as patients on dialysis greater than 90 days (*r*= -.34, *p* <.05) after initiation of outpatient dialysis. No association was found for patient satisfaction with the practice environment by Gardner and colleagues.

In one of the first studies evaluating the impact of the practice environment on outcomes, Aiken, Smith, and Lake (1994) compared 39 reputational magnet hospitals with 195 control non-magnet hospitals that had at least 100 Medicare discharges per year. Findings supported a significant difference in mortality that was measured as deaths per 1000 discharges. After adjusting for predicted mortality, the Magnet® hospital group had a mortality of 4.9% (*95% CI=* .9 to 9.4; *p* = .026) fewer deaths per 1,000 discharges compared to non-magnet hospitals.

Kutney-Lee et al. (2009) used three subscales of PES (i.e., nurse manager ability, leadership, and support, collegial nurse-physician relationships, and nursing foundations for quality care) from a previous study (i.e., the University of Pennsylvania Multi-state Nursing Outcomes), along with administrative data from American Hospital Association Annual Survey and Healthcare Consumer Assessment of Healthcare Providers and Systems (HCAHPS) to study the association of the nurse practice environment and organizational characteristics with patient satisfaction. The sample consisted of 430 hospitals and survey responses from 20,984 nurses (demographics indicated the hospital in which they worked) with outcomes analyzed at the hospital level. Findings included that the work environment had a significant impact on all ten HCAHPs measures and the important global measure of willingness to recommend (Kutney et al., 2009).

Friese, Lake, Aiken, Silber & Sochalski (2008) reported on the hospital-level outcomes of surgical oncology patients associated with the PES. The specific outcomes aggregated to the hospital were unadjusted death (all cause 30-day mortality), failure to rescue (death within 30 days following surgery), and complications (21 secondary diagnoses and procedure codes not identified in prior admissions). After controlling for hospital and patient characteristics,

patients in hospitals with poor work environments had increased odds of death (OR=1.37; 95% CI=1.07-1.76), increased odds of failure to rescue (OR=1.48; 95% CI=1.07-2.03) and increased odds of complications (OR= .92; 95% CI= .72-1.9).

Lucero, Lake, and Aiken (2010) identified an association between unmet patient care needs (a composite measure based on an aggregate of listed necessary nursing care items) and nurse-reported increased adverse patient outcomes (i.e., falls with injury, nosocomial infections, and medication errors). Hospital practice environments were measured by PES and categorized as favorable, mixed, or unfavorable. The majority of hospitals were identified as mixed (66%), with the remainder being favorable (23%) and unfavorable (11%). Using multiple regression, Lucero and colleagues did not identify any significant associations of the practice environment with the perception of any adverse events. A significant association was identified with the aggregate measure of unmet care needs and nurse-reported frequency of each of the adverse events (Lucero et al., 2010). While this is contrary to the majority of studies found regarding the practice environment, the aggregation of data to the hospital level using a mean score, may have obfuscated the practice environment differences at the unit level.

McHugh and colleagues (2013) identified significant differences (p=.0001) in practice environment between 56 Magnet® hospitals and 508 non-magnet hospitals using the PES aggregate scores (M=2.86 and M=2.66, respectively). Outcomes in Magnet® hospitals versus non-magnet hospitals of 30-day mortality for surgical patients (1.5% and 1.8%, respectively; $p<$ 0.001), death of post-surgical patients with complications (failure to rescue) was lower (3.8% and 4.6%, respectively; $p<$0.001). Controlling for differences in nursing characteristics (e.g., age, education), hospital, and patient characteristics, surgical patients in Magnet® hospitals had

14% lower odds of inpatient death within 30 days of admission and 12% lower odds of failure to rescue (Aiken, 1994).

Nurse manager impact. The impact of the nurse manager on the practice environment and ultimately job enjoyment as noted by Laschinger (2008) has been supported well in the literature. In a review of the literature, Hayes, Bonner, and Pryor (2010) reported that collaboration between nurse managers and nursing staff was crucial to increasing satisfaction with the work unit. In six of the studies positive leadership and respect from managers were key to increased job satisfaction. Different leadership styles and mechanisms (e.g., transformational leadership, servant-leader, and emotional intelligence) have been identified in the literature (McGuire & Kennerly, 2006; Jenkins & Stewart, 2010; Akerjordet & Severinsson, 2008) as important to RN job satisfaction and decreasing RN turnover. Regardless of the specific mechanism, the nurse manager is key to developing the shared mental model of professional nursing practice and resources important to development and sustenance of a good work environment.

Kramer, McGuire, and Brewer (2011) conducted a study of the impact of multiple contextual factors on the presence and extent of a healthy work environment as measured by the Essentials of Magnetism II in 34 Magnet® hospitals (*N*=12,233 RNs; *N*=717 units,). The authors found that there were no hospital or unit type differences that were significant; however, the elements of visionary leadership, empowerment, and collaboration were important to the development and maintenance of a healthy work environment. Clearly the nurse manager is key to providing a healthy practice environment.

Staffing and Quality Outcomes

An important body of work has been accumulating around the association of appropriate staffing levels with morbidity and mortality. In a cross-sectional study of nurses from surgical units (*N*=10,184) linked with data from 232,342 surgical patients, Aiken, Clarke, Sloane, Sochalski, and Silber (2002) identified a relationship between nurse staffing (i.e., nurse-to-patient ratio), nurse satisfaction, and patient 30-day mortality as well as failure to rescue (FTR). After controlling for hospital and patient characteristics, each additional patient per nurse increased the odds of patient mortality and failure to rescue by 7%.

Staffing levels have been reported to impact medication errors (Frith, Anderson, Tseng, & Fong, 2012; Lucero, Lake, & Aiken, 2010), mortality (McHugh et al., 2013; Aiken et al., 2011; Lucero, Lake, & Aiken, 2010; Sales et al., 2008; Needleman et al., 2011), and missed nursing care (Lucero, Lake, & Aiken, 2010; Kalisch, Tschannen, & Lee, 2012). In contrast to the majority of studies, Spetz, Harless, Hemera, and Mark (2013) found only limited impact on adverse events (i.e., pressure ulcers, failure to rescue, nosocomial infections, postoperative respiratory failure, postoperative deep vein thrombosis/pulmonary embolus) in California hospitals when comparing data from before and after specified nurse-to-patient ratios were mandated. Spetz and colleagues found a slight improvement in postsurgical mortality in medical-surgical units, and posited that this was due to the increased time for surveillance of patients due to better nurse-to-patient staffing levels.

There is preponderance of studies (Aiken et al., 2001, 2002, 2011; Needleman et al., 2002, 2011; Lake, & Friese, 2006; Sales et al., 2008; Gunnarsdottir, Clarke, Rafferty, & Nutbeam, 2009; Kalisch, Tschannen, & Lee, 2012; Frith, Anderson, Tseng, & Fong, 2012) that have found significant associations with an increase in adverse events (e.g., mortality, failure to

rescue, nosocomial infection) and higher patient- to-nurse ratios; the nurse workload increases are primarily from increased numbers of patients rather than increased acuity of patients.

In a study from 665 hospitals in four large states, Aiken, Cimiotti, Sloane, Smith, Flynn, and Neff (2011) reported the impact of the practice environment (measured by PES) on the odds of 30-day mortality and failure to rescue (FTR) that was associated with different nurse-to-patient ratios. The findings from this large study indicated that hospitals with the poorest staffing (1:8 nurse-to-patient ratio or greater) and good work environments decreased the odds of 30-day mortality and FTR by 2% to 3%. However, when compared with best staffed hospitals (1:4 nurse-to-patient ratio or less) and good work environments, they found a 12% to 14% decrease in 30-day mortality and FTR with fewer patients per nurse. Another finding was that a 10% increase in nurses with a BSN degree resulted in a 4% decrease in the odds of a patient death. The improvement associated with lower nurse-to-patient staffing ratios was increased in the presence of good practice environments.

In a study of unit level RN satisfaction measured by the Job Enjoyment Scale (JES), Choi and Boyle (2013) identified an inverse association between general job enjoyment and fall rate. Using 2009 data from the National Database for Nursing Quality Indicators® (NDNQI®) for quality outcomes and the associated RN Satisfaction survey (*N*=2,763 units from 576 hospitals), Choi and Boyle found that higher RN unit level scores on the JES were significantly related to fewer falls (*incident rate ratio*=.941; *95% CI*=.911-.972). For each one unit increase in RN satisfaction fall rates decreased by 5.9%.

Nursing Worklife Model (NWLM) Studies

A causal model, the Nursing Worklife Model (NWLM), was posited and tested by Leiter and Laschinger (2006). Five practice environment elements and their relationship to emotional

exhaustion (burnout) and personal accomplishment as noted previously in Figure 1.1 (p. 9) were proposed. The five elements of the NWLM (strong leadership, RN-MD collaboration, policy involvement, staffing adequacy, and a nursing model of care) were used to depict the complex relationships involved in the practice environment that impact emotional exhaustion (burnout) and personal accomplishment.

According to Leiter and Laschinger, strong leadership was identified as the starting point of the model that influenced the other four components of the explanatory model. Conceptually the five factors of the practice environment were operationalized based on Lake's (2002) Practice Environment Scale (PES) derived from the Nursing Work Index (NWI). Leiter and Laschinger used these definitions to operationalize the elements of their model. Nurse manager ability, leadership, and support (i.e., *Strong Leadership*) was identified as the ability to garner and manage resources and processes needed to deliver care. Collegial nurse physician relationships (i.e., RN-MD collaboration) reflected the over-all quality of the working relationship between the two disciplines. Nurse involvement in hospital affairs (i.e., policy involvement) was defined as the extent that nurses were involved in decision making with an impact on hospital administration. Adequate staffing and resources (i.e., staffing adequacy) was a measure of the perception of the nurse that resources were available to meet patient care demands. Nursing foundations for quality care (i.e., nursing model of care) reflected the support and presence of a nursing model of care rather than care based on medical model. The interaction of these elements was posited to influence a sense of emotional exhaustion or personal accomplishment, two opposing poles of burnout (Leiter & Laschinger, 2006).

Leiter and Laschinger (2006) tested their model using structural equation modeling (SEM) in a secondary analysis of a large data set of individual surveys of hospital-based

Canadian nurses (N= 8,597). This sample was a subset from a larger study, *International Survey of Hospital Staffing and Organization of Patient Outcomes* (Aiken et al., 2001). The sample was randomly divided into two samples (n=4,298 and n=4,299); the first sample was used to identify the best model fit to the data (χ^2= 10,230.23, *df* = 11; *p*< .001; *CFI*=.90; *RMSEA* =.04) and the second sample was used for replication (χ^2= 10,215.30, *df* = 11; *p* <.001; *CFI*=.91; *RMSEA* not reported). In the final model strong leadership was found to have a significant positive direct path with three elements, RN-MD collaboration, policy involvement, and staffing adequacy. The model testing also revealed that strong leadership had an indirect path through nursing model of care to personal accomplishment. The findings from the study supported the NWLM and tested the elements of the practice environment that were predictors of emotional exhaustion or personal accomplishment as measured by the Maslach Burnout Inventory-Human Service Scale (Maslach & Jackson, 1981).

Laschinger and Leiter (2006) extended their work on the NWLM in a subsequent study using the same sample of hospital-based Canadian nurses (N=8,597) to test the components of the model and nurse-reported frequency of adverse events (i.e., falls, nosocomial infections, medication errors, and patient complaints). They used the question, "Over the past year, how often would you say each of the following incidents has occurred involving you or your patients?" (p. 263) Responses ranged from one (never) to four (frequently). Using SEM, the pathways between the elements of the NWLM were demonstrated as described above with a good fit to the hypothesized model (X^2=16,557.35, *df* = 1,346; *CFI* =.907; *IFI* =.907; *RMSEA* =.037). Further analysis indicated an improvement in model fit with the addition of a direct paths from staffing adequacy and nursing model of care to reported frequency of adverse events (X^2 = 16,438.19, *df* = 1,344; *CFI* =.908; *IFI* =.908; *RMSEA* =.037). As Laschinger and Leiter

noted, although causality cannot be determined due to the cross sectional study design, the relationship between the practice environment and the ability to ensure patient safety was supported and warranted further study.

Using a random selection of Michigan nurses (*N*=276), Manojlovich and Laschinger (2007) tested a modification of the NWLM by adding structural empowerment (measured by the Conditions of Work Effectiveness-II) and evaluating its impact on the five practice environment elements along with job satisfaction. According to Manojlovich and Laschinger, structural empowerment was a construct developed by Kanter that was based on the study of industrial managers who were found to be more productive and happier with their work when provided with opportunity, and power through access to information and resources. Findings supported that strong leadership had a significant direct effect on the same three elements of the NWLM identified by Laschinger and Leiter (2006) as well as an indirect effect on nursing model of care and job satisfaction. Of importance was that the additional variable, structural empowerment, also had a direct effect on both nurse leader ability and job satisfaction.

Laschinger (2008) continued work on the NWLM and extended the model to evaluate the impact of structural empowerment (measured by the CWEQ-II) on nurse perception of quality of care, measured using a one-item scale developed by Aiken and Patrician (2000). The one-item scale had response options from one to four (a high score indicating excellent quality). A sample of Canadian nurses (*N*=237) from acute care hospitals were used to fit two separate models; (1)structural empowerment using the CWEQ-II, the practice environment scales (PES), and work satisfaction (Hackman and Oldham's Job Diagnostic; and (2) the same elements using nurse perceived quality of care in place of work satisfaction. The PES was used to evaluate the elements of the NWLM (e.g., adequate staffing, involvement in hospital affairs,

etc.) to job satisfaction or nurse perceived quality of care. Laschinger found that structural empowerment was mediated by the practice environment on both work satisfaction and nurse perception of quality; findings also validated the impact of structural empowerment on nurse leadership and nurse satisfaction identified by Manojlovich and Laschinger (2007) reported above.

Catheter Associated Urinary Tract Infection (CAUTI) Incidence and Prevention.

Research on CAUTI prevention and diagnosis is voluminous with more than 250 studies ranging from catheter type to protocols for catheter management that are listed on the CDC website. For the purpose of this study the literature review will focus on patient outcomes related to the incidence of CAUTI along with nursing practice that impacts CAUTI.

As noted in Chapter 1, the financial impact per case of CAUTI is low compared to the other hospital-associated infections (HAIs); however, CAUTI is one of the leading causes of secondary nosocomial bloodstream infections. Approximately 75% of hospital UTIs are associated with indwelling catheters (Centers for Disease Control, n. d.). Additionally, CAUTI is considered one of the nurse-sensitive indicators as nursing practice has an impact on its prevention. Data from the CDC indicated that the 2011 median CAUTI rate in adult medical and surgical critical care units was approximately 2.0 per 1000 catheter days with higher rates in Neurological (Neuro) Intensive Care Units (ICUs) and Burn ICUs. In adult medical, surgical, and medical-surgical combined inpatient units the median rate was 0.8-1.0 per 1000 catheter days. While improvements are being made, CAUTI prevention is still a concern for patients in acute care hospitals.

One of the issues in studying CAUTI rates has been the ability to garner a sample large enough to do meaningful analyses. Simon, Klaus, and Dunton (2009) analyzed the CAUTI

prevalence in the ICU using the second quarter 2008 NDNQI® data. Based on these data, the pooled median CAUTI rate was 2.6 per 1000 catheter days with a catheter utilization rate of 75% in the ICU. In a 20-bed ICU, this equates to 15 catheters per day and a CAUTI rate of 1.0 per month.

Modifiable risk factors and evidence-based guidelines for prevention have been defined by the CDC. The primary modifiable risk factor for symptomatic urinary tract infection (SUTI) is prolonged catheterization. The primary modifiable risk factors for bacteruria are disconnection of the drainage system and improper training of the inserter (CDC-CAUTI Toolkit, n.d.). The core preventive measures include the following: (a) insert catheters only for appropriate indications; (b) leave catheters in place only as long as needed; (c) only properly trained persons insert and maintain catheters; (d) insert catheters using aseptic technique and sterile equipment; (e) maintain a closed drainage system; (f) maintain unobstructed urine flow; and (g) use hand hygiene and standard (or appropriate isolation) precautions.

While these guidelines have been available since 2009, universal adoption has not followed. Conway, Pogorzelska, Larson, and Stone (2012) conducted a survey to assess implementation of the guidelines and other evidence-based recommendations in ICUs using National Healthcare Safety Network (NHSN) participating hospitals. With 415 ICUs responding to questions regarding adoption of the recommendations, policy adoption was less than optimal with only 26% ($n = 106$) reporting policies supporting bladder ultrasound, 20% ($n=82$) reporting the use of condom catheters, 12% ($n= 51$) reporting use of catheter removal reminders, and 10% ($n= 39$) reporting nurse-initiated catheter discontinuation.

Research on nurse-driven practice in CAUTI prevention has demonstrated some success, but the majority comes from quality improvement studies. Fuchs, Sexton, Thornlow, and

Champagne (2011) tested a nurse-driven protocol for catheter removal and found a decreased

CAUTI incidence from 2.88 per 1000 catheter days to 1.46 per 1000 catheter (p=.068). In a

quality improvement study in non-ICU units in a 804-bed tertiary teaching hospital, Fakih, Rey,

Pena, and Szpunar (2013) tested three different interventions over a 5-year period and were able

to demonstrate a significant (linear regression with time as independent variable, R^2= 0.61; $p <$

.0001) reduction in catheter days from17.3% to 12.7%. The nursing protocol involved screening

for both the necessity of placement and early removal. An additional intervention was done that

included catheter-necessity guidelines for physicians. Fakih and colleagues also surveyed the

nurses to ascertain perception of nurses regarding who was responsible for assessing catheter

necessity. Of the 227 nurses who responded, 97.8% felt that the direct care nurse was

responsible or partially responsible for this assessment. Fakih et al. attributed nursing

accountability as the over-all success in large part due to the nurse ownership of the process.

Gokula, Smolen, Gaspar Hensley, Benninghoff, and Smith (2012) reported on the

implementation of a multidisciplinary team approach (i.e., physician/geriatrician, academic

nurse educator, infection prevention nurse, and clinical nurse specialists) for a urinary catheter,

insertion, removal and maintenance protocol. Monitoring, education, and hands-on competency

demonstration over the course of several years led to significant reduction in CAUTI rates.

Implementation struggled until forms were simplified and a nurse-driven system was developed.

Following full implementation of the training and the nurse driven system, hospital acquired

urinary tract infections decreased from 2.21 per 1000 patient days in January 1 to April 30, 2007

to 0.87 per 1000 patient days in November 1 to December 31, 2009 and 0.435 per 1000 patient

days in 2011.

Using 2006 nurse survey data (i.e., the Pennsylvania Healthcare Cost Containment Council Report on hospital infections) and the American Hospital Association Annual survey, Cimiotti, Aiken, Sloane, and Wu (2012) studied the association of burnout (emotional exhaustion subscale from the Maslach Burnout Inventory Human Services Survey) with urinary tract infection (UTI) and surgical site infection (SSI) rates. A high burnout rate was defined as a score $\geq$ 27, the normal score identified for healthcare workers (Cimiotti et al.). A hospital score for burnout was created (i.e., taking the proportion of nurses with a high burnout score and multiplying by 10) in order to report regression coefficients as changes in infection rate with a 10% change indicating burnout (Cimiotti et al.). The study included 161 hospitals with 7,076 RNs. Cimiotti and colleagues reported infection rates of 8.6 per 1000 patients for UTI and 4.2 per 1000 patients for SSI. Using least squares regression models, nurse burnout was found to be strongly associated with both UTI (.82; $p=.02$) and SSI (1.56; $p<.01$). It was estimated that by reducing burnout levels by 30% there was the potential to reduce the cases of UTI and SSI by 4,006 and 2,233, respectively.

Summary

The practice environment that supports professional nursing practice has been found to have a positive impact on nurses' job satisfaction and to some extent on patient quality outcomes (e.g., mortality, HAIs, etc.). From the literature review, nurse-to-patient staffing ratios along with the impact of the practice environments could play an important role in prevention of HAIs. Nurse involvement and ownership have been found to be instrumental in implementation of practices important to CAUTI prevention.

Research to date testing the NWLM in relation to patient outcomes has used data at the individual nurse level based   on survey data that included nurses' perception of adverse events

to evaluate the association of the practice environment to quality and safety outcomes. No studies have reported testing the model using data aggregated to the unit-level and incorporating patient outcomes that are directly measured. The proposed studies add to the literature by evaluating the unit-level data from a national nurse sample collected by NDNQI® that included measures that reflect the practice environment (PES) and personal accomplishment (job enjoyment) of the NWLM along with actual incidence of CAUTI. Evaluation of the CAUTI rate associated with the NWLM elements that comprise the practice environment as a unit level phenomenon will provide insight into another potential area for emphasis in prevention of CAUTI.

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CHAPTER THREE

Evaluation of Elements of the Nursing Worklife Model Using Unit Level Data

This manuscript was accepted for publication by the *Western Journal of Nursing Research* (in press). Co-authors include Diane Boyle, PhD, RN and Marjorie Bott, PhD, RN.

A description of the analyses using SEM to fit the NWLM to a data extract from the 2011 NDNQI® RN Satisfaction Survey is provided. Unit level data from medical, surgical, combined medical-surgical, stepdown, and critical care unit types were used to fit the model. Modifications to improve model fit to the unit level data are described. Clinical implications and recommendations for further research are included.

Abstract

The practice environment is important to nurse satisfaction and patient outcomes. Laschinger and Leiter (2006) posited causal relationships by development and testing of the Nursing Worklife Model (NWLM).

Using a secondary analysis of unit-level data ($N = 3,203$); medical, surgical, medical. surgical, critical-care and step-down units) from the 2011 National Database for Nursing Quality Indicators®, hypothesized pathways of the NWLM were tested using structural equation modelling. Practice Environment subscales (PES) developed by Lake (2002) were used to operationalize model variables with Job enjoyment being the outcome variable.

 Positive pathways identified in the original causal model were supported. However, using an iterative process, additional pathways were identified that improved model fit (*CFI*=0.99; *RMSEA*=0.06; *SRMR*=0.002). Nurse manager ability, leadership, and support had direct links to job enjoyment as well as other elements of the model. Development of nurse managers is important to the retention of clinical nurses in the hospital setting.

Key Words: Nursing Worklife Model, Practice Environment, NDNQI® Data

Evaluation of Elements of the Nursing Worklife Model Using Unit Level Data

The nurses' practice environment has been identified as important to patient outcomes, nurse's perceived quality, and registered nurse (RN) satisfaction (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002; Laschinger, 2008; Patrician, Shang, & Lake, 2010). As Beurhaus (2008) identified, inclusion of nurse-sensitive indicators of the practice environment by the National Quality Forum (NQF), the Joint Commission (TJC), the Agency for Healthcare Research and Quality (AHRQ), and the Centers for Medicare and Medicaid Services (CMS) indicates recognition of the practice environment's importance to quality of care delivery. In spite of the current easing of the nursing shortage due to economic pressures keeping older nurses on the job, retirement of the "baby boomers" (Auerbach, Buerhaus, & Staiger, 2014) coupled with predicted job growth for Registered Nurses (RNs) still creates a concern that a shortage of nurses will continue over the next decade (McMenamin, 2014). With 56% of nurses working in hospitals (Budden, Zhong, Moulton, & Cimiotti, 2013), the study of the relationships and processes that impact RN job satisfaction in the hospital practice environment is important in order to retain nurses in the hospital setting.

Since the seminal research in the early 1980s that identified characteristics of hospitals deemed Magnet Hospitals, the characteristics and impact of the practice environment and measurement of the contributing components have become an important research focus (McClure & Hinshaw, 2002). Instruments such as the Practice Environment Scale of the Nursing Work Index (Lake, 2002), Condition for Work Effectiveness II (Laschinger, Finegan, Shamian, & Wilk, 2001), and the Essentials of Magnetism II (Kramer & Schmalenberg, 2008),

have been developed to measure practice environment characteristics with good evidence of reliability and validity.

As noted by Kramer, Schmalenberg, Brewer, Verran, & Keller-Unger (2009) attributes of the practice environment are group/unit level phenomena. Study of the practice environment at the unit level with large samples has been limited. This study will examine the fit of the Nursing Worklife Model posited by Leiter and Laschinger (2006) using elements of the practice environment with unit level data from the National Database for Nursing Quality Indicators ® (NDNQI®).

NWLM

Leiter and Laschinger (2006) proposed and tested a causal Nursing Worklife Model (NWLM) that explored the relationships among five practice environment elements (strong nursing leadership, RN/MD collaboration, policy involvement, staffing adequacy, and a nursing model of care) on emotional exhaustion and depersonalization (burnout) and personal accomplishment (see Figure 3.1, p. 54). In the NWLM strong leadership was identified as the starting point of the model with positive direct pathways to RN/MD collaboration, policy involvement, and staffing adequacy. The positive pathway to nursing model of care from strong leadership was mediated by policy involvement and RN/MD collaboration. Nursing model of care had a positive pathway to staffing adequacy. Strong leadership influence on personal accomplishment was mediated by pathways through RN/MD collaboration, policy involvement, and nursing model of care. Strong leadership also had an indirect link to emotional exhaustion and depersonalization (burnout) via staffing adequacy (Leiter &Laschinger, 2006, p. 142). In summary, the NWLM was confirmed to depict the hypothesized associations of measured elements of the nurse practice environment.

Figure 3.1. Leiter and Laschinger (2006) Nursing Worklife Model
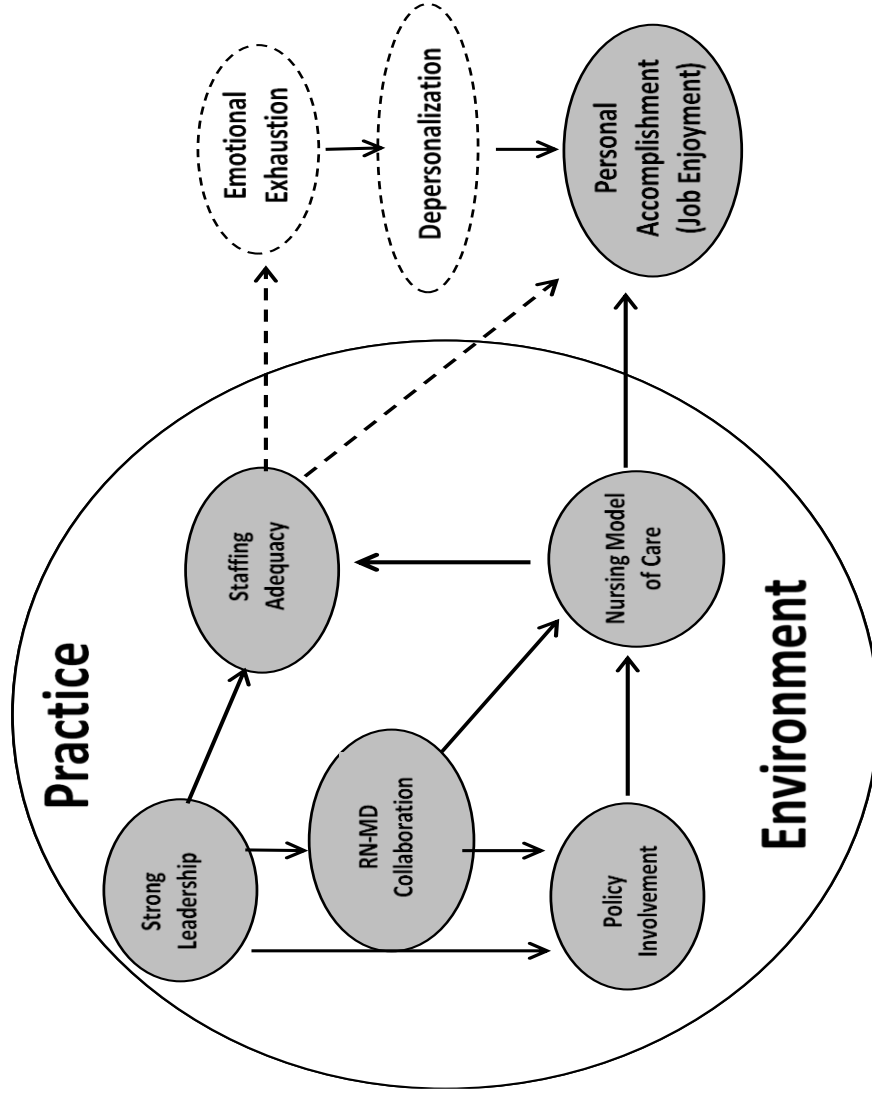
Note: **Emotional Exhaustion and Depersonalization not included in current study yielding a direct pathway from Staffing Adequacy to Personal Accomplishment**

Source. Adapted from Leiter and Laschinger (2006, p. 139). Copyright 2006 by Lippincott Williams & Wilke

Conceptually the five elements measuring the practice environment were defined based on Lake's (2002) Practice Environment Scale (PES) derived from the Nursing Work Index (NWI). Nursing leadership (PES-Nurse manager ability, leadership and support) was identified as the ability to garner and manage resources and processes needed to deliver care. RN/MD collaboration (PES-Collegial RN-MD relationships) reflected the over-all quality of the working relationship between the two disciplines, nurses and physicians. Policy involvement (PES-Nurse participation in hospital affairs) was defined as the extent nurses were involved in decision making with an impact on hospital administration. Nursing model of care (PES-Nursing foundation for quality care) reflected the presence and support for a nursing model of care rather than a medical model of care. Staffing adequacy (PES-Staffing and resource adequacy) was a measure of the perception of the nurse that resources were available to meet patient care demands. The inter-relationships of these elements that provide a supportive practice environment were posited to influence or decrease burnout and in turn increase a sense of personal accomplishment or nurse engagement in their work (Leiter & Laschinger, 2006).

To date, the NWLM has been studied using nurse survey data tested at the individual nurse level (Laschinger & Leiter, 2006; Leiter & Laschinger, 2006; Manojlovich & Laschinger, 2007; Laschinger, 2008). Since nurses work together within a unit structure within the hospital, testing the model at the unit level will extend the understanding of the model as a unit-level phenomenon.

Kramer, Maguire, and Brewer (2011) noted studies at the work unit level are essential because the practice environment is the aggregate of the conditions and processes that create it. Kramer et al. (2011) in a large national study (N=717 units, 12,223 experienced nurses) in 34 Magnet hospitals (equally distributed by geography, size, and type) found that the most

important correlates to the presence of a healthy practice environment were measured best at the unit level and were dependent on "the support, leadership and empowerment of visionary leaders" (p. 15). Development of an excellent practice environment is a dynamic process due to an inter-play of both human and process factors. With the development of valid and reliable measures of the processes, further study is needed at the unit level: (a) to identify the interrelationships among the elements of the practice environment and (b) to evaluate the influence of the elements within the NWLM on a sense of personal accomplishment that is measured in this study by the Job Enjoyment Scale (JES).

Leiter and Laschinger (2006) used eight items from one of three subscales of the Maslach Burnout Inventory-Human Service Scale (MBI-HSS) to operationalize Personal Accomplishment. The JES, used for this study, encompasses items of a similar nature to the items depicted in the Personal Accomplishment subscale. For example, two of the items from the personal accomplishment subscale, "I feel I am positively influencing other people's lives through my work" and "I feel very energetic" demonstrate positive aspects of the work environment (Maslach & Jackson, 1981) and capture similar concepts to the JES items, " Find real enjoyment in their work" and "Are enthusiastic about their work every day." No tested variables from the NDNQI® survey measure concepts similar to emotional exhaustion or depersonalization, so these variables will be excluded from our analysis. Our exploration will add to the literature regarding dynamics of positive practice environments on job enjoyment as a unit-level phenomenon and sets the stage for further evaluation that could include unit-level patient outcomes.

We conducted a unit-level, secondary analysis of a large national sample (hospitals from all census divisions) of Registered Nurses (RNs) who participated in the 2011 RN Survey

conducted by the NDNQI® to evaluate the relationships of the five elements of Leiter and Laschinger's Nursing Worklife Model (NWLM) with RN Job Enjoyment, a proxy measure of Personal Accomplishment. The PES was used to measure elements of the practice environment from data collected from nurses who worked on medical, surgical, medical/surgical, intensive care, or step-down units. Using structural equation modelling (SEM), we tested the pathways of Leiter and Laschinger's (2006) NWLM at the unit level using the PES elements of nurse manager ability to lead; collegial RN-MD relations; involvement in hospital affairs; staffing and resource adequacy; nursing foundations for quality of care; with the job enjoyment scale.

Prior Tests of the NWLM

Leiter and Laschinger (2006) tested their model in a secondary analysis of a large data set of surveys from Canadian nurses (N= 8,597) using structural equation modeling (SEM). Their study sample was a subset from a larger study, International Survey of Hospital Staffing and Organization of Patient Outcomes (Aiken et al., 2001). Strong leadership was found to be a driving force with direct effects on three elements—RN/MD collaboration, policy involvement, and staffing adequacy—with an indirect effect on personal accomplishment via nursing model of care, and emotional exhaustion via staffing adequacy. The model was supported and confirmed, using a split sample to test the hypothesized model ($\chi2_{(340\ df\ =}$3,355.40; $p < .001$; *CFI*=.923; and $\chi2_{(1,152\ df}$=3,355.40; $p<.001$; *CFI*=905, respectively) (Leiter & Laschinger, 2006, p. 142).

To evaluate the impact on patient outcomes, Laschinger and Leiter (2006) extended the model using the same sample used by Leiter and Laschinger (2006) and included the nurse reported frequency of occurrence of patient adverse events (i.e., falls, nosocomial infections, medication errors, and patient complaints). Frequency of adverse events ranged from 1 (never)

to 4 (frequently). The hypothesized model added paths from emotional exhaustion, depersonalization and personal accomplishment to adverse events. The model with the best fit to the data indicated significant paths as hypothesized with added pathways for staffing adequacy (-.13), a nursing model of care (-.25), personal accomplishment (-.27), emotional exhaustion (-.08), and depersonalization (-.08) (as measured by the three subscales of the Maslach Burnout Inventory-Human Service Scale) to the perceived adverse events ($\chi2_{(1344\ df)}$ =16,438.19; $p < .001$; *CFI*=.908; *RMSEA* =.037).

Manojlovich and Laschinger (2007) tested a modification of the NWLM using a random selection of Michigan nurses (*N*=276) to evaluate structural empowerment on the elements of the strong leadership in the NWLM as well as the relationship to job satisfaction as measured by the Index of Work Satisfaction. Findings supported that structural empowerment, as measured by the Conditions of Work Effectiveness Questionnaire-II (CWEQ-II), had a direct effect on nurse leadership ability and job satisfaction. The NWLM was supported with strong leadership demonstrating a significant direct effect on the same three elements of the NWLM model identified by Leiter and Laschinger, with an indirect effect of strong leadership on nursing model of care and job satisfaction.

The NWLM was tested by Laschinger (2008) and extended to include structural empowerment with nurse perception of quality of care and nurse work satisfaction in two separate models using Canadian nurses (*N*=237) from acute care hospitals. Linkages were examined between structural empowerment using the CWEQ-II, the practice environment scales (PES), and work satisfaction (Hackman and Oldham's Job Diagnostic Survey) in one model. A second model substituted nurse perception of quality of care measured by a 1-item scale (1–4 range with a high score indicating excellent quality) for nurse work satisfaction as the outcome

variable. Laschinger found the practice environment characteristics mediated the relationship between structural empowerment for both nurse work satisfaction and perception of quality patient care. The indirect impact of nursing leadership on nursing model of care and job satisfaction identified by Manojlovich and Lachinger (2007) was supported in the final model.

The analysis of the NWLM included data from nurses that were analyzed at the individual level and not the unit level. Consequently, testing and confirming the relationships at the unit level is important prior to extending the work to include patient outcomes that are measured at the unit level within the NDNQI®.

Methods

Design

Our study was a correlational, secondary analysis of NDNQI® data to test an *a priori* model using structural equation modeling (SEM) to evaluate the fit of the model to the unit level data. We tested the hypothesized pathways between strong leadership (PES-Nurse manager ability, leadership & support) and personal accomplishment (Job Enjoyment Scale) based on Laschinger's NWLM. Approval for the study was obtained from the Midwestern academic medical center Institutional Review Board. After approval, a de-identified data extract was obtained from NDNQI® research team.

The data were aggregated to the unit level after using case selection to obtain a data set that included acute care hospitals, adult unit types (medical, surgical, medical-surgical, critical care, and stepdown) with a minimum unit level response rate of 40%. In addition, case selection was used to select hospitals that chose the survey option that included the PES. After aggregation to the unit level there were no missing data for variables used in the model analysis.

Setting and Sample

RNs from units were included in our sample if they participated in the PES version of the 2011 NDNQI® RN Survey and their respective unit-level response rate was at least 40% of eligible RNs. A unit sample with at least 40% participation is adequate to measure psychometric properties for unit specific scales (Kramer, Schmalenberg, Brewer, Verran, & Keller-Unger 2009). Only adult in-patient medical, surgical, medical/surgical, intensive care, and step-down units in acute care hospitals were included.

Of the 3,203 inpatient units, the largest percentage was medical-surgical ($n = 848$; 26.5%) with critical care as the second largest ($n = 753$; 23.5%). Medical ($n = 589$; 18.4%), step-down ($n= 553$; 17%) and surgical ($n = 468$; 14.6%) made up the remaining units. Size of hospitals covered a wide range from less than 100 beds (5.9%), 100-199 (19.3%), 200-299 (22.5%), 300-399 (18.9%), 400-499 (13.2%), to greater than 500 beds (20.2%). Thirty-seven percent of hospitals were Magnet® designated and 95.6% were located in a metropolitan area. Hospitals were primarily not-for-profit (83.6%) with government supported hospitals accounting for 11%, and the remaining 5.4 % were for-profit hospitals. All census divisions in the United States were represented in the sample (New England 4.8%, Mid-Atlantic 13.8%, East North Central 15.5%, West North Central 5.5%, South Atlantic 24.7%, East South Central 4.7%., West South Central 12.5%, Mountain 9.8%, Pacific 8.5%).

To be eligible to participate in the 2011 NDNQI RN Survey, RNs must have spent at least 50% of their time providing direct patient care and must have had a minimum of three months employment in their current unit. Our sample included 78,881 RNs from 3,203 units. The sample was predominantly female ($n=77,213$, 88.3%) and white ($n=76,881$, 66.6%), with a mean age of 39 ($n=71,731$, $SD = 11.1$). Among the five units types, an average of 58% reported

nurses with a Baccalaureate or higher degree (*range* $= 0 - 100\%$), and an average of 63%

(*range* $= 30\text{-}96\%$) reported nurses certification by a national nursing association.

Measures

     PES. Variables from Lake's (2002) PES were used to operationalize the work

environment concepts posited in Laschinger and Leiter's (2006) NWLM. The PES subscales

used in the analysis were as follows: (a) Nurse manager ability, leadership, and support; (b)

Collegial RN-MD relationships; (c) Nurse participation in hospital affairs;(d) Staffing and

resource adequacy; and (e) Nursing foundations for quality care. Table 3.1 provides the

conceptual and operational definitions of the variables. All PES items are Likert-type with four

response options ranging from strongly disagree (1) to strongly agree (4). For each of the PES

subscales, item scores were summed and averaged, dividing by the number of items, to

calculate the mean subscale score. All PES subscales had demonstrated reliability ranging from

.82 to .87 (Patrician, Shang, & Lake, 2010). Findings from a multilevel confirmatory factor

analysis supported convergent, discriminant, and criterion-related validity at both the unit and

individual RN level (Gajewski, Boyle, Miller, Oberhelman, & Dunton, 2010). Reliability of the

PES sub-scales was re-calculated using unit level data with a Cronbach's alpha on each subscale

ranging from .94 to .96 as noted in Table 3.1. Confirmatory factor analysis for each of the PES

subscales was conducted using SEM with the *CFI* ranging from .91 to 1.00 across the subscales

with the exception of Nurse participation in hospital affairs subscale (*CFI* =0.85). Subsequently,

the measured subscales were used in the analysis rather than the measured items and the latent

variables.

Table 3.1.

Theoretical definitions, number of items and Cronbach's alpha of the PES subscales and Job

Enjoyment Scale

Variable	Nursing Worklife Model	Definition	Items	*Cronbach's Alpha*
Nurse Manager Ability, Leadership, & Support	Strong Leadership	Nursing manger viewed as a leader who provides strong support	5	.95
Collegial RN-MD Relationships	RN-MD Collaboration	Presence of collaborative working relationships	3	.95
Participation in Hospital Affairs	Policy Involvement	Policy development and decisions about practice	9	.95
Staffing & Resource Adequacy	Staffing Adequacy	Staffing level is adequate to provide the care needed	4	.96
Nursing Foundations for Quality Care	Nursing Model of Care	Nursing practice is supported by high standards, professional nursing philosophy, education, expectation of competency, and measurement of quality	10	.94
Job Enjoyment Scale	Personal Accomplishment	Measurement of general job enjoyment	7	.97

JES. Job Enjoyment served as a proxy measure for personal accomplishment in the

NWLM and was measured by the Job Enjoyment Scale (JES), a 7-item scale that uses 6-option,

Likert-type responses ranging from strongly disagree (1) to strongly agree (6) (Taunton et al.,

2004). Taunton and colleagues (2004) modified the stem to capture workgroup level

perceptions with the following phrasing, "Nurses with whom I work would say . . . ."

Reliabilities ranged from .91 to .97 at the workgroup level for the JES (Boyle et al., 2006).

Cronbach's alpha for the current study sample at the unit level was .97 with the confirmatory

factor analysis *CFI* of .94. Five questions evaluate perception of positive aspects of the unit and

over-all enjoyment with work (Example: "Nurses with whom I work would say that they: 1) are

enthusiastic about their work … 2) find real enjoyment in their work"), two items evaluate

negative perceptions ("have to force themselves to come to work" and "feel that each day will never end" (Brayfield & Rothe, 1951; Taunton et al., 2004).

Data Analysis

In the first step of the analysis one way analysis of variance (ANOVA) using SPSS version18.0 (2009) was used to evaluate differences related to hospital characteristics (i.e., bed size, hospital type, teaching status and Magnet ® status) and unit type. Although significant differences were found due to large sample size, the mean differences were not meaningful and the corresponding effect sizes were negligible; consequently, these characteristics were not controlled in the model testing.

As recommended by Raykov and Marcoulides (2006), model fit was evaluated using incremental and absolute fit indices, Comparative Fit Index (*CFI*), Root Mean Square Error of Approximation (*RMSEA*), and Standardized Root Mean Square Residual (*SRMR*). Because Chi-square tests are sensitive to large sample sizes, Chi-Square is evaluated based on the improvement between models. Ranges for acceptable fit of the hypothesized model to the data are *CFI* > .90, *RMSEA* < .08, and *SRMR* < .08 (Hooper, Couglan & Mullen, 2008). The objective was to evaluate the paths of the *a priori* model posited by Leiter and Laschinger (2006) with unit level data. A sample size of at least 100 cases is considered adequate for SEM (Raykov & Marcoulides, 2006). The sample for this study, 3203 nursing units, was more than adequate for conducting SEM. Modification indices from MPlus program were evaluated along with theoretical indications to assess potential improvement of model fit to the unit level data (Hooper, Couglan & Mullen, 2008).

Results

Table 3.2 presents the means for the Practice Environment subscales (PES) and the Job

Enjoyment Scale (JES) by unit type. There were minimal differences in the means across all

subscales. Workgroups reported their job enjoyment in the moderate range across all unit types,

(M =3.22 to 3.31) (see Table 3.2). Job enjoyment was highest in the medical-surgical units (M =

3.31) and lowest in critical care and /surgical units (M = 3.22). All variables were moderately to

highly correlated (r = .50 - .87) (see Table 3.3).

Table 3.2.

Summary Statistics for PES Subscales and Job Enjoyment by Unit Type and Total Sample

Variable	Medical-Surgical M/SD	Medical M/SD	Surgical M/SD	Critical Care M/SDN	Step-down M/SD	Total Sample M/SD
Nurse Manager Ability, Leadership & Support	2.05/.34	2.02/.36	2.03/.31	2.11/.36	2.05/.37	2.06/.35
Collegial RN-MD Relationships	2.06/.25	2.03/.26	2.00/.26	1.97/.26	2.03/.34	2.02/.26
Participation in Hospital Affairs	2.16/.29	2.11/.29	2.13/.26	2.24/.21	2.15/.27	2.16/.29
Nursing Foundations for Quality Care	1.91/.22	1.89/.21	1.89/.19	1.96/.21	1.90/.21	1.91/.21
Staffing & Resource Adequacy	2.46/.39	2.41/.37	2.40/.36	2.29/.36	2.40/.38	2.39/.37
Job Enjoyment	3.31/.55	3.23/.58	3.22/.53	3.22/.54	3.28/.54	3.26/.55

Key: *M*=Mean; *SD* = Standard Deviation

Table 3.3.

Correlations among Job Enjoyment Scale and the PES subscales

|	JES	PES-NM	PES-RN-MD	PES-HA	PES-QC
PES-NM Ability, Leadership & Support	.75	-	-	-	-
PES Collegial RN-MD Relationships	.61	.50	-	-	-
PES-Participation in Hospital Affairs	.75	.76	.58	-	-
PES- Nursing Foundation for Quality Care	.76	.75	.64	.87	-
PES-Staffing & Resource Adequacy	.86	.65	.56	.70	.72

Source: Data is average score of unit level responses from the 2011 NDNQI® RN Satisfaction Survey Practice Environment Scale (PES) and Job Enjoyment Scale (JES).

Key: JES=Job Enjoyment Scale; PES-NM=Nurse Manager Ability, Leadership & Support; PES-RN-MD=Collegial RN-MD Relationships; PES-HA=Participation in Hospital Affairs; PES-QC=Nursing Foundations for Quality Care; PES-SR=Staffing and Resource Adequacy.

Using MPlus 7 (Muthén & Muthén, 1998-2012) the *a priori* Leiter and Laschinger (2006) model was specified with the hypothesized positive relationships among nurse manager ability, leadership and support; collegial RN-MD relationships; nurse participation in hospital affairs; nursing foundation for quality care, and staffing and resource adequacy to job enjoyment as indicated in Figure 3.1. Model fit was acceptable with the exception of the RMSEA ($\chi2_{(6\,df)}$=914.10, $p < .001$; *CFI*=0.95; *RMSEA*= 0.217 [*95% CI* 0.206-0.2293]; *SRMR*=0.048; *adjusted Bayesian Information Criterion [BIC]* =-7736). Because the criterion for the RMSEA was exceeded, modification indices suggested potential improvement in model fit and were evaluated based on theoretical congruence. Through an iterative process, the following pathways were added to the model: (a) direct paths from nurse manager ability, leadership and support and collegial RN-MD relationships to the job enjoyment scale; (b) a direct path from nurse manager ability, leadership and support to nursing foundations for quality

care; and (c) direct paths from collegial RN/MD relationships and nurse participation in hospital affairs to staffing and resource adequacy (see Figure 3.2). With the addition of these pathways, the model fit to the data improved for all fit indices ($\chi2_{(1\,df)} = 13.35$, $p < .001$; *CF I*=0.99; *RMSEA* 0.06 [95% *CI* = 0.035-0.094]; *SRMR* = 0.002; *adjusted BIC* = -8612). Standardized path coefficients are presented in the model (see Figure 3.2) and all are significant (*p*<.001).

Figure 3.2. Results for Final Nursing Worklife Model of Job Enjoyment
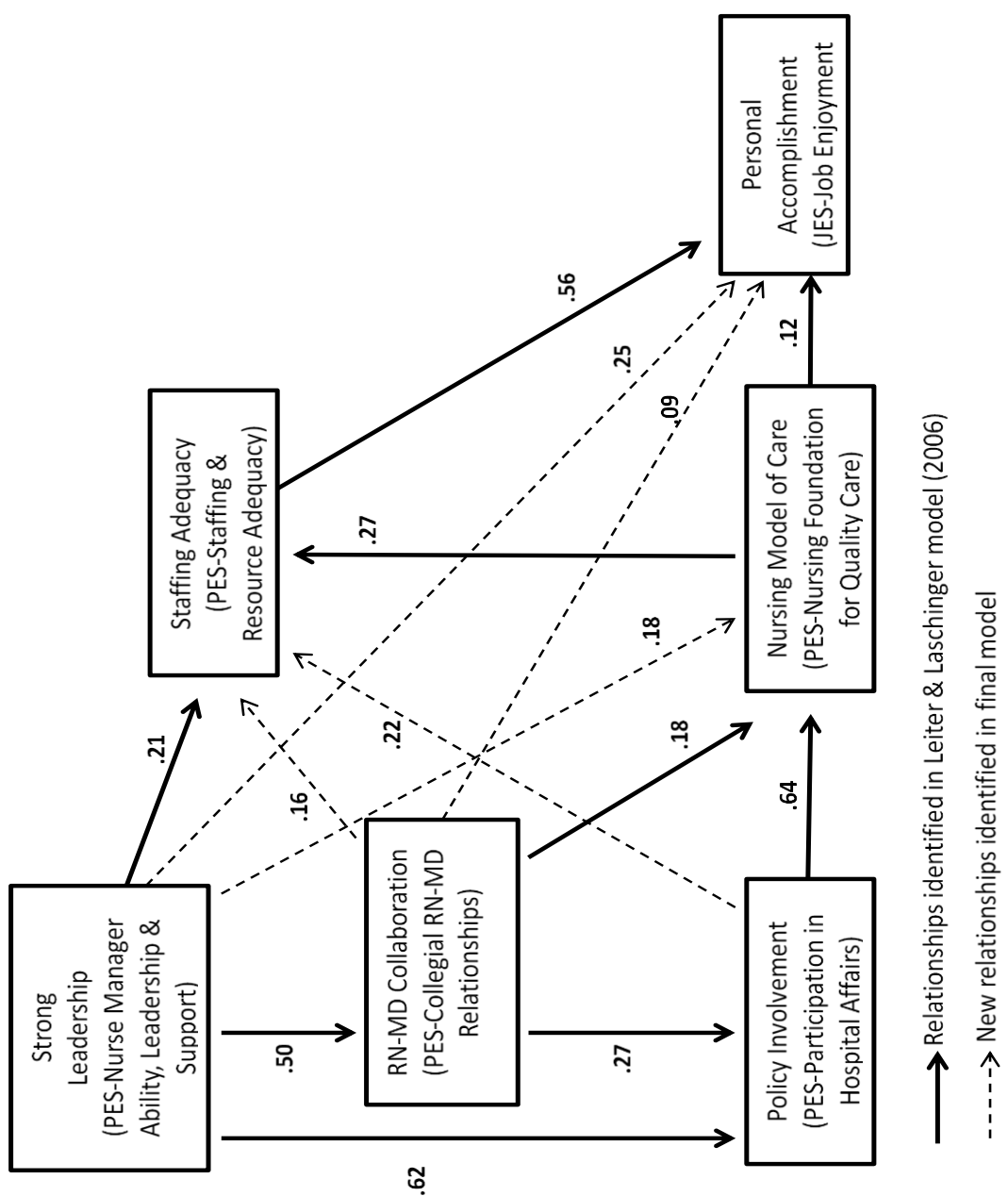
Discussion

The practice environment is a complex system with many interrelated factors. Scales developed and used by previous researchers have provided valid and reliable tools to measure the elements of the practice environment (Lake, 2002; Laschinger, Finegan, Shamian, & Wilk, 2001; Kramer & Schmalenberg, 2008; Taunton et al., 2004). Leiter and Laschinger (2006) posited a model to explain the relationship of the identified variables along with the impact on nurse burnout. This secondary analysis was done to test the model at the unit level with a large national sample of nursing units across a wide variety of hospitals in the United States. Further understanding of unit level dynamics can assist in developing processes that can affect the practice environment and potentially patient outcomes.

In our study, subscales of the PES were used as proxy measures of the components of the NWLM as identified in Table 3.1. The job enjoyment scale served as a proxy measure for Personal Accomplishment in the NWLM. The concept of burnout was not addressed in this analysis because a measure of burnout was not available in the data used for the secondary analysis; however, the remaining relationships were explored. The findings of the path analysis at the unit level are supportive of earlier tests of the NWLM at the individual nurse level of analysis, but also provided support for other relationships in the model when job enjoyment was used to represent personal accomplishment (Leiter & Lachinger, 2006; Laschinger & Leiter, 2006; Manojlovich & Lachinger, 2007; Laschinger, 2008).

Additional pathways added to the model were theoretically congruent with other findings from the literature. At the unit level, the pathways added from nurse manager ability, leadership, and support to nursing foundations for quality care and job enjoyment support other findings related to the influence of the nurse manager on the practice environment and job

enjoyment (Lucas, Laschinger, & Wong, 2008; McDonald, Tullai-McGuinness, Madigan, & Shively, 2010; Rivera, Fitzpatrick, and Boyle, 2011). These data also are congruent with the findings of Kramer and Schmalenberg (2008) that identified the nurse leader as the consistent element needed in development of a practice environment that is supportive of professional practice.

The direct relationship from collegial RN-MD relationships to job enjoyment is theoretically congruent with the work by Kramer and Schmalenberg (2008) regarding the importance of interdisciplinary relationships to a Magnet® culture and the importance of communication and teamwork to quality patient care. The path added from nurse participation in hospital affairs to staffing and resource adequacy aligns well with the work regarding the importance of shared decision making and control over nursing practice identified by Weston (2008). The results of nurse input into decisions regarding practice and care delivery systems is a culture of ownership of practice rather than task oriented care.

Previous studies of Leiter and Laschinger's model have maintained that the nurse manager ability, leadership, and support on job enjoyment (personal accomplishment) was mediated by the other elements in the model. Our study, the first to be conducted testing the NWLM using unit-level data, indicated that nursing leadership has a direct impact on job enjoyment of nurses on the unit. This supports the findings from the literature (Kramer & Schmalenberg, 2008; Laschinger & Leiter, 2006; McDonald, Tullai-McGuinness, Madigan, & Shively, 2010) of the key role of the nurse manager in development of a practice environment that supports direct care nurses and nurses' overall job enjoyment.

Understanding the contribution of the various elements of the practice environment adds to the knowledge needed to specify areas for interventions that can lead to a better practice

environment as well as increased job enjoyment for nurses working in that environment. Contrary to the previous research on the NWLM analyzed at the individual level, nurse manager leadership had a direct impact on nurses' job enjoyment—a new study finding. This is important for nurse managers as well as hospital administrators in the retention of nurses within the hospital setting.

Future research at the unit level should be expanded to include all potential unit types (e.g., labor and delivery, pediatrics, etc.) to evaluate the NWLM in various settings and to explore the associations with other patient outcomes. Adding measures that represent burnout (i.e., depersonalization and emotional exhaustion) will be important to replicate the entire model posited by Laschinger and Leiter (2006). Further study examining units with low scores on nurse manager leadership might provide insight into needs for manager development. Study of units with high scores for nurse manager leadership might provide insight into training or interventions that could inform orientation or education for new nurse managers.

Limitations

There were several limitations to this study. Selection bias is a limitation as 37% of hospitals that participated in the survey have achieved Magnet Designation, which is a much higher percentage than the national average of 7% in all hospitals across the U.S. (American Nurses Credentialing Center, 2014). The sample was not representative of all hospitals in the U.S., as hospitals under 100 beds or from non-metropolitan areas are under-represented. Although all data were collected at different time points throughout the year for each hospital, this study uses cross-sectional data that limits the inference of strong causality. The lack of elements to assess depersonalization or emotional exhaustion is a limitation to study of the model posited by Leiter and Laschinger (2006).

Strengths of the study were the large national sample including hospitals from all census divisions, standardized definitions of variables, and standardized data collection processes. In spite of the limitations, this study adds support for the NWLM as a model that represents the practice environment of the direct care nurse in acute care settings. Further study regarding the relationships of the practice environment elements that provide the best support for direct care nurses is warranted as well as testing a model that includes measured patient outcomes.

Acknowledgement

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CHAPTER FOUR

Nursing Worklife Model: A Predictive Model of Catheter Associated Urinary Tract Infection at the Unit Level

This manuscript to be submitted to *Nursing Research.* Co-authors will be Byron Gajewski, PhD, Shin Hye Park, PhD, RN, Peggy Miller, PhD, RN, Sue Popkess-Vawter, PhD, RN, and Marjorie J. Bott, PhD, RN

The manuscript describes the methodology using SEM to fit an *a priori* model (modified Nursing Worklife Model of Job Enjoyment) at the unit level to an outcome measure, catheter associated urinary tract infection (CAUTI) rate. Data extracts were obtained from the National Database for Nursing Quality Indicators® (NDNQI®) for the 2012 RN Survey and Quality database to fit the modified NWLM that included CAUTI rate as the outcome variable of interest. This manuscript describes the analysis and outcome of the secondary analysis that supported an inverse relationship of job enjoyment to CAUTI rate and the positive relationship to hospitals with a bed size greater than 500 as well as academic medical centers.

Abstract

Background: Exploration of the Nursing Worklife Model (NWLM) with catheter associated urinary tract infections (CAUTI), an identified *never event,* is an important area for research. Care occurs at the work unit level where practice environments may vary. Study of relationships at the unit level with a measured clinical outcome extended previous hospital-level NWLM research.

Objectives: To validate the fit of a modified NWLM as a predictor of CAUTI rate at the work unit level.

Method: Secondary data analysis of a national sample (*N*=1106) of medical, surgical, and combined medical-surgical unit level data from the National Database for Nursing Quality Indicators® (NDNQI®), was conducted. Using structural equation modeling (SEM) a modified NWLM of job enjoyment was confirmed with the measurement of an outcome, CAUTI rate.

Results: An *a priori* model from previous work testing the modified NWLM at the unit level showed an excellent model fit (*CFI* =.995, *RMSEA*=.041 [*95% CI*=.028-.056]; *SRMR*=.020) to the NDNQI® data. The results revealed a significant negative pathway from job enjoyment to CAUTI rates (β= -.08). There were significant positive effects on CAUTI for hospital characteristics that included Academic Medical Centers (β=.13) and hospitals greater than 500 beds (β=.07), indicating both had higher CAUTI rates. Previous NWLM pathways among the elements of the practice environment were supported.

Discussion: The validated model using unit level data showed that the nurse practice environment might play a significant role in reducing negative clinical outcomes (i.e., CAUTI rates). The results demonstrated the importance of the unit practice environment based on the NWLM, for improving quality of care. In addition to attention on process and outcomes, strategies to support a culture of professional practice are indicated.

Key Words: Catheter Associated Urinary Tract Infection, Nurse Practice Environment, Job

Enjoyment, Nursing Worklife Model, Structural Equation Modeling

Nursing Worklife Model: A Predictive Model of Catheter Associated Urinary Tract Infection at the Unit Level

Patient outcomes in acute care settings have been identified as indicators of quality and have an impact on reimbursement. The Centers for Medicare and Medicaid (CMS) in the United States have developed policies that reward positive patient outcomes and penalize hospitals for poor outcomes, often referred to as *never events*, such as hospital acquired conditions considered preventable. The Institute of Medicine (IOM), identified the standard for *Patient Safety* as, ". . . care that is free from unintended injury from acts of commission or omission (p. *ix*)," (IOM, 2004). A research agenda that included identification of patients at high risk for injury or nosocomial infections (e.g., falls, ventilator associated pneumonia, catheter associated urinary tract infections, etc.) along with prevention strategies is identified in recommendation Six from the 2004 IOM report.

Hospital acquired conditions related to nosocomial infection are adverse patient events that have a significant impact on financial, morbidity and mortality outcomes (Umscheid et al., 2011; Zimlichman et al., 2013). The majority of acute care in the United States is in hospitals, which are complex systems comprised of interdisciplinary teams, varied practice environments, a wide range of socio-economic factors, and diverse cultures that may or may not be conducive to providing the high quality of care essential to reducing hospital acquired conditions (HACs). One of the most frequent HACs is catheter associated urinary tract infections (CAUTI) (Centers for Disease Control [CDC], 2010). Understanding the association of the professional practice environment, a major contributor to the complex environment where care occurs, with CAUTI rate is an important area for study.

Using the Nursing Worklife Model as the guiding framework (Leiter and Laschinger, 2006), the purpose of this study was to examine the relationships between elements of the nurse practice environment predictive of CAUTI at the unit level. A data extract from the 2012 National Database for Nursing Quality Indicators® (NDNQI®) RN Survey and CAUTI data elements from the Quality Outcomes data.

CAUTI

McNair, Luft, Andrew, and Bindman (2013) found that CAUTI along with in-hospital falls/traumas were the most commonly coded of the six definable HACs in an evaluation of 2008 Centers for Medicare and Medicaid Services (CMS) data from California. In a meta-analysis evaluating costs to healthcare organizations, conducted by CAUTI was one of the top five preventable nosocomial infections (Zimlichman et al., 2013). Among nosocomial infections, CAUTI has the lowest per case cost (Zimlichman et al., 2013) but the highest frequency, comprising 30% of reported infections, [Center for Disease Control (CDC), 2010].

According to CDC (2010) reports, CAUTI has been associated with increased morbidity, mortality, and higher hospital length of stay, and is one of the *never events* for acute care. Specific data on mortality related to CAUTI are difficult to parse out, but Conway and Larson (2011) identified that catheters were associated with 80% of reported hospital urinary tract infections (UTIs). Using a nationalized cohort of hospitalized adults, Daniels, Lee, and Frei (2014) reported that mortality odds were significantly greater ($p < .0001$) for patients with a CAUTI (3.9%) versus patients without a CAUTI (2.0%). In addition, 17% of hospital-acquired bacteremias have a urinary source with a reported mortality rate of 10% (CDC, 2010).

CAUTI prevention has focused on catheter type, reduction in catheter days, and nurse driven processes to facilitate early removal of catheters (Fakih, Rey, Pena, Szpunar, &

Saravolatz, 2013; Fuchs, Sexton, Thornlow, & Champagne, 2011; Simon, Klaus, & Dunton, 2009). With the increased attention to prevention, the incidence of CAUTI in intensive care units (ICUs) from 1990 to 2007 decreased from 19% to 67% depending upon the type of intensive care unit. The lowest rate of decrease was for cardio-thoracic ICUs, and the highest rate of decrease was for medical surgical ICUs (Burton, Edwards, Srinivasan, Fridkin, & Gould, 2011). In spite of the trend in decreased catheter usage, the CDC (2010) reported that deaths attributable to UTIs were 13,000 in the available 2002 CDC survey data.

Nursing has a critical role in prevention and reduction of CAUTI. CAUTI was endorsed by the American Nurses Association and the National Quality Forum as a nurse sensitive indicator of quality (Simon et al., 2009). Standardization of practice along with prevention has been studied, but study of the relationship between the practice environment and CAUTI rates has been limited. Using hospital level data (n=161) and nurse surveys (n=7,076), Cimiotti, Aiken, Sloane, and Wu (2012) described an association between nurse staffing and the incidence of UTIs that was mediated by burnout. However, no specific aspects of the practice environment were included at the unit level in the study.

Nurse Practice Environment

There is mounting evidence of the importance of nurse leadership to the development of a professional practice environment and the association of the nurse practice environment with patient outcomes. The important role of leadership in creating a supportive practice environment has been established by several researchers (Kramer & Schmalenberg, 2008; Laschinger & Leiter, 2006; McDonald, Tullai-McGuinness, Madigan, & Shively, 2010).

Aiken and colleagues (2011) examined the association of staffing levels with mortality. They extended earlier work where that examined staffing with burnout and mortality (Aiken,

Clarke, Sloane, Sochalski, & Silber, 2002) by evaluating the impact of nurse-rated practice

environments on the outcomes associated with nurse-to-patient ratios. Findings from Aiken et

al. (2011) supported findings from their 2002 study and indicated that the practice environment

affected the impact of improvement in outcomes associated with lower nurse-to-patient ratios

(fewer patients per nurse). In average or good practice environments, lower nurse-to-patient

ratios and a higher proportion of baccalaureate-prepared nurses produced the highest reduction

in 30-day mortality and failure to rescue. In practice environments rated as poor the impact of

decreased nurse-to-patient ratios made insignificant improvement in 30-day mortality or failure

to rescue.

Kalisch, Tschannen, and Lee (2012) identified an association with missed nursing care

(e.g., ambulation, turning, discharge planning, teaching) and higher fall rates on units with

lower nurse staffing levels (i.e., higher patient-to-nurse ratios). Using hospital-level data,

Needleman, Beurhaus, Mattke, Stewart, and Alevinsky (2002) found better outcomes associated

with higher nurse staffing levels (i.e., lower nurse-to-patient ratios) and better outcomes for both

medical conditions (i.e., urinary tract infections, upper gastro-intestinal bleeding, shorter LOS)

and surgical(i.e., pneumonia, shock/cardiac arrest, and failure to rescue) conditions.

Inclusion of a nurse-sensitive measures of the practice environment are endorsed by

National Quality Forum (NQF), The Joint Commission (TJC), Agency for Healthcare Research

and Quality (AHRQ), and the Centers for Medicare and Medicaid Services (CMS), and

validates a broad recognition of the importance of the practice environment association with

quality of care delivery (Buerhaus, 2008). The work by Aiken et al. (2011) noted above

reinforces the premise that providing good care is not solely related to the number of patients

assigned to the nurse. Analysis of specific elements of the practice environment at the unit level

and the potential association with specific nurse-sensitive quality indicators (e.g., CAUTI) will add to the body of knowledge that has accumulated using hospital-level data. Since practice environments may vary between units in the same institution based on factors identified previously, it is important to evaluate association of outcomes at the unit level.

Nursing Worklife Model

In the Nursing Worklife Model, Leiter and Laschinger (2006) described the relationship of five interrelated components of the nurse practice environment (i.e., strong nursing leadership, collegial Registered Nurse [RN]-Medical Doctor [MD] relationship, involvement in policy development, adequate staffing, and support for a nursing model of care) to emotional exhaustion (i.e., burnout) and personal accomplishment. Lake's (2002) Practice Environment Scale (PES) was used to operationalize the elements of the practice environment as measured by the five corresponding subscales. The Maslach Burnout Inventory-Human Service Scale (MBI-HSS) subscales were used to measure elements of burnout (emotional exhaustion, and depersonalization) and personal accomplishment (Maslach & Jackson, 1981). The complex relationships of the NWLM framework of the practice environment identified an impact on nurse emotional exhaustion by direct pathways from strong leadership to involvement in policy development, collaborative RN-MD relationships, and adequate staffing. Indirect pathways were found from strong leadership through the three elements along with nursing model of care to emotional exhaustion, depersonalization, and personal accomplishment. The model fit was tested using structural equation modelling (SEM) and split samples were used for model specification and confirmation, respectively. The study with a large sample of Canadian nurses (N= 8,597, split samples n=4,606 & n=3,991) resulted in good fit to the data ($\chi2_{(340\ df)} =$ 3,355.40, p<.001; CFI =.923; and $\chi2_{(1152\ df)}$ =3,355.40, p<.001; CFI =.905; respectively).

Laschinger and Leiter (2006) extended the model to include nurse perception of quality outcomes using the same sample. Perception of quality was based on nurse report of the frequency of adverse events, such as, nosocomial infections, falls, patient complaints, and medication errors. In the study, adverse events were scored by nurses as one (never) to four (frequently). Final model fit ($\chi2_{(1344\ df)} = 16,438.19$; $p < .001$; *CFI*=.908; *RMSEA*=.037) was improved with the addition of significant standardized pathways from staffing adequacy (-.13), a nursing model of care (-.25), personal accomplishment (-.27), emotional exhaustion (-.08), and depersonalization (-.08) to perception of adverse events.

Manojlovich and Laschinger (2007) used a random sample of Michigan nurses (*N*=276), to test the elements of the NWLM association with job satisfaction (measured by Hackman & Oldham's Job Diagnostic Survey), PES subscales, and structural empowerment measured by the Conditions of Work Effectiveness Questionnaire-II (CWEQ-II). The previous paths within the NWLM were supported along with the addition of an indirect path from strong leadership to nurse satisfaction.

In a secondary analysis of a 2011 NDNQI® RN Survey data, Ballard, Boyle and Bott (2015) tested selected elements of the NWLM with unit-level data (*N*=3,023 units) that comprised job enjoyment (personal accomplishment) and the five subscales of Lake's (2002) PES. The five subscales include (a) PES- nurse manager ability, leadership and support (strong leadership); (b) PES-collegial RN-MD relationships (RN-MD collaboration); (c) PES-nurse participation in hospital affairs (policy involvement); PES-nursing foundation for quality care (nursing model of care); and PES-staffing and resource adequacy (staffing adequacy). No measures for emotional exhaustion were available from the NDNQI® data, limiting the ability to test the hypothesized pathway of the elements of the NWLM to emotional exhaustion. The

sample included nurses working on medical, surgical, combined medical-surgical, critical care, step-down units from hospitals across all census divisions of the U.S. Using SEM, data were fit using the *a priori* model identified by Leiter and Laschinger (2006). Modifications to the original NWLM were identified via an iterative process to obtain good model fit ($\chi 2_{(1\ df)}$=13.35, p <.001; *CFI*=.99; *RMSEA*=.06 [*95% CI* =.035-.094]; *SRMR* =.002; *adjusted BIC* =-8,612) at the unit level with additional positive pathways from Nurse Manager ability to all other elements of the NWLM.

To date, previous studies that examined the associations of the elements of the NWLM with patient outcomes have been conducted using individual-level data based on nurses' perception of outcomes rather than actual measures of patient outcomes (Laschinger & Leiter, 2006; Laschinger, 2008; Leiter & Laschinger, 2006; Manojlovich & Laschinger, 2007). Kramer, Maguire, and Brewer (2011) posited that the work unit was the aggregate of conditions where care occurs and identified the need for studies at the work unit level as work units may vary within a particular institution. The modified NWLM tested by Ballard, Boyle, & Bott (2015) guided this study to examine the relationships between elements of the practice environment and CAUTI rates at the unit level (see Figure 4.1). Data at the unit level may identify differences that are masked when data are aggregated at the hospital level.

Specifically the aim of this study was to examine the relationships between elements of the nurse practice environment predictive of CAUTI using 2012 NDNQI® unit level data.

Figure 4.1. Hypothesized Modified Nursing Worklife Model of Job Enjoyment Association Predictive of CAUTI Rates
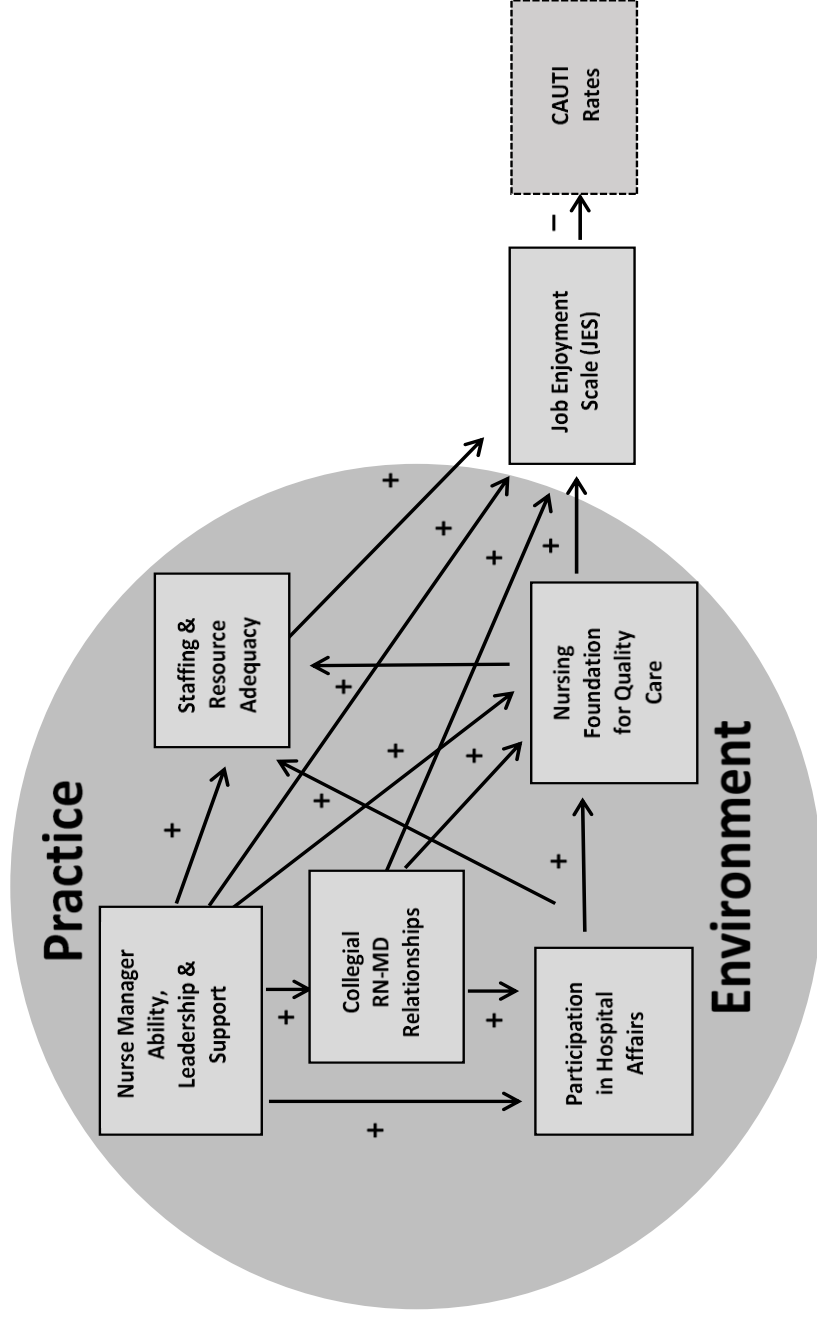
Key: CAUTI = Catheter Acquired Urinary Tract Infection

Figure 4.1. Nursing Worklife Model of Job Enjoyment predictive model of CAUTI rate. Adapted from" Evaluation of Elements of the Nursing Worklife Model Using Unit Level Data" by N. Ballard, D. Boyle, & M. Bott, 2015, *Western Journal of Nursing Research.* Copyright 2015 by Sage Publications.

Methods

Design

A correlational study, using a secondary analysis at the unit level, was conducted to examine the relationships between the modified NWLM elements and to test the ability of the model to predict-a patient outcome—CAUTI rates. Unit level data were obtained from the 2012 RN Survey and Quality Outcomes database. NDNQI® provides unit level data with standardized data element definitions and data collection processes that provide a mechanism for national benchmarking, quality improvement, and research into the impact of nursing on reducing nurse-sensitive hospital-acquired conditions along with the evaluation of the practice environment (Gallagher, 2003). Data are collected quarterly for quality outcome measures and annually on RN work context including the elements of the practice environment and job satisfaction.

Following non-human subject determination by a Midwestern academic medical center Institutional Review Board, a de-identified data extract was obtained. All hospitals that participated in the 2012 RN Survey with the Practice Environment Scale (PES) option and that reported CAUTI incidence in the Quality Outcomes database were included. Case selection with listwise deletion was used to aggregate data to the unit level using the following selection criteria: (a) acute care hospitals who chose the PES RN survey option; (b) adult medical, surgical, and medical-surgical unit types; (b) units with a minimum of a 40% participation rates of the staff nurses in the RN survey (Kramer, Schmalenberg, Brewer, Verran, & Keller-Unger, 2009); and (d) units reporting CAUTI rates for a minimum of at least two quarters for 2012. Nurses were eligible to participate in the RN Survey if they: (a) provided direct care at least 50% of the time, and (b) worked on the unit at least three months. Units with less than five

respondents were excluded. Limitation of unit type to adult medical, surgical and combined medical surgical units served to control the difference that might occur due to differences in acuity of patients and staffing levels in other unit types.

Setting and Sample

After merging the data extracts and aggregating to the unit level, the sample of units (*N*=1,106) had complete data for the RN Survey data. Of the 1,106 adult units meeting inclusion criteria, 33.9% (*n*=375) were medical, 25.2% (*n*=279) were surgical, and 40.5% (*n*=452) were combined medical-surgical. The majority were located in hospitals that were in metropolitan areas (94%) with the majority of hospitals classified as non-teaching (46%; *n*=509), teaching (34.5%; *n*=382), and academic (19.4%; n=215). Magnet® status had been achieved by 45% (*n*=500). Except for bed size <100(8.1%; *n*=90), all others were well represented (100-199, 18.8% [*n*=208], 200-299, 22.3% [*n*=247]; 300-399, 16.4 % [*n*=181], 400-499, 14.3% [*n*=158]; and >500 20.1% [*n*= 222]). Units with complete data for CAUTI rates (*N*=1,083) comprised the final sample for the analysis.

Demographic characteristics for staff nurses that met the inclusion criteria for participation in the RN survey were aggregated to the unit level. Among the 1,083 units, on average staff were: (a) primarily female (92%; *range*=50-100%); (b) white (67%; *range*=0-100%), with the remainder divided between Asian (12%; *range*= 0-92%), Black (11%; *range*=0-83%), Hispanic (4%; *range*=0-67%) and other (6%; *range*=0-75%).   Units reported that on average 56% of nurses (*range* =0-100%) were educated with a Bachelor's degree or higher and on average 16% of nurses were certified (*range* = 0-100%) by a national professional organization.

Measures

      Practice Environment Scale (PES).   The subscales of Lake's practice environment

scale: (a) Nurse manager ability, leadership, and support; (b) Collegial RN-MD relationships;

(c) Nurse participation in hospital affairs;(d) Staffing and resource adequacy; and (e) Nursing

foundations for quality care were used to operationalize five of the elements of the NWLM.

Table 4.1 provides the definitions and numbers of items for each of the elements. Items for each

of the subscales are Likert-type with response options ranging from strongly disagree (1) to

strongly agree (4). Item scores were summed and averaged for each of the subscales. Reliability

of these subscales is well established with a range from .82-.87 (Patrician, Shang, & Lake,

2010). Reliability for the PES subscales was calculated for this sample at the unit level and

ranged from .90 to .96. Using confirmatory factor analysis, Gajewski, Boyle, Miller,

Oberhelman, and Dunton (2010) established convergent, discriminant, and criterion-related

validity at both the unit and individual RN level. Confirmatory factor analysis using MPLUS

was done using the sample for this study with comparative fit indices (*CFIs*) ranging from .92

to 1.0 for all subscales with the exception of nurse participation in hospital affairs (*CFI* =.85).

Table 4.1.

Variable Definitions, Number of Item and Cronbach's Alpha for Elements of the Nursing

Worklife Model at the Unit Level

Variable	Nursing Worklife Model Element	Definition	Items	*Cronbach's Alpha*
Nurse Manager Ability, Leadership, & Support	Strong Leadership	Nursing manger viewed as a leader who provides strong support	5	.95
Collegial RN-MD Relationships	RN-MD Collaboration	Presence of collaborative working relationships	3	.95
Participation in Hospital Affairs	Policy Involvement	Policy development and decisions about practice	9	.95
Staffing & Resource Adequacy	Staffing Adequacy	Staffing level adequate to provide the care needed	4	.96
Nursing Foundations for Quality Care	Nursing Model of Care	Nursing practice supported by high standards, professional nursing philosophy, education, expectation of competency, and measurement of quality	10	.94
Job Enjoyment Scale	Personal Accomplishment	Measurement of general job enjoyment	7	.97

Job Enjoyment Scale (JES). The JES was used as a proxy measure of personal

accomplishment depicted in the NWLM. Developed from items originally identified by

Brayfield and Rothe (1951) that was modified by Taunton et al. (2004), the JES was used to

reflect work unit perceptions rather than individual perception by changing the stem to "Nurses

with whom I work would say . . . . Boyle, Miller, Gajewski, Hart, and Duncan (2006) reported

high reliability at the work group level with *Cronbach's alphas* ranging from .91-.97. For the

current study, the *Cronbach alpha* for unit-level items was .97 and the *CFI* was .94 using

confirmatory factor analysis.

The JES was used as a proxy measure for the Maslach Burnout Inventory-Human Service Scale (MBI-HSS) (Maslach & Jackson, 1981) that represented personal accomplishment in the original model tested by Leiter and Laschinger (2006). While the two instruments, the MBI-HHS and JES, are not exactly the same, the instruments include similar items. Two items from the MBI-HSS, "I feel I am positively influencing other people's lives through my work" and "I feel very energetic" are similar to the JES items, such as, (Nurses with whom I work would say that they…) " find real enjoyment in their work," and "are enthusiastic about their work every day."

Catheter associated urinary tract infection (CAUTI) rate. The CAUTI rate was measured using the 2012 NDNQI® Quality Outcomes data. The CAUTI ratio was computed based on the number of CAUTIs and the number catheter days for each unit across the year. The total number of CAUTIs was divided by the total number of catheter days and multiplied by 1000 to generate a CAUTI rate per 1000 catheter days for each unit following the calculation method recommended by CDC (2015)

Data Analysis

Following merging of the data from the RN Survey and Quality Outcome data, one way analysis of variance (ANOVA) using SPSS version 18.0 was conducted to determine if there were differences among hospital characteristics (Magnet® status, bed-size, teaching status), unit types, , and general location (metropolitan population $\geq$50,000, micropolitan population >10,000 but < 50,000, and neither metro/micropolitan). Levene's test indicated a violation of equality of variance assumption so Dunnett T3 was used to evaluate differences between unit type, hospital bed size, Magnet® status, teaching status and general location. Significant differences in CAUTI rates were found for teaching status ($F_{(1, 1081)}$ =11.66, p <.001 and bed

size ($F_{(5, 1077)}$=3.52, p <.01]. Follow up testing with Dunnett's T3 identified academic medical centers as significantly different from teaching and nonteaching hospitals. Comparison of CAUTI rates by bed size indicated the only significant difference was between bedsize greater than 500 beds and all other bed size categories. Based on the preliminary analysis, the study controlled for hospital teaching status (academic medical center [1] versus others [0]) and hospital size (bed size greater than 500 beds [1] versus others [0]) when fitting the elements of the NWLM associated with CAUTI rates.

Structural equation modeling (SEM) using MPlus version 7, was used to evaluate the hypothesized model fit to the data using fit indices identified by Raykov and Marcoulides (2006): Comparative Fit Index (*CFI*), Root Mean Square Error of Approximation (*RMSEA*), and Standardized Root Mean Square Residual (*SRMR*). Acceptable fit of the hypothesized model to the data was identified as *CFI*>.90, *RMSEA*< .08, and *SRMR* < .08 (Hooper, Couglan & Mullen, 2008). A sample size of 1,106 exceeds the minimum of 100 cases recommended as a minimum for SEM by Raykov and Marcoulides (2006).

Results

Means and standard deviations for all model variables by unit type and total sample are presented in Table 4.2. Means for the PES subscales and JES were similar across the three unit types. Surgical units demonstrated lower CAUTI rates (*M*=1.54 per 1000 days) than medical or combined medical-surgical units (*M*=1.91 per 1000 days). Based on bivariate analysis, all elements of the NWLM were moderately to strongly correlated (*r*=.53 to .87) (see Table 4.3).

Table 4.2.

Summary Statistics for PES Subscales, Job Enjoyment & CAUTI Rate by Unit Type and Total Sample (N=1,083)

Variable	Medical-Surgical	Medical	Surgical	Total Sample
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Nurse Manager Ability, Leadership & Support	3.01 (.32)	2.97 (.34)	2.99 (.34)	2.99 (.34)
Collegial RN-MD Relationships	2.99 (.23)	3.00. (26)	3.05 (.25)	3.01 (.24)
Participation in Hospital Affairs	2.93 (.25)	2.91 (.28)	2.92 (.26)	2.92 (.27)
Nursing Foundations for Quality Care	3.14 (.19)	3.13 (.21)	3.14 (.19)	3.14 (.20)
Staffing & Resource Adequacy	2.58 (.35)	2.58 (.39)	2.62 (.39)	2.59 (.37)
Job Enjoyment	3.75 (.53)	3.71 (.58)	3.78 (.58)	3.75 (.53)
CAUTI Rate	1.91 (2.73)	1.91 (2.73)	1.54 (2.07)	1.82 (2.47)

Note: M=Mean; *SD* = Standard Deviation; CAUTI = Catheter Acquired Urinary Tract Infection

Table 4.3.

Correlations Among Job Enjoyment Scale, PES subscales, and CAUTI Rate (N=1,083)

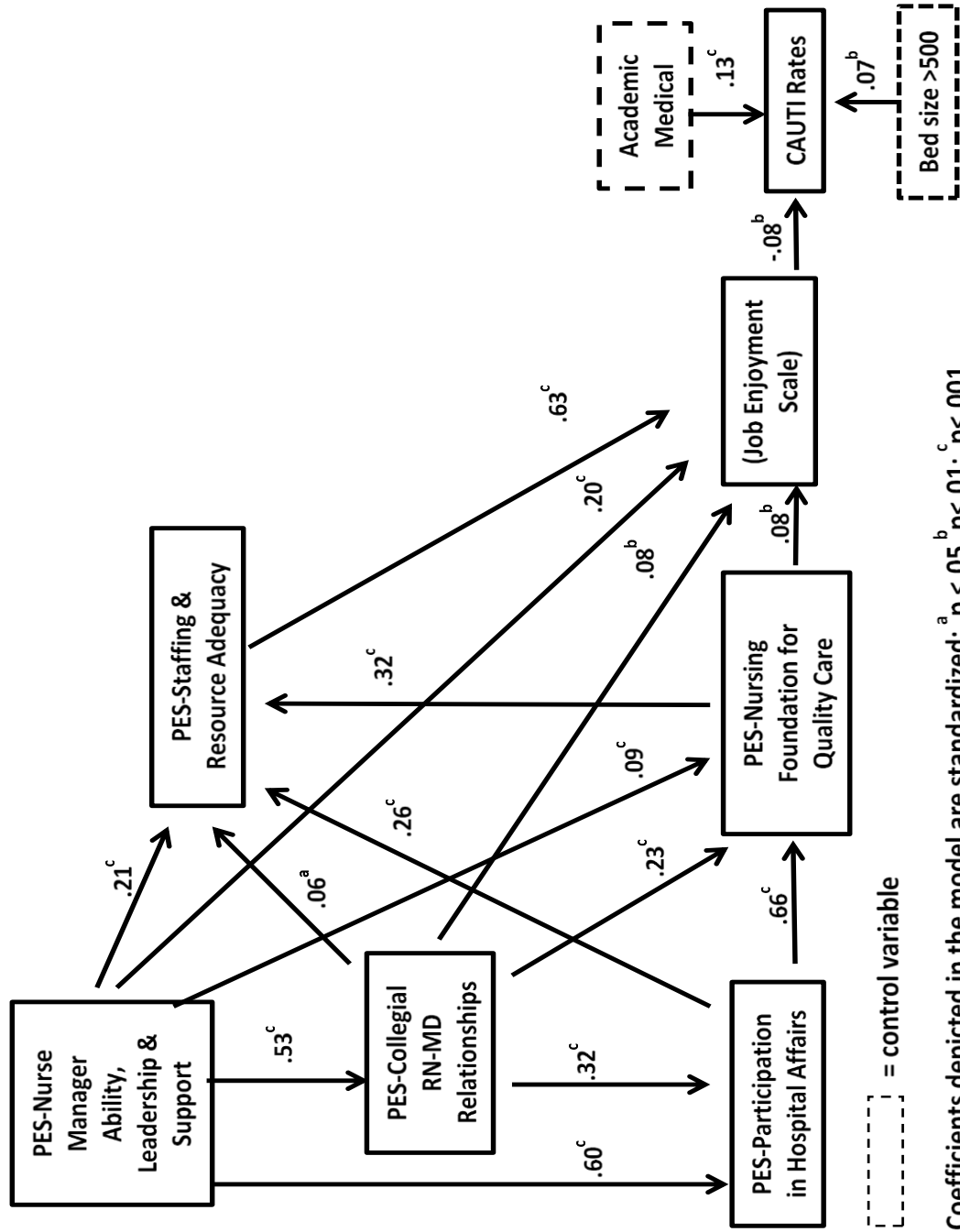|	JES	PES-NM	PES-RN-MD	PES-HA	PES-QC	PES-SR
PES-Nurse Manager Ability, Leadership & Support	.73	-	-	-	-	-
PES-Collegial RN-MD Relationships	.60	.53	-	-	-	-
PES-Participation in Hospital Affairs	.75	.77	.64	-	-	-
PES-Nursing Foundation for Quality Care	.75	.72	.70	.88	-	-
PES-Staffing & Resource	.87	.67	.56	.74	.75	-
CAUTI Rate	-.08	-.08	-.07	-.07	-.06	-.06

Source: Data were average scores of unit level responses from the 2012 NDNQI® RN Satisfaction Survey Practice Environment Scale (PES) and Job Enjoyment Scale (JES) and CAUTI rate from 2012 NDNQI® Quality Outcomes Data.

Note: JES=Job Enjoyment Scale; PES= Practice Environment Scale; PES-NM=Nurse Manager Ability, Leadership & Support; PES-RN-MD=Collegial RN-MD Relationships; PES-HA=Participation in Hospital Affairs; PES-QC=Nursing Foundations for Quality Care; PES-SR=Staffing and Resource Adequacy; CAUTI= Catheter Associated Urinary Tract Infection.

Using the 2012 unit level NDNQI® data and based on the *a priori* model tested by Ballard, Boyle and Bott (2015), findings showed excellent fit of the adapted NWLM to the data (*CFI*=1.0; *RMSE*= .00 [*95% CI* =.00-.06]; *SRMR*=.00). Consistent with the findings from Ballard et al. (2015) study, positive significant pathways from nurse manager ability, leadership, and support to job enjoyment and nursing model of care were found (*β*=.20 and .09, respectively). Additionally, pathways from collegial RN-MD relationships to job enjoyment (*β*= .08) and staffing and resource adequacy (*β*= .06); and participation in hospital affairs to staffing and resource adequacy (*β*=.26) were supported.

To test the association with elements of the NWLM with CAUTI rate, a second model was fit to the data that included a direct pathway from JES to CAUTI rate controlling for bed size greater than 500 and academic medical center. Model fit was still excellent (*CFI* = .995; *RMSEA*=.04 [*95% CI*=.028-.056]; *SRMR*=.02) with a significant negative association from JES to CAUTI rate (β=-.08, *p* <.01) and a positive association with both bed size greater than 500 (β=.07, *p*<.05) and academic medical center (β=.13, *p*<.001). Figure 4.2 depicts the standardized coefficients for all relationships identified in the model testing. No additional paths were identified in the modification indices. Additional findings from the analyses at the unit level included the negative association of the elements of the practice environment through job enjoyment to CAUTI rates and the positive association of hospital characteristics to CAUTI.

Figure 4.2. Results of the Modified Nursing Worklife Model Testing for Elements of the Practice Environment with CAUTI Rates

Coefficients depicted in the model are standardized; [a] p <.05 [b] p<.01; [c] p<.001

Note: PES = Practice Environment Scale; CAUTI = Catheter Associated Urinary Tract Infection

Discussion

The findings from this study supported the modified NWLM of Job Enjoyment that replicated earlier work using 2011 NDNQI® Survey data (Ballard, Boyle, & Bott, 2015). Based on the modified NWLM framework, this study examined associations between PES subscales, JES, and CAUTI rate at the unit level. From this study, a negative association was found between job enjoyment and CAUTI rates and supported the previous positive association of nurse manager ability, leadership, and support with all elements of the practice environment (see Figure 4.2, p. 98). The extension of the model to include a patient outcome (i.e., CAUTI rate) measured at the unit level adds to the literature regarding the importance of the unit level professional practice environment on clinical practice and ultimately on patient outcomes.

The practice environment, a complex system, provides the setting in which nursing leadership is accountable for ensuring best practice. With the emphasis on identifying preventative measures for hospital acquired conditions, it is essential not to overlook this area for evaluation and improvement. While it is important to follow protocols and use best evidence for good clinical practice, this study supports that additional focus needs to be directed at the unit environment where practice occurs. The findings from this study taken from a national sample of varied hospital types are important in recognizing those elements in the practice environments of medical, surgical and combined medical-surgical units that can impact and reduce CAUTI rates, the most common hospital acquired infection (CDC, 2010) that leads to higher costs of care and longer length of stay.

Clinical outcomes reported at the hospital level may mask unit level issues. Drilling down to the unit level for analyses identified an impact that aligns with work done by other researchers at the hospital level regarding the influence of professional practice environment. .

Study at the unit level provides additional insight that can be used to focus on specific elements unique to each unit. Findings are congruent with the work by Kramer and Schmalenberg (2008) about the importance of the nurse manager leadership in supporting a practice environment in which a culture of professional practice focuses on providing care that positively impacts patient outcomes rather than just focusing on task completion. Influence of the practice environment also was noted by Kalisch, Tschannen, and Lee (2012) in their findings regarding the relationship of adequate staffing and resources to missed nursing care. The authors noted that the nurses' perceptions of adequate resources was influenced by other elements in the practice environment (i.e., relationships and teamwork) other than the nurse-to-patient ratio (i.e., staffing). Aiken et al. (2011) found that the impact on the decrease in morbidity and mortality found from reducing patient-to-nurse ratios (fewer patients per nurse) was almost nil in hospitals with poor practice environments. These studies supported the findings from this study and emphasize the importance of paying close attention to all elements of the practice environment including staffing when exploring the impact on patient outcomes at the unit level.

The positive association with academic medical centers (AMC) and hospitals with bed size greater than 500 was not a new finding. Thurnlow and Stukenborg (2006) found higher rates of infection in academic medical centers and noted that academic medical centers made up a large portion of the large medical center category of their study. Further exploration of this difference is warranted.

The practice environment is a complex system at both the hospital and unit level should not be overlooked when considering strategies and tactics for reducing CAUTI rates. While there are many contributing factors associated with CAUTI, attention to the unit practice environment is warranted along with clinically-based interventions. CAUTI has been identified

as a nurse-sensitive indicator and the negative association with elements of the practice environment (i.e., job enjoyment in this study) provides further support for strategies that support a strong practice environment in addition to clinical practices that decrease urinary catheter use.

Limitations and Strengths

Limitations to this study include the lack of representativeness of the population of hospitals across the U.S. in this sample. There was a higher percentage of hospitals that had achieved Magnet® designation (45%) and a lower percentage of hospitals with bed sizes less than 100 (9%). This limits generalizability of the findings to those facilities. Hospitals that participate in NDNQI® are investing in quality improvement that may provide a sample in which efforts to reduce CAUTI may have influenced the CAUTI rates over-all compared with the population of all acute care hospitals. There was a lower proportion (16%) of nurses who had achieved national certification in this study compared to studies that include nurses from both critical care and step-down units (63%) (Ballard, Boyle, & Bott, 2015). However, as Boyle et al. (2006) found in the 2004 data set, medical, surgical, and combined medical-surgical units generally have a lower proportion of certified nurses (25%) achieving national certification than nurses working critical care (38%) and step-down unit (31%). Differences in sample sizes as hospital participant levels change year to year may partially explain the differences noted.

The collected data are essentially cross sectional data even though collected at different points during the year and limits the inference of causality. The lack of measures in the NDNQI® that operationalize depersonalization or emotional exhaustion is a limitation to testing all of the paths of the original NWLM posited by Leiter and Laschinger (2006).

In spite of the limitations, the strengths are worth noting: (a) use of a large national sample; (b) inclusion of hospitals from all census divisions in the U. S.; (c) unit level data for all measured variables and (d) well-defined reliable and valid variables and data collection processes. This study supports the NWLM as a model representing the practice environment at the work unit level in acute care. Using secondary data to inform practice with additional studies conducted at the unit level to evaluate the association with other nurse-sensitive outcomes (e.g., falls, infections, etc.) are indicated.

Future Research

Validation of the Modified NWLM of Job Enjoyment provides a framework for additional study of clinical outcomes, such as, pressure ulcer prevalence, restraint use, central line blood stream infection, as well as other nursing outcome measures (e.g., RN intent to leave, RN Tenure, nursing hours per patient day, etc.). These outcomes also are included in the NDNQI®.

Staff perception of staffing and resource adequacy was found to be associated with several elements of the model. Exploration of the factors affecting nurse perception of staffing adequacy in comparison to actual staffing rates would provide additional insight into strategies that could ultimately translate into improvements in the practice environment. It also would be important to develop strategies for nurse leader development that potentially could translate into the development of excellent practice environments.

Acknowledgement

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CHAPTER FIVE

DISCUSSION

This chapter presents a discussion of how the two manuscripts fit together in exploration of the research aims and a summary of the results from the two studies. Conclusions, implications for practice, implications for future research, as well as strengths and limitations of the study also will be addressed.

Explication of Fit of the Two Manuscripts

The two manuscripts submitted present a stepped approach to evaluation of the Nursing Worklife Model (NWLM) posited by Leiter and Laschinger (2006) using unit level data. In the first manuscript, using structural equation modeling (SEM), a modified NWLM (see Figure 3.1, p. 54) was fit to unit level data obtained from a national sample of nurses from five unit types (*N*=3,023 units) from hospitals across the U.S. participating in the 2011 NDNQI® RN Satisfaction Survey data (Ballard, Boyle, & Bott, in press). Nursing units included medical, surgical, combined medical-surgical, step-down, and critical care. Using an iterative process based on reported modification indices, suggested changes to the hypothesized NWLM produced a model with excellent model fit to the data (*CFI*=.99; *RMSEA*=.059 [*95% CI*=.034-.089]; *SRMR*=.002; adjusted *BIC*= -8,612). Findings revealed that there were direct relationships from nurse manager ability, leadership and support to all elements in the NWLM with new pathways identified to nursing model of care and to personal accomplishment (i.e., job enjoyment). Other significant new pathways were from participation in hospital affairs and collegial RN-MD relationships to staffing and resource adequacy (see Figure 3.2, p. 67).

In the second manuscript, the purpose was two-fold: (a) to validate the modified NWLM tested in manuscript one using 2012 unit-level data from NDNQI®; and (b) to evaluate the association of a measured nurse- sensitive clinical outcome (i.e., catheter associated urinary

tract infection [CAUTI] rate) with job enjoyment. The 2012 NDNQI® RN Satisfaction Survey

was merged with the Quality Outcome database that contained information to calculate CAUTI

rates by unit. The merged file contained information from medical, surgical, and combined

medical-surgical units (*N*=1,106 units) to test the NWLM that included a patient outcome (i.e.,

CAUTI rate: an annualized rate standardized to CAUTI rate per1000 catheter days). In the

second study the units were limited to medical, surgical, and combined medical-surgical units

due to the potential confounding effect of staffing with patient acuity in both step-down and

critical care units. Findings from this study also revealed excellent model fit to the data (*CFI* =

.995; *RMSEA* = 0.04 [*95% CI*=.028-.056]; *SRMR*=0.02; *adjusted BIC*= 1,506) with a significant

negative association between job enjoyment and CAUTI rates (β= -.08, *p* <.01).

This study was the first study done using unit level data that comprised a large national

sample to assess the fit of the posited modified NWLM that included a clinical outcome

measure to evaluate its association with elements of the nurse practice environment. Previous

studies have used individual level survey data to test the fit of the model (Leiter and Laschinger,

2006; Manolivich & Laschinger, 2007) and nurse perception of adverse events to operationalize

the clinical outcomes rather than an actual measured indicator (Laschinger & Leiter, 2006;

Laschinger, 2008). Evaluating and confirming the fit to unit level data extends usefulness of the

model as a framework for practice; also the findings of a significant inverse relationship from

job enjoyment to CAUTI rate provides additional support for the importance of the influence of

the practice environment on CAUTI incidence—an adverse event.

Study Aims and Summary of Results

The overall study aims for manuscripts one and two, respectively, are as follows: (a) to

examine the fit of the Nursing Worklife Model posited by Leiter and Laschinger (2006) using

elements of the practice environment with unit level data from the 2011 National Database for

Nursing Quality Indicators ® (NDNQI®); and (b) using the Nursing Worklife Model as the

guiding framework, confirm the fit of the NWLM at the unit level from study one and evaluate

the relationships of elements of the nurse practice environment with CAUTI rate at the unit

level using 2012 data from the National Database for Nursing Quality Indicators ® (NDNQI®).

Testing the model using unit level data in the first manuscript set the stage for validating the

model in manuscript two, which included a measured patient outcome variable—CAUTI rate.

Confirmation of the findings from initial fitting of the NWLM in a second dataset was

important to strengthen the findings prior to extending the model to include a nurse-sensitive

patient outcome—CAUTI rate.

Manuscript One Study Results

The modified NWLM was tested and refined in the first manuscript and validated in the

second manuscript. Modification of the NWLM revealed excellent model fit indices (*CFI*=.99;

RMSEA=.06 [*95% CI* =.035-.094]; *SRMR* =.002; *adjusted BIC* =-8,612) (Ballard, Boyle, &

Bott, 2015). These modifications included additional direct relationships as follows: (a) nurse

manager ability, leadership, and support (*β*=.25, *p* <.001) and collegial RN-MD relationships

(*β*=.09, *p* <.001) to job enjoyment; (b) collegial RN-MD relationships (*β*=.16, *p*<.001) and

participation in hospital affairs (*β*=.22, *p*<.001) to staffing and resource adequacy; and (c) nurse

manager ability, leadership, and support (*β*=.18, *p*<.001) to nursing foundations for quality care

(see Figure 3.2, p. 67).

In previous studies of the NWLM, the relationship of nurse manager ability, leadership,

and support was depicted as influencing nursing foundations for quality care and job enjoyment

through the other elements in the model as shown in Figure 3.1, p. 54. The direct relationships

of the nurse manager with these additional elements of the practice environment are congruent with the findings from other studies (Kramer & Schmalenberg, 2008; McDonald, Tullai-McGuinness, Madigan, & Shively, 2010; Schmalenberg & Kramer, 2009), that identifies the importance of first-line nurse managers in nurse job enjoyment and a supportive practice environment.

While Leiter and Laschinger (2006) identified the nurse manager ability, leadership, and support (i.e., strong leadership) as the starting point of the model and key to the practice environment, the direct paths supported in their model testing were from nurse manager ability, leadership and support (i.e., strong leadership) to staffing and resource adequacy (i.e., staffing adequacy), collegial RN-MD relationships (i.e., RN-MD collaboration), and participation in hospital affairs (i.e., policy involvement) (see Figure 3.1, p. 54). This was in contrast to the direct paths from nurse manager ability, leadership, and support to nursing foundations for quality care (i.e., nursing model of care) and job enjoyment (i.e., personal accomplishment) found by Ballard, Boyle and Bott (2015). The additional findings could be a unit level phenomena not identified when individual nurse level data were used. This study met the recommendation of Kramer, Schmalenberg, Brewer, Verran, and Keller-Unger (2009) who advocated for studies at the unit level as the practice environment is the aggregate of the complex process that occurs at the unit level that may vary between units in the same institution. Paths to depersonalization and emotional exhaustion from the NWLM posited by Leiter and Laschinger (2006) were not measured by Ballard and colleagues (2015) due to lack of variables in the data to measure these elements, a limitation of this study.

The additional path from collegial RN-MD relationships (i.e., RN-MD Collaboration) to staffing and resource adequacy is congruent with the work of Schmalenberg and Kramer (2007),

who found that collegial relations within the inter-disciplinary team was a contributor to staff perception of staffing adequacy. In addition, the presence of interdisciplinary relationships are identified as a key tenet of a professional practice culture in standards of the Magnet® designation program (American Nurses Credentialing Center, 2013).

The added path from participation in hospital affairs (i.e., policy involvement) to staffing and resource adequacy aligns with the movement for shared decision making that has been underway since the 1980's (O'May & Buchan, 1999). Shared decision making has been recognized as essential to nurse perception of control over nursing practice and is an expectation of exemplary professional practice identified in the Magnet Designation® program (American Nurses Credentialing Center, 2013).

Manuscript Two Study Results

The study reported in manuscript two provides validation of the modified NWLM of Job Enjoyment using 2012 NDNQI® unit-level data and extended the model to examine the impact of the practice environment on a measured nurse-sensitive patient outcome—CAUTI rate (see Figure 4.1, p. 88). This study also addressed the call for study of prevention strategies outlined by the IOM report (2004). Findings from the model testing revealed excellent model fit to the data (*CFI* = .995; *RMSEA* = 0.04 [*95% CI* .028-.056]; *SRMR*=0.02; *adjusted BIC*= 1,506).

All of the relationships that were identified in testing the NWLM using 2011 NDNQI® data were validated in the 2012 sample (see Figure 4.2, p. 98). Results demonstrated a significant negative association from job enjoyment to CAUTI rate (β= -.08, *p*<.01) signifying as job enjoyment scores increased CAUTI rates decreased. This aligns with work by Aiken et al. (2011) that examined the impact of the practice environment on the effect of patient-to-nurse

ratios (i.e., staffing rates) on mortality and failure to rescue at the hospital level. When nurse-to-patient ratios decreased by one patient (e.g., 1:8 to 1:7), Aiken and colleagues found odds of death and failure to rescue decreased by 4% in hospitals when the unit work environment was rated as average, and decreased 9-10% when the work environment was rated excellent (using the PES without the staffing and resource adequacy subscale). However, the impact of one fewer patient did little to improve outcomes in a practice environment when it was rated as poor.

Using 2009 NDNQI® data, Choi and Boyle (2013) had similar findings in a study that measured the relationship of job enjoyment with falls at the unit level: the results indicated an inverse relationship between job enjoyment and falls (higher job enjoyment was associated with lower fall incidence). However, other elements of the nurse practice environment were not included in their evaluation.

The association of higher CAUTI rates with academic medical center status and bed size greater than 500 aligned with Thurnlow and Stukenborg (2006) who found higher rates of infection in academic medical centers. In addition, Thurnlow and Stukenborg noted that academic medical centers made up a large portion of the large medical center category (i.e., larger bed sizes).

While clinical protocols (e.g., criteria for use of urinary catheters, early removal, and reduction of catheter days) have contributed to a reduction in CAUTI, consideration of the practice environment and the elements that support professional nursing practice should be included as an additional contributing factor. With the exception of NDNQI®, clinical outcomes are most commonly reported at the hospital level; however, the provision of care is a

unit level phenomenon. Drilling down to unit level analyses provided additional insight into other potential mechanisms for improving outcomes.

The NWLM provides a model that takes into consideration the complexity of the elements of the practice environment and the relationships to outcome measures to elicit information that can inform practice. These two studies have supported the importance of the practice environment to the job enjoyment of nurses and the importance of job enjoyment to the lower incidence of CAUTI in medical, surgical, and combined medical-surgical unit types.

Clinical Relevance

While these two studies evaluating the Leiter and Laschinger (2006) original NWLM using unit level data were modified due to a lack of measures for depersonalization and emotional exhaustion in the NDNQI®, the association of job enjoyment (a proxy measure for personal accomplishment) with CAUTI rate in a large national sample is important. Because data used for this analysis are cross-sectional, causality cannot be determined from this study; however, the importance of valid and reliable measures representing the practice environment and the potential for improvement in unit level outcomes cannot be ignored. From work of researchers (Aiken et al., 2011; Cimiotti, Aiken, Sloane, & Wu, 2012) conducting analysis at the hospital level, and this study conducting analysis at the unit level, the influence of the practice environment deserves attention. Using large national samples, all of these studies supported that a better practice environment was associated with lower incidence of an adverse event (i.e., failure to rescue, 30-day inpatient mortality, surgical site infections, and CAUTI rates).

The influence of the nurse manager on all aspects of the practice environment needs to be considered as an important variable in the evaluation of clinical outcomes. This element is a

reflection of the ability and leadership of the nurse manager to support a practice environment that provides the milieu in which professional practice thrives and drives the outcomes important to quality care for patients. Ultimately, this impacts the healthcare organization's bottom line (i.e., patient length of stay and reimbursable costs).

Implications for practice are multifaceted. The influence of the nurse manager at the unit level is clearly supported in these studies. The association of the practice environment with a measured patient outcome at the unit level supports the need to develop action plans and interventions that focuses on a practice environment that supports professional nursing care and practice while monitoring nurse-sensitive outcomes. If the practice environment is not conducive to professional practice of nurses (e.g., quality of care, adequate staffing resources, collegial inter-disciplinary relationships), it is important to question whether recommended best clinical practices can occur consistently. While the prevention of CAUTI is improved with nurse driven protocols, the empowerment of nurses is dependent upon a nurse manager that supports and facilitates autonomous practice. Autonomous practice is supported by a practice environment that empowers clinical nurses to have adequate resources, involvement in decision making within the unit and hospital, a foundation for quality care as well as the expectation of a collegial nurse physician relationship that also extends to other health care team members. There isn't a quick fix, but the need for development of a professional practice environment that is supported by both unit and the hospital leadership is clearly indicated.

Careful selection and development of first-line nurse managers for the nursing units should be an organizational priority in view of the association of the nurse manager ability, leadership, and support with all other elements of the practice environment. Providing training, tools and support to new nurse managers may be key to obtaining the outcomes important to

delivery of high quality patient care and achieving outcomes prevent adverse impact on the hospital.

In addition to the impact of the nurse manager, job enjoyment is clearly influenced by collegial nurse-physician relationships and to a large extent upon staffing and resource adequacy. Assessing nurse perception of the practice environment that includes their perception of the adequacy of staffing and resources available to them in the provision of care can assist leadership in identifying clinical units in need of interventions that create a more positive practice environment. According to work by Schmalenberg and Kramer (2007), perception of staffing adequacy is influenced by the other aspects of the practice environment, it is more than just the nurse-to-patient ratios. In the future, study is needed of units that report lower scores on staff and resource adequacy (PES) or perception of staffing adequacy (EOM-II), in spite of meeting minimal standards of professional organizations or accrediting bodies. Potentially, this could assist in the identification of other root causes that ultimately would impact clinical outcomes.

The positive association between CAUTI rates with the hospital characteristics (academic medical center and bed-size greater than 500) deserves closer scrutiny, and serves to alert larger hospitals and academic medical centers to the increased risk to their patients. Identifying the increased association with hospital characteristics highlights the need for hospitals to pay careful attention to aspects of their clinical practice related to catheter use as well as the practice environment in which care is provided. An important consideration for all hospitals in reducing CAUTI rates is cultivating a unit culture that embraces professional practice and a nursing model of care that focuses on providing quality care rather than just completing tasks.

Valid and reliable measures representing the practice environment are available to researchers as well as nurse executives in examining the impact of interventions that can reduce adverse events on nursing units. Consequently, it is important to use data to identify specific elements that can be analyzed and addressed at the unit level. Using data rather than anecdotal information, nurse executives can identify strategies appropriate to the units with lower scores on specific elements of the practice environment and determine quality improvement projects to address issues specific to their units. These strategies could include: (a) more judicious allocation of resources, (b) providing team training or approaches to strengthen nurse-physician collegiality, or (c) improved support of shared governance if participation in hospital affairs is low. In the current healthcare environment that is focused on value-based care, efficient use of resources is essential. The NWLM provides a framework to identify and focus on specific elements of the practice environment that contribute to better patient and staff outcomes.

Future Research

Future research is needed to evaluate the relationship of the practice environment to other measured nurse-sensitive outcomes at the unit level. The second study was limited to medical, surgical, and medical-surgical units. Additional studies are needed at the unit level in critical care and step-down units to confirm the relationships of the practice environment and job enjoyment to CAUTI rates in those settings. Extending the model to other nurse-sensitive outcome measures (e.g., falls, other infections, pressure ulcers, etc.) would add to the growing body of knowledge of the impact of the practice environment in areas that are important to patients as well as health care providers.

Complexity of the practice environment and the associated influences leads to research needs in several areas. These areas include: identification of interventions aimed at improving

clinical nurse involvement in decision making; evaluation of strategies that improve staff perception of staffing and resource adequacy; and further study into practices of first-line nurse managers in developing and sustaining a culture of professional practice.

Strengths and Limitations

Strengths of the study include well defined, standardized measures, and a standardized data collection process across hospitals for both the practice environment elements and CAUTI incidence. The tools used to measure the elements of the practice environment and job enjoyment are well established with good reliability and validity at the unit level. The use of a measured outcome in place of a perceived outcome of adverse event rates strengthens support for the relationship of the practice environment as a predictor of a clinical outcome at the unit level.

Limitations to this study include the potential for selection bias as the NDNQI ® database has a higher proportion of hospitals that have achieved Magnet designation (37%) compared to the national average of 7%. Magnet-designated hospitals biases the sample toward higher performing hospitals that are focusing on quality improvement using benchmarking reports such as the NDNQI®. Hospitals with less than 100 beds or from those from non-metropolitan areas (rural) are under-represented compared to all hospitals in the U.S. Although data were collected at different points throughout the year, the data would be considered cross-sectional, which limits inference of causality. The inability to operationalize depersonalization or emotional exhaustion in the NWLM due to lack of variables that represented those elements was a limitation to evaluation of the posited model by Leiter and Laschinger (2006), and should be explored in the future.

In spite of limitations, the NWLM was supported as a framework to study the practice environment at the interface of the clinical nurse and the patient, the unit level, where care is provided and prevention of adverse events occurs. Collection and monitoring of data is not enough, it must be used to inform practice at all levels of the organization but especially at the unit level where delivery of patient care is dependent upon clinical nursing practice.

Conclusions

Secondary analyses of large data sets that included clearly defined reliable and valid measures for the practice environment and nurse-sensitive outcome indicators provided a methodology to evaluate unit level influences that otherwise would not be feasible. The use of SEM provided additional insight into the complex setting in which care occurs. Findings that supported the negative association between job enjoyment and CAUTI rate provided valuable information to inform practice.

The importance of the nurse manager ability, leadership, and support to all elements of the practice environment clearly was identified and supported. Clinical practice that results in the best practice that achieves desirable outcomes is the product of an excellent practice environment that is dependent on excellent nurse manager leadership. The association of the elements of the practice environment and clinical outcomes demonstrates the need for assessment that is inclusive of both domains. The influence of elements of the practice environment to a measured outcome (i.e., CAUTI rate) provides additional evidence supporting this important connection.

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Appendix A

Practice Environment Scale

Practice Environment Scale
For each item, please indicate the extent to which you agree that the item is PRESENT IN YOUR CURRENT JOB.
Response options: strongly agree, agree, disagree, strongly disagree.

Nurse Participation in Hospital Affairs
1. Career development/clinical ladder opportunity.
2. Opportunity for staff nurses to participate in policy decisions.
3. A chief nursing officer which is highly visible and accessible to staff.
4. A chief nursing officer equal in power and authority to other top-level hospital executives.
5. Opportunities for advancement.
6. Administration that listens and responds to employee concerns.
7. Staff nurses are involved in the internal governance of the hospital (e.g., practice and policy committees).
8. Staff nurses have the opportunity to serve on hospital and nursing committees.
9. Nursing administrators consult with staff on daily problems and procedures.

Nursing Foundations for Quality of Care
1. Active staff development or continuing education programs for nurses.
2. High standards of nursing care are expected by the administration.
3. A clear philosophy of nursing that pervades the patient care environment.
4. Working with nurses who are clinically competent.
5. An active quality assurance program.
6. A preceptor program for newly hired RNs.
7. Nursing care is based on a nursing, rather than a medical, model.
8. Written, up-to-date nursing care plans for all patients.
9. Patient care assignments that foster continuity of care, i.e., the same nurse cares for the patient from one day to the next.
10. Use of nursing diagnoses.

Nurse Manager Ability, Leadership, and Support of Nurses
1. A supervisory staff that is supportive of the nurses.
2. Supervisors use mistakes as learning opportunities, not criticism.
3. A nurse manager who is a good manager and leader.
4. Praise and recognition for a job well done.
5. A nurse manager who backs up the nursing staff in decision-making, even if the conflict is with a physician.

Staffing and Resource Adequacy
1. Adequate support services allow me to spend time with my patients.
2. Enough time and opportunity to discuss patient care problems with other nurses.
3. Enough registered nurses to provide quality patient care.
4. Enough staff to get the work done.

Collegial Nurse-Physician Relations
1. Physicians and nurses have good working relationships.
2. A lot of team work between nurses and physicians.
3. Collaboration (joint practice) between nurses and physicians.

Source: National Database of Nursing Quality Indicators®.(2013).*NDNQI® RN Survey with Practice Environment Scale.*

Appendix B

Job Enjoyment Scale

Job Enjoyment Scale
Nurses with whom I work would say that they:
Response options: strongly agree, agree, tend to agree, tend to disagree, disagree, strongly disagree.

1. Are fairly well satisfied with their jobs.
2. Would not consider taking another job.
3. Have to force themselves to come to work much of the time.
4. Are enthusiastic about their work almost every day.
5. Like their jobs better than the average worker does.
6. Feel that each day on their job will never end.
7. Find real enjoyment in their work.

Source: National Database of Nursing Quality Indicators®. (2012). *NDNQI® RN Survey with Practice Environment Scale.*

Appendix C

Permission to use Manuscript One in Dissertation

No, that will not be a problem.
Thank you,
Sandra
-----Original Message-----
From: Nancy Ballard [mailto:nballard@kumc.edu]
Sent: Wednesday, March 25, 2015 7:34 PM
To: Western Journal of Nursing Research
Subject: RE: Western Journal of Nursing Research

I got both messages. Thanks. I will probably need to upload the dissertation prior to publication (early May). Will that be a problem.

_____

From: Dearlove, Sandra T. [dearloves@missouri.edu] on behalf of Western Journal of Nursing Research [wjnr@missouri.edu]
Sent: Wednesday, March 25, 2015 5:00 PM
To: Nancy Ballard
Subject: RE: Western Journal of Nursing Research

Oh my, I didn't realize that my message from Monday afternoon didn't reach your inbox; I didn't receive an error message! I will forward that now, but let me know if you don't receive a second message from me right after this one.

As for permission, the contributor form you signed allows SAGE to publish the paper, but you retain the copyright to your material. I think #6 applies most closely to the situation with your dissertation: "6. You may use the Contribution (version 3) in a book you write or edit any time after publication in the Journal."

Best regards,
Sandra

-----Original Message-----
From: Nancy Ballard [mailto:nballard@kumc.edu]
Sent: Wednesday, March 25, 2015 3:17 PM
To: Western Journal of Nursing Research
Subject: RE: Western Journal of Nursing Research

Hi Sandra

I have one other question- I will need permission to include a copy of the manuscript in my

dissertation as it is one of two manuscripts that will meet the publication option for my dissertation. I will also need permission to use Figure 2 in a second manuscript submission as the basis for model confirmation used prior to extension of the model in a new data set. Thanks for your assistance.

Nancy

_____

From: onbehalfof+wjnr+missouri.edu@manuscriptcentral.com
[onbehalfof+wjnr+missouri.edu@manuscriptcentral.com] on behalf of wjnr@missouri.edu
[wjnr@missouri.edu]
Sent: Wednesday, March 18, 2015 11:15 AM
To: Nancy Ballard
Subject: Western Journal of Nursing Research

18-Mar-2015

WJNR-2014-Aug-0179.R1 - Evaluation of Elements of Nursing Worklife Model Using Unit Level Data

Dear Nancy,

I have had the chance to complete my review your manuscript, the final stage before I submit the files to the publisher. I've come across a few things that need to be addressed before it can be considered complete and ready for publication. Please reply to this email with your response in the body of the message.

Let me know if you need more clarification on any of these requests. Thank you for your assistance in readying your manuscript for publication.

Sincerely,
Sandra Dearlove, Editorial Assistant
Western Journal of Nursing Research