

**THE EFFECT OF MODE OF NURSING CARE DELIVERY AND SKILL MIX ON
QUALITY AND PATIENT SAFETY OUTCOMES**

by

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Abstract

Aims: This study examined the effect of various components of a model of nursing care delivery, the mode of nursing care delivery and nursing skill mix on (a) quality of nursing care (i.e., nurse reported quality of nursing care and nursing tasks left undone), (b) patient adverse events, and (c) nurse outcomes (i.e., job satisfaction and emotional exhaustion) after controlling for nurse demographic characteristics, work environment and workload factors. This study also explores the moderating effects of mode of nursing care delivery and skill mix on the relationship between workload factors and the five outcome variables.

Background: Research into redesigning care delivery has typically focused on only one care delivery component at a time (e.g., skill mix). There exists little research focusing on both components, and controlling for one factor while the other is investigated to determine quality of nursing care delivery and nurse and patient outcomes.

Method: This cross-sectional exploratory correlational survey study drew upon secondary data from 416 direct care registered nurses (RNs) from medical-surgical settings.

Results: Nurses working in a team-based mode of care delivery reported a greater number of nursing tasks left undone compared to those working in a total patient care mode of delivery. Nurses working in a skill mix with licensed practical nurses (LPNs) reported a higher frequency of patient adverse events compared to those working in a skill mix without LPNs. Two moderating effects were found. At higher levels of acuity, nurses in a team-based mode of care delivery reported a higher frequency of patient adverse events than did nurses in a total patient care mode of delivery. At higher levels of acuity, nurses working in a skill mix with LPNs reported lower levels of emotional exhaustion than nurses in a skill mix without LPNs.

Conclusion: Models of nursing care delivery components influenced quality and safety outcomes.

Implications: To be effective, a team-based mode of care delivery requires collaborative teamwork. Policy makers, administrators and healthcare providers should work together to clarify and optimize the scopes of practice for RNs and LPNs.

Preface

This dissertation is original, unpublished, independent work by the author, Farinaz Havaei. The research study was conducted under the supervision of committee members: Dr. Maura MacPhee, (co-supervisor, Professor, UBC School of Nursing), Dr. Susan Dahinten (co-supervisor, Associate Professor, UBC School of Nursing) and Dr. Arminee Kazanjian (Professor, UBC School of Population & Public Health). Ethics approval was received from the University of British Columbia Research Ethics Board (ethics approval number H14-00789).

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List of Abbreviations

LPNs= Licensed Practical Nurses

NWI= Nursing Worklife Index

PES-NWI= Practice Environment Scale-Nursing Worlife Index

RNs= Registered Nurses

TN= Team Nursing

TPC= Total Patient Care

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Dedication

I dedicate this work to those who have ALWAYS been by my side, my parents, Fereshteh and Javad, and my husband, Amir. Mom and Dad, I learned many life lessons from you, among them how to be strong and independent, always upholding my values and principals. Amir, your patient and kind soul along with your open mind has been an inspiration in my life. I am forever indebted to all three of you.

Chapter 1: Introduction

Increasing healthcare human resource shortages, constrained health care budgets, and quality and safety concerns have resulted in many workforce redesign initiatives within health care (MacPhee, 2014). Many of these initiatives focus on models of nursing care delivery. A model of nursing care delivery refers to a structured approach for organizing and providing nursing care to clients (Jost, Bonnell, Chacko, & Parkinson, 2010). Models of nursing care delivery contain several components, including skill mix and mode of nursing care delivery (Huber, 2013). This study will focus on these two key components of models of nursing care delivery.

Mode of nursing care delivery refers to how nurses work collaboratively or independently to provide direct patient care to a group of patients (Shirey, 2008). Total patient care and team nursing are the predominant modes of nursing care delivery in most acute care settings (King, Long, & Lisy, 2014). In total patient care, one registered nurse (RN) is primarily responsible for the complete care of a group of patients throughout his/her shift (Duffield, Roche, Diers, Catling-Paull, & Blay, 2010; Shirey, 2008). In team nursing, a designated team of nursing staff members with various skill levels and scopes of practice provide care to a group of patients (Duffield et al., 2010; Shirey, 2008).

Skill mix refers to the classifications of nurses providing patient care (Harris & McGillis Hall, 2012). In acute care, the key classifications are RNs and licensed practical nurses (LPNs), and nursing care aides (Harris & McGillis Hall, 2012). Registered nurses and LPNs are self-regulated: they have regulatory bodies that oversee their licensure and maintenance of professional standards of practice (MacPhee, 2014). In Canada, RNs typically comprise three-

quarters of the workforce (Canadian Institute of Health Information, 2012). Care aides may have some training, and they are typically available to provide non-nursing supports to regulated nurses (e.g., delivering food trays, stocking rooms) (MacPhee, 2014).

Care delivery model redesign is an international phenomenon associated with changes to modes of nursing care delivery and skill mix (MacPhee, 2014). These redesign initiatives have been happening throughout Canada (e.g., British Columbia) and internationally in Australia, New Zealand, the US, and the UK for over a decade. Redesign initiatives aimed at mode of nursing care delivery typically promote team nursing. A well-known Institute of Medicine report (2004), “Keeping Patients Safe: Transforming the Work Environment of Nurses,” recommended team-based care delivery to maximize health human resource utilization and enhance the quality and safety of care delivery. According to BC Ministry of Health, this US report was the inspiration for a shift towards team nursing in provincial acute care settings (British Columbia Ministry of Health, 2014). In Canada, redesign initiatives aimed at skill mix began over a decade ago, with substitution of LPNs for RNs (Shamian & Elisheva, 1997). Historically in Canada, LPNs were “auxiliary workers,” trained on the job to provide nursing services prior to 1945. Over time, their roles and responsibilities have been expanding. In British Columbia (BC), LPNs became recognized as autonomous, self-regulated nurse professionals in 2008 (College of Licensed Practical Nurses of BC, 2015).

Nurse researchers have shown that in some instances, these redesign initiatives have been associated with quality and safety breaches (MacPhee, 2014; Rodney, 2014). An infamous example is the Mid Staffordshire Trust within the National Health Service of England. In this

Trust, RNs were replaced with unregulated care aides. Government-commissioned inquiries found that care delivery model redesign resulted in unnecessary patient deaths (Francis, 2013). In BC, health authorities have instituted a variety of care delivery model redesign initiatives. For example, Island Health Authority reconfigured the skill mix on medical and surgical units within several hospitals. As a result of nurses' patient safety concerns, various nursing organizations, such as BC Nurses' Union and the Association of Registered Nurses of British Columbia, have been in consultation with the provincial government and health authorities (British Columbia Nurses' Union, 2016; Rodney, 2014). Consultations have focused on legal scopes of practice for nurses (i.e., RNs and LPNs) and safe workload management. Research is needed to determine how these redesign initiatives influence quality and safety outcomes.

Care delivery model redesign can be evaluated in multiple ways. One way care delivery model redesign is evaluated pertains to quality/safety (Q/S) outcomes. These outcomes are operationalized as measurable Q/S indicators (Montalvo, 2007). The nursing literature focuses on "nurse sensitive" indicators that are directly attributed to nurses' capacity to provide quality, safe care (Montalvo, 2007; Savitz, Jones, & Bernard, 2005). One Q/S outcome is nurse perceptions of quality of care (i.e., quality of care indicator). Quality of nursing care is defined as the degree to which nursing services are consistent with current nursing standards of practice. Nurse researchers consider quality of nursing care a separate outcome from nurse and patient outcomes, because it is based on nurses' assessments of the overall quality of their care delivery (Aiken, Clarke, & Sloane, 2002; Aiken et al., 2012). Patient Q/S indicators include medication errors, falls, pressure ulcers, urinary tract infections (UTIs), and hospital-acquired infections: these patient indicators are patient-related outcomes known as patient adverse events. Some

nurse outcomes Q/S indicators are absenteeism, job satisfaction and burnout (2005). Quality of nursing care, patient, and nurse Q/S indicator data are obtained through administrative databases and/or by nurse reports (Aiken et al., 2011). McHugh and Stimpfel (2012) used administrative data and nurse surveys to study nurse and patient Q/S indicators across 396 hospitals from four US states. They found that nurse reports are a valid method for studying Q/S outcomes in situations where administrative data are not obtainable (McHugh & Stimpfel, 2012). Quality of nursing care, patient outcomes and nurse outcomes are the three Q/S indicators of interest in this study.

1.1 Problem Statement

Care delivery redesign research typically focuses on only one care delivery model component at a time (i.e., mode of care delivery or skill mix). Limited research exists where both components are included, and where one factor is controlled while the other factor is investigated with respect to quality of nursing care delivery and nurse and patient outcomes (Fernandez, Johnson, Tran, & Miranda, 2012). There are conflicting research findings that may be due to these types of methodological issues (Crossan & Ferguson, 2005; Currie, Harvey, West, McKenna, & Keeney, 2005). For instance, some research indicates that a richer skill mix (more RNs per LPNs) results in better quality of nursing care delivery; whereas other research has failed to find a statistically significant relationship. Without including the other key component of care delivery design, the mode of care delivery, research findings remain nebulous. Another limitation is the lack of control for workload factors such as staffing levels and patient characteristics. A majority of the model of care delivery research fails to control for the effect of these important determinants of quality of nursing care and nurse and patient outcomes.

1.2 Purpose and Study Research Questions

The purpose of this study was to examine the unique effects of nursing skill mix and mode of care delivery with respect to quality of nursing care, patient and nurse outcomes. The four key research questions were: (1) What is the relationship between mode of nursing care delivery and (a) quality of nursing care (b) patient outcomes, and (c) nurse outcomes after controlling for nurse characteristics, nurse workload factors, and work environment factors? (2) What is the relationship between skill mix and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes after controlling for nurse characteristics, nurse workload factors, work environment factors, and mode of nursing care delivery? (3) Does mode of nursing care delivery moderate the relationship between nurse workload factors and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes? (4) Does skill mix moderate the relationship between nurse workload factors and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes?

1.3 Outline

This dissertation begins with a comprehensive literature review (Chapter 2) that focuses on quantitative research related to mode of care delivery and skill mix and demonstrates the knowledge gaps that have informed this study. Methodological considerations related to cited research evidence are presented at the end of each sub-section in Chapter 2. The end of Chapter 2 identifies, explains, and presents this study's conceptual model. Chapter 3 provides detailed information about study design and analytic methods. Chapter 4, presents descriptive and inferential findings with respect to the study key research questions. Chapter 5 is an interpretation of the findings with respect to previous research evidence; practice, policy and research implications associated with study findings will also be discussed in this chapter.

Chapter 2: Literature Review

The first section of this chapter presents the search and appraisal strategies of the selected literature followed by an examination of this literature related to the study's key concepts, mode of care delivery and nursing skill mix. The third reviews this body of literature with a view to identifying other concepts important to quality of nursing care, patient and nurse outcomes. Drawing on the findings from the literature review, the fourth section, presents a testable conceptual model.

2.1 Search and Appraisal Strategies

The key search terms were “nursing skill mix”, “nursing staffing mix”, “nursing care delivery model”, “nursing mode of care delivery,” “quality of care”, “patient outcomes”, “patient adverse events”, “nurse outcomes”, “nurse burnout”, “nurse emotional exhaustion”, “job satisfaction” “nurse satisfaction”, “job dissatisfaction”, “nurse turnover”, “nurse absenteeism” and “nurse overtime”. The databases searched included CINAHL, Google scholar, and MedLINE. The search was limited to the following categories: a) scholarly research articles and comprehensive literature reviews published in peer reviewed journals; b) English publications with available full text; c) systematic reviews and quantitative research studies; and d) studies conducted after 2000. After the titles and abstracts of the retrieved studies were reviewed, 22 articles were selected for the literature review. It is important to note that qualitative studies were not included in this literature review mainly because the purpose of this study was to examine the effect of care delivery model components, mode and skill mix, on quality of nursing care, patient and nurse outcomes. Figure 1 shows a flow chart of study selection for the literature review.

Each of the selected studies was critically evaluated mainly with a view to determining the gaps in the model of care delivery literature. Study methods such as design, sampling strategy, sample size, data collection and data analysis were appraised to determine whether they were appropriate to answer study research questions. In this process, conceptual and methodological limitations in each study were identified. These efforts contributed to evaluating the care delivery model evidence, identifying gaps in the literature, and informing the proposed study's design.

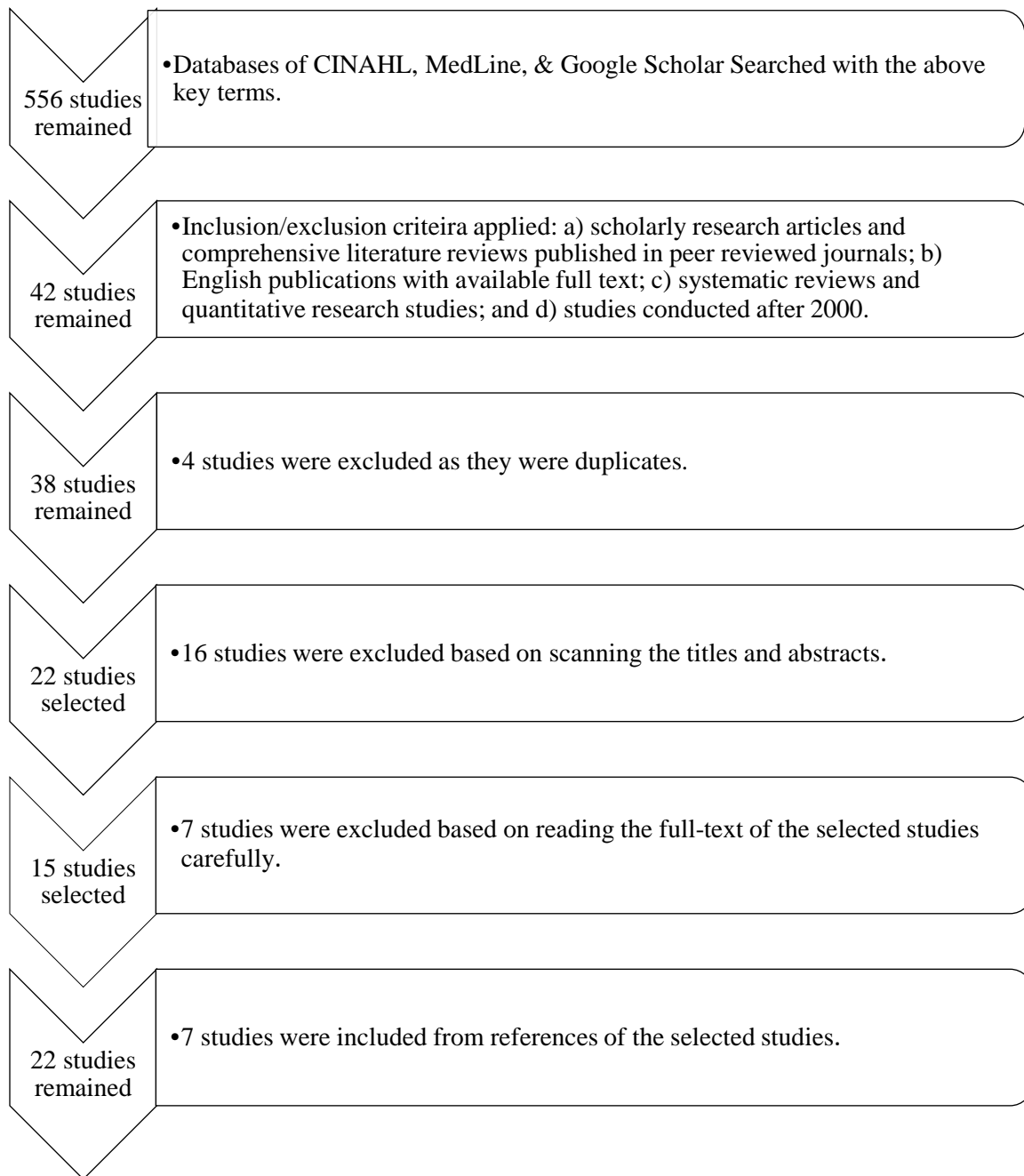


Figure 1. Flow Chart of Literature Review

2.2 Modes of Nursing Care Delivery

Total patient care and team nursing constitute the two major modes of nursing care delivery. The type of mode is determined primarily by the nature of the patient population and by staff

availability. Total patient care requires a comparatively large number of RNs each of whom cares for a group of patients, usually numbering between four and five. This mode of care delivery is favored by nurses who regard it as a superior mode of care delivery because it allows for continuity of care and close nurse-patient relationships (Shirey, 2008; Wells, Manuel, & Cuning, 2011). Total patient care minimizes the need for nursing team members to communicate and coordinate their duties, because only one nurse is responsible for caring for each group of patients (2011). Shirey noted that total patient care is often delivered by RN staff, particularly in acute care settings (2008).

In contrast, team nursing is based on collaboration and the sharing of responsibilities among team members: an RN typically performs a supervisory function. This mode of care delivery often has fewer RNs in relation to non-RNs. Team nursing places greater responsibility on RNs who supervise and coordinate team care delivery (Shirey, 2008). The chief advantage of this mode of care delivery is collaborative teamwork: the whole team is responsible for the quality and safety of care delivery. There are also advantages associated with the RN team leadership role: greater confidence in communicating with other nursing and medical staff, better task-prioritizing, time-management skills, and improved relations with co-workers (Tran, Johnson, Fernandez, & Jones, 2010). In addition, team nursing promotes integration of different skill levels and maximum use of limited health human resources (Dubois & Singh, 2009; Duffield et al., 2010). Team nursing is hard to enact in settings with hierarchical modes of leadership where professional autonomy (especially that of non-RN staff) may be compromised (Shirey, 2008; Tiedeman & Lookinland, 2004).

The appropriateness of a mode of nursing care delivery is known to be context dependent (Shirey, 2008). For example, total patient care may be more suitable than team nursing for patients in an Intensive Care Unit (ICU) where many of the critically ill require one-to-one care. In acute care settings where team nursing is based on effective, collaborative teamwork, there is evidence of improved quality of nursing care (Kalisch & Lee, 2010), and better nurse outcomes (Kalisch, Lee, & Rochman, 2010). Two cross-sectional studies involving more than 2,200 nursing staff across over 50 acute care units in several US hospitals found more effective teamwork was associated with less number of nursing tasks left undone (Kalisch & Lee, 2010) and higher levels of nurses' satisfaction with current job as well as satisfaction with the occupation (Kalisch et al., 2010). "When team work is present, it is much more likely that the care will not be missed . . . [because staff] are aware of other team members' workload and then backing one another up by moving to assist" (Kalisch & Lee, 2010, p. 238-239). Although these studies did not compare team nursing with another mode of care delivery (e.g., total patient care), these findings suggest that team nursing, if done effectively, is an appropriate mode of care delivery for acute care settings. A systematic review of 14 studies between 1985 and 2011 investigated the effect of various modes of nursing care delivery on quality of nursing care, patient and nurse outcomes (Fernandez et al., 2012). Nurses' perceptions of their quality of care delivery were significantly higher when combinations of team nursing and total patient care were the modes of care delivery. In these instances, nurse managers had the capacity to select mode of delivery (i.e., team nursing vs. total patient care) based on available staff and patient care needs (i.e., the context). With respect to patient outcomes, there were equivocal findings. Team nursing was negatively associated with the prevalence of some Q/S indicators (e.g., medication errors) and not others (e.g., patient falls). The review also reported mixed findings for team nursing and

its association to nurse outcomes, such as job satisfaction. The authors cited one key limitation: operational definitions for modes of care delivery were difficult to determine among the individual studies.

2.3 Skill Mix

In Canada, self-regulated nurses fall into four categories: RNs, LPNs, registered psychiatric nurses (RPNs) and nurse practitioners (NPs). Each has its own scope of practice; moreover, the competencies required of entry-level members are legally specified. Scopes of practice and related practice competencies are covered by formal educational programs approved by provincial regulatory bodies. Increasing shortages of health care workers and health care budget constraints have resulted in different skill mix across healthcare sectors, including acute care. The replacement of RNs with LPNs and care aides has generated research related to quality of nursing care delivery and nurse and patient outcomes.

The term 'nursing skill mix' is usually defined in one of two ways, depending on whether it is viewed as a continuous or categorical variable. In the case of the former, two key operational definitions may apply: (a) the proportion of nurse hours per nurse type to total nursing hours (Cho, Ketefian, Barkauskas, & Smith, 2003; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002; Seago, Williamson, & Atwood, 2006; Staggs & Dunton, 2012; Unruh, 2003; West, Patrician, & Loan, 2012); and (b) the proportion of regulated or licensed staff to unregulated or unlicensed staff (McGillis Hall & Doran, 2004; McGillis Hall & Doran, 2007; McGillis Hall et al., 2003; McGillis Hall, Doran, & Pink., 2004). It is important to note that typically these metrics ought to include only those hours worked by direct care nurses providing

“hands-on” care and exclude those hours worked by nurses performing other roles, such as management and education. Most researchers, moreover, take into account only productive nursing hours, thereby excluding those hours devoted to annual leave, sick leave, and training and orientation (Twigg, Duffield, Bremner, Rapley, & Finn, 2012).

In the case of the categorical variables, nursing skill mix either has two categories (e.g., all- RN vs. RN/LPN) (Huang et al., 2011; McGillis Hall & Doran, 2007; Yang et al., 2012) or three or more categories (e.g., all-RN, RNs/LPNs, RNs/LPNs/Care aides) (McGillis Hall & Doran, 2004; McGillis Hall et al., 2003). A skill mix including a higher proportion of RNs (i.e., higher RN to non-RN ratios) is known as a “richer” skill mix and is related to better quality and safety outcomes such as decreased 30-day patient mortality (Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005). In a skill mix that is not all-RN, richer skill mix refers to a greater proportion of regulated nurses (Canadian Nurses Association, 2005).

Nursing skill mix and mode of care delivery are known to be related. One article examined the relationship between nursing skill mix and modes of care delivery (Duffield et al., 2010).

Overall, this study found that skill mix was a determinant of mode of nursing care delivery. A greater proportion of RN hours to all nursing hours was found to have a negative relationship with team nursing ($\beta=-.54, p<.01$). A greater proportion of LPN hours to all nursing hours, on the other hand, was found to have a negative relationship with total patient care ($\beta=-.33, p<.01$).

These findings also emphasize how flexible modes of delivery, based on available nursing skill mix, may be necessary with respect to efficient health human resource management.

2.4 Quality of Nursing Care: Mode of Nursing Care Delivery and Skill Mix Evidence

Quality of nursing care is defined as the degree to which nursing services are consistent with current nursing standards of practice (Hall, Moore, & Barnsteiner, 2008). Quality of nursing care is often assessed by nurse self-reports on surveys (Clarke & Donaldson, 2008; Hughes, 2008). There are several operational definitions of quality of nursing care including: nurse ratings of general and last shift quality of nursing care, patient safety grade, recommendation of the hospital to friends and family, and number of nursing tasks left undone (Aiken, et al., 2002; Aiken et al., 2012; Aiken et al., 2013; Sochalski, 2001; Stimpfel & Aiken, 2013). One longitudinal study (Wells et al., 2011) and one cross-sectional study (Huang et al., 2011) examined the effect of mode of nursing care delivery on quality of nursing care in acute care settings.

A pre- and post- longitudinal Canadian study collected RN and LPN data from a regional hospital's two acute care units at baseline and at three and 12 months post-transition from team nursing to a total patient care mode of care delivery (Wells et al., 2011). Quality of nursing care was operationalized as nurses' perceptions of care delivery effectiveness. Both RNs and LPNs perceived client care delivery as significantly more effective at three and 12 months (*Mean*= 3.14 and 3.40 respectively) when compared with the baseline (*Mean*= 2.62, $p<.000$). A Taiwanese study employed a cross-sectional design in three medical units six months after a change from total patient care (all-RN skill mix) to a team nursing mode of delivery with RNs and care aides (Huang et al., 2011). 66% of the RNs reported an increase in the quality of care versus 34% who reported a decline or no change following the introduction of a team nursing mode ($p<.001$). Overall, team nursing was favored in Huang et al., (2011) study, while total patient care was favored in the Wells et al., (2011) study.

No studies were located that examined only nursing skill mix in relation to nurse-reported quality of care. One Canadian cross-sectional survey study examined the effect of both skill mix and mode of care delivery on quality of nursing care (McGillis Hall & Doran, 2004). The sample consisted of 1,116 RNs working in 77 medical, surgical, and obstetrical units in 19 teaching hospitals in Ontario, Canada. Skill mix was operationalized as both a continuous variable (i.e., proportion of regulated to unregulated staff), assessing right numbers of nurses in the skill mix; and a categorical variable (i.e., all-RN; RNs/LPNs; RNs/LPNs/care aides), assessing right types of skill mix. Mode of nursing care delivery was operationalized as total patient care vs. “others”. An all-RN skill mix was positively related to nurses’ perceptions of the quality of care ($\beta=2.43$, $p<.05$) while total patient care was negatively related to quality of nursing care ($\beta=-3.04$, $p<.01$). The authors attributed the latter finding to nurses’ poor understanding of modes of nursing care delivery: these surmised that nurses incorrectly reported team nursing as total patient care. The proportion of regulated to unregulated nursing staff was not related to any of the study outcomes, although other researchers have shown that richer skill mix is associated with enhanced nurse and patient outcomes (Estabrooks et al., 2005; Harris & McGillis Hall, 2012; Staggs & Dunton, 2012; Twigg et al., 2012).

In summary, based on research design, the two strongest studies were conducted by Canadian nurse researchers, McGillis Hall and Doran (2004) and Wells et al. (2011). In the former study, the inclusion of both skill mix and mode of care delivery was a key strength, and skill mix was conceptualized and measured in two different ways. Nevertheless, there were limitations: cross-sectional study design, lack of control for staffing levels and operationalization of mode of

delivery (i.e., total patient care versus “others”). In the latter study, the longitudinal design and control for potential confounding effects (e.g., staffing levels and skill mix) were key strengths, although this study did not examine the effect of skill mix (Wells et al., 2011). Overall, the effect of mode of delivery was equivocal, while richer skill mix (i.e., all-RN) was associated with better quality of care nurse self-reports.

2.5 Patient Outcomes: Mode of Nursing Care Delivery and Skill Mix Evidence

Patient outcomes encompass patient experiences, such as patient satisfaction; and patient incidents or adverse events such as falls, UTIs, hospital acquired pneumonia, pressure ulcers. These are “nurse sensitive” indicators that have been empirically tested with demonstrated, direct relationships between the quality of nursing care delivery and patient outcomes (Bolton, Donaldson, Rutledge, Bennett, & Brown, 2007a). As part of their quality improvement initiatives, the majority of North American hospitals are mandated to collect information pertaining to the occurrence of patient adverse events on a regular basis. Previous research has found a positive strong correlation between nurse-reported patient adverse events and institutional reports of patient adverse event such as patient falls (Purdy, 2011). Thus, when patient adverse events data are not accessible, nurse perceptions of patient outcomes serve as a valid and reliable proxy (Aiken et al., 2001; Sochalski, 2001, 2004).

No studies examined the effect of mode of care delivery on patient outcomes. There were, however, nine studies that reported the effect of skill mix on patient outcomes where patient adverse events data were accessible from administrative databases (Bolton et al., 2007b; Cho et al., 2003; McGillis Hall et al., 2004; Needleman et al., 2002; Needleman et al., 2011; Seago,

Williamson, & Atwood, 2006; Unruh, 2003; West et al., 2012; Yang et al., 2012). Eight studies operationalized skill mix as a continuous variable (Bolton et al., 2007b; Cho et al., 2003; McGillis Hall et al., 2004; Needleman et al., 2002; Needleman et al., 2011; Seago et al., 2006; Unruh, 2003; West et al., 2012), and one study operationalized skill mix as a binary variable (i.e., all RN vs. RN/care aide). As mentioned above, one study (McGillis Hall et al., 2004) defined skill mix in continuous and categorical terms. All these studies found that a richer skill mix was significantly associated with decreased patient adverse events such as pneumonia (Cho et al., 2003; Needleman et al., 2002; Unruh, 2003).

Two studies operationalized skill mix as the proportion of RN hours to regulated nurse hours (RNs and LPNs). Needleman et al. (2002) used a large longitudinal dataset from medical and surgical patients in about 800 US hospitals. A richer skill mix was associated with lower frequency of UTIs, upper GI bleeding, pneumonia, cardiac arrest, hospital acquired pneumonia, shock or cardiac arrest, failure to rescue, and length of stay decreased, especially among medical patients. Among surgical patients, a richer skill mix was only associated with a lower rate of UTIs (2002). A cross-sectional study of 12,204 acute care patients found that a 10% increase in skill mix corresponded with a 9.5% decline in the risk of developing pneumonia (Cho et al., 2003). There were no significant relationships between skill mix and other patient adverse events such as patient falls, pressure ulcers, adverse drug events, UTIs, wound infections and sepsis.

Three studies operationalized skill mix as the proportion of RN hours to total nursing hours (Bolton et al., 2007b; Seago et al., 2006; West et al., 2012). West et al., (2012) used data from the Military Nursing Outcomes Database, collected over a period of 13 years, encompassing

11,500 nursing shifts on 56 inpatient units in 13 US Army, Navy, and Air Force hospitals to study skill mix. Outcomes were patient falls with injury, and medication errors. This study found a 10% reduction in skill mix resulted in a 30% increase in the probability of falls with injuries and a 13% increase in medication errors in medical-surgical units (2012). Similarly, Bolton et al. (2007b) used a large-scale longitudinal data set from 252 California medical-surgical units, representing a sample of more than 500,000 patient days in three years. This study found skill mix was negatively related only to patient falls ($\beta = -.03, p < .01$). There was no relationship between skill mix and prevalence of other patient adverse events such as pressure ulcers and restraint use. The authors attributed this finding to the confounding effects of several ongoing patient safety initiatives, targeting pressure ulcers in particular, at the time of this study. Seago et al. (2006) found that skill mix was positively related to patient satisfaction with pain management ($\beta = 13.63, p < .01$) and with physical care requests ($\beta = 22.9, p < .01$) but not with patient satisfaction with instruction and failure to rescue from medication errors, and from decubitus ulcers.

One study operationalized skill mix as RN staffing below target level (Needleman et al., 2011). This study calculated the difference between target RN hours for the shift based on patient needs during that shift versus actual hours worked on the unit in direct patient care. Data involving 197,961 admissions and 176,696 nursing shifts among 43 medical units were used to examine the effect of RN staffing on patient mortality. After adjusting for patient and unit-specific factors, this study found a positive association between shifts with RN staffing below target level and patient mortality. In particular, the risk of patient death increased by 2% for each shift below the target level.

Unlike the above five studies that focused on the effect of RNs in skill mix, two studies focused on the proportion of regulated nurses (RNs and LPNs) to total nursing staff (RNs, LPNs, care aides) (Unruh, 2003), or to unregulated nurses (care aides) (McGillis Hall et al., 2004). Unruh (2003) used seven years of data from acute care hospitals in Pennsylvania. This study found that a richer skill mix was associated with lower rates of pressure ulcers ($\beta=-.25, p<.001$) and pneumonia ($\beta=-.12, p<.05$) (Unruh, 2003). McGillis Hall et al. used cross-sectional data from 77 medical, surgical, and obstetrical patient care units in 19 urban teaching hospitals in Ontario, Canada (2004). This study found a richer skill mix was related to a lower number of medication errors ($\beta=-3.25, p<.05$) and wound infections ($\beta=-2.57, p<.01$). No relationship was found between skill mix and other adverse events such as patient falls and UTIs.

One Taiwanese retrospective study operationalized skill mix as a binary variable: all-RN vs. RNs/care aides (Yang et al., 2012). This study found that a richer skill mix was associated with a lower incidence of UTIs (6.7% vs. 22.3%, $p<.01$) and higher rates of ventilator weaning (52.1% vs. 37.3%, $p<.01$). Surprisingly, this study found a richer skill mix was associated with higher bloodstream infections (12.9% vs. 6.9% $p\leq.01$). The authors attributed this finding to poorer hand hygiene practices of RNs in the richer skill mix cohort (i.e., all-RN).

One Canadian repeated-measures study examined the effect of both skill mix and mode of nursing care on patient outcomes (McGillis Hall et al., 2003). Similar to the cross-sectional study on the effect of mode of nursing care delivery and skill mix on quality of care outcomes (McGillis Hall & Doran, 2004), this study operationalized skill mix as both a continuous variable (i.e., the proportion of regulated nurses to unregulated staff) and a categorical variable with four

categories (i.e., all-RN; RNs/LPNs; RNs/care aides; RN/LPN/care aides). Modes of nursing care delivery was operationalized as primary nursing (i.e., patients assigned to the same nurse from admission to discharge) vs. patient assignment (i.e., patients assigned to nurses based on geographic proximity). Patient outcomes were assessed via patient reports of functional status and pain control at admission, discharge, and six weeks after discharge. Patient satisfaction was assessed on discharge (McGillis Hall et al., 2003). There were no significant relationships six weeks after discharge, but at discharge a higher proportion of regulated nurses to unregulated staff was associated with higher patient satisfaction and functional status. A nursing skill mix of RNs/care aides was found to be positively associated with better pain control at discharge when compared with a nursing skill mix of RNs/LPNs/care aides ($\beta=2.28, p<.05$). Surprisingly, an all-RN skill mix was not found to be associated with patient outcomes. This finding may be due to the order of independent variable entry into the multiple regression equation, suggesting that an all-RN skill mix was not related to patient outcomes over and above the proportion of regulated to unregulated staff. Mode of nursing care delivery was not related to a majority of study outcomes (McGillis Hall et al., 2003). In comparison to primary nursing mode of nursing care delivery, patient assignment mode was associated with better patient social functioning.

In summary, based on research design, the two strongest studies were by Needleman et al. (2002) and McGillis Hall et al. (2003). Needleman et al. was a superior study given its longitudinal nature, its large dataset from 800 US hospitals, and its control for staffing levels and risk adjustment for patient conditions, such as acuity and comorbidities. This study, however, did not control for mode of nursing care delivery. The McGillis Hall et al. study was also longitudinal in nature with a large dataset from 19 Canadian hospitals; patient acuity was controlled for and

mode of care delivery was included as a predictor variable. Mode of delivery, however, was defined as primary nursing versus assignment based on geographic layout; other mode of care delivery studies typically compare team nursing to total patient care (Huang et al., 2011; Wells et al., 2010). A key limitation of this study was failure to control for staffing levels. The key finding from skill mix studies was that regardless of how nursing skill mix was operationalized, a richer skill mix was associated with less negative patient outcomes (e.g., UTIs, pneumonia, and better pain control).

2.6 Nurse Outcomes: Mode of Nursing Care Delivery and Skill Mix Evidence

Nurse outcomes are Q/S indicators that encompass positive and negative nurse related experiences such as job satisfaction, organizational commitment, burnout and turnover. Four studies examined the effect of mode of nursing care delivery on nurse outcomes using either longitudinal (Lee, Yeh, Chen, & Lien, 2005; Tran et al., 2010; Wells et al., 2011) or cross-sectional data (Huang et al., 2011).

Tran et al. (2010) conducted a two-group pre- and post- quasi-experimental study that compared RNs' satisfaction scores at baseline and six months after total patient care was replaced with team nursing. At baseline, team nursing was introduced into four units (N=25) while the remaining four units continued to use a total patient care mode (N=13). The change in mode of nursing care in the former unit also accompanied a change in skill mix (e.g., introduction of care aides). The key study outcomes included RN satisfaction with work, supervision, and co-workers, and a global satisfaction measure. Neither the within-group analysis over time nor the between-group comparisons yielded significant findings (Tran et al., 2010). Similarly, Lee et al.,

(2005) conducted a quasi-experimental study of 22 Taiwanese RNs. Registered nurses' satisfaction with care aides' performance scores were compared at three and six months after total patient care (all-RN) was replaced with team nursing (RNs and care aides). No statistically significant differences were found in nurse satisfaction scores across two time periods. A Taiwanese cross-sectional study examined the change in satisfaction of 38 RNs after a total patient care mode (all-RN) was replaced by team nursing (RNs/care aides) (Huang et al., 2011). No change in RNs' level of satisfaction was found. A Canadian pre- and post- longitudinal study examined nurse perceptions of job satisfaction and empowerment before and three and 12 months after team nursing was changed to total patient care mode (N = 38, 36, 21 at Times 1, 2, 3) (Wells et al., 2011). Job satisfaction and empowerment scores did not vary across the three time periods. Overall, all four studies failed to find a relationship between mode of nursing care delivery and nurse outcomes such as job satisfaction. The non-significant findings of these studies may be a result of low power due to small sample size.

One cross-sectional study of 1,884 nursing units in 306 US hospitals examined the effect of skill mix on nurse outcomes (Staggs & Dunton, 2012). Skill mix was operationalized as the proportion of RN hours to all nursing hours. Study outcomes included human resource data on actual RN turnover and total nurse turnover (RNs and LPNs and care aides) (Staggs & Dunton, 2012). The study found a richer skill mix was negatively related to both RN turnover ($\beta = -.04$, $p < .001$) and total nurse turnover rates ($\beta = -.05$, $p < .001$); a 10% increase in skill mix resulted in 4% and 5% decline in RN turnover and total nurse turnover respectively. This study finding is consistent with previous skill mix findings with respect to quality of nursing care and patient outcomes.

Only one Canadian study, a secondary analysis of data, examined the effect of both mode of nursing care delivery and skill mix on nurse outcomes (McGillis Hall & Doran, 2007). Skill mix was operationalized as both a continuous variable (the proportion of regulated nurses to unregulated staff) and a categorical variable with three categories (all-RN, RNs/LPNs, RNs/LPNs/care aides). Mode of nursing care delivery was operationalized as total patient care vs. other (i.e., team nursing and primary nursing). Study outcomes included RN job stress and role tension. No relationship was found between nursing skill mix and job stress outcomes. Total patient care was a negative predictor of job stress ($\beta=-3.81, p<.001$) in comparison to other modes of nursing care delivery (McGillis Hall & Doran, 2007).

In summary, the strongest mode of care delivery studies used a quasi-experimental design (Lee et al., 2005; Tran et al., 2010; Wells et al., 2011). Their non-significant findings may be due to small sample size (i.e., low power) (Lee et al., 2005; Tran et al., 2010; Wells et al., 2011); and simultaneous changes in mode of care delivery and skill mix (Lee et al., 2005; Tran et al., 2010). The only study that included both mode of nursing care delivery and skill mix found an inverse relationship between total patient care and negative nurse outcomes; no significant relationship was found between skill mix and nurse outcomes (McGillis Hall & Doran, 2007). This study suffered from lack of control for staffing levels and patient acuity. Overall, the lack of consistent skill mix and mode of care delivery findings may be attributed to methodological weaknesses.

2.7 Summary of the Mode of Nursing Care Delivery and Skill Mix Literature

The above literature review highlights the methodological limitations of a small number of studies, some conducted over a decade ago. Only three studies included both mode of care delivery and skill mix (McGillis Hall & Doran, 2004; McGillis Hall & Doran, 2007; McGillis Hall et al., 2003). These three studies were all done with the same dataset in one province of Canada. Mode of nursing care delivery was conceptualized in different ways, such as total patient care versus “others” and primary care delivery versus nurse assignment by geographic layout (i.e., “patient assignment”). Given a current RN workforce shortage, care delivery model redesign has resulted in different skill mix, particularly the addition of LPNs. Although RNs and LPNs are both self-regulated, more research is needed to distinguish between the effects of different types of regulated nurses. Earlier studies by McGillis Hall and colleagues, for instance, did not distinguish between a skill mix with and without LPNs. Overall, other limitations were identified in the mode of nursing care delivery and skill mix literature. The majority of studies failed to account for the potential effect of nurse staffing levels and/or patient characteristics. Insufficient sample size was a common limitation, especially among nursing outcome studies. Another common drawback was failure to include both models of care delivery components. For example, often changes in mode of nursing care delivery accompanied changes in skill mix. Therefore, it was unclear which component (i.e., mode of nursing care delivery, skill mix) was most strongly related to quality of nursing care, patient and nurse outcomes.

This study design addressed the limitations noted in the reviewed studies in several ways: (a) differentiate between total patient care and team nursing modes of care delivery; (b) distinguish between a skill mix with LPNs vs. one without LPNs; (c) examine the effect of both mode of

nursing care delivery and skill mix on Q/S outcomes; (d) control for the effect of staffing levels and patient characteristics; and (e) conduct a-prior power calculations to ensure adequate sample size for detecting smaller effect sizes.

2.8 Other Antecedents of Quality of Nursing Care and Patient and Nurse Outcomes

Improving the internal validity of this study requires consideration of the potential effects of known predictors that are important to quality of nursing care, patient and nurse outcomes. These include demographic characteristics, work environment factors and nurse workload factors.

2.8.1 Nurse demographic characteristics.

Evidence suggests nurse demographic characteristics can influence nurse and patient outcomes. Nurse demographics include type of employment contract (i.e., permanent or temporary), level of education, nursing experience, age, and gender. Aiken and colleagues conducted a survey study of 13,152 nurses working in 198 acute care hospitals in Pennsylvania. Hospitals with greater than 15% nurses with a temporary employment contract were more likely to have poorer nurse outcomes (i.e., increased job dissatisfaction, burnout, and intent to leave) and poorer nurse-reported patient outcomes (i.e., increased patient falls, nurse work-related injuries and patient verbal abuse towards nurses) compared to hospitals with lower proportions of temporary nurses (i.e., less than 15%) (Aiken, Xue, Clarke, & Sloane, 2007). Similarly, previous Canadian research has linked hospitals employing a greater number of temporary nursing staff to higher 30-day patient mortality rates obtained from hospital administrative databases (Estabrooks et al., 2005). Nurse employment status has also been linked to nurse outcomes. Another Canadian study used survey data from 348 new graduate nurses over five years to show that casual nurses

were more likely to leave in comparison to part-time nurses (Rheaume, Clement, & LeBel, 2011). This finding is consistent with the research findings on temporary vs. permanent nursing.

Nurses' level of education has also been linked to nurse and patient outcomes. A large scale study of patients and nurses from 665 US hospitals showed that as a result of 10% increase in the proportion of nurses with a bachelor's degree, the odds of both 30-day inpatient mortality and failure to rescue decreased by about 4% (Aiken et al., 2011). With respect to nurse outcomes, a Canadian cross-sectional survey study of 3,051 RNs in rural areas found that nurses with higher levels of nursing education (masters/doctorate, advanced nursing practice, baccalaureate, or diploma) were more likely to express an intention to leave their nursing position with the next 12 months (Stewart et al., 2011). The most common reason for leaving was "to take further education" as less educational opportunities were available in rural areas. A systematic review of nurse turnover evidence found inconsistent study findings in terms of level of education and nurse intent to leave (Hayes et al., 2012).

Other demographic characteristics such as age, gender and nursing experience have been linked to nurse outcomes, such as burnout and intent to leave. The Maslach Burnout Inventory (MBI) is a commonly used assessment tool that measures different components of burnout (Maslach, Jackson, & Leiter, 1996). A cross-sectional survey study of 574 Australian RNs showed that age was negatively related to nurses' emotional exhaustion and depersonalization scores on the MBI, indicating that older nurses were less prone to burnout (Lavery & Patrick, 2007). Other research with the MBI found RNs under 30 years of age were more emotionally exhausted than their older counterparts (Erickson & Grove, 2007). Age has also been linked to nurses' intent to leave. A

cross-sectional study of 110 acute care units in the US showed that nurses' units with nursing staff who were older than 35 were less likely to have staff who intended to leave. Interestingly, only gender was related to actual turnover behaviors: units with a higher percentage of male nurses had higher turnover rates (Tschannen, Kalisch, & Lee, 2010). Nurses with less years of experience have been associated with an increased likelihood of leaving their current jobs (Boswell, Lowry, & Wilhoit, 2004; Stewart et al., 2011; Stone et al., 2007). According to the above evidence, to increase the internal validity of this study, nurse demographic characteristics were statistically controlled.

2.8.2 Nursing work environments.

Nursing work environments refer to organizational characteristics of a work setting that facilitate or constraint professional nursing practice. Since the 1990s, numerous factors, including budget constraints and shortages of healthcare workers, have resulted in the restructuring of healthcare work environments. In light of the continuous restructuring of nursing work environments, healthcare services researchers have been studying the relationship between these environments and quality of nursing care, nurse and patient outcomes. Earlier research from the US found that some hospitals, known as "magnet hospitals", had excellent nurse recruitment and retention rates (Lake, 2002). Close examination of magnet hospital work environments found certain organizational characteristics common to these hospitals. Laschinger and colleagues developed a conceptual framework, the Nursing Worklife Model that has been empirically tested for over two decades (Figure 2) (Laschinger & Leiter, 2006; Leiter & Laschinger, 2006). Based on a common set of organizational attributes, Lake (2002) initially developed a 65-item measure called the Nursing Work Index (NWI) survey tool. A random sample of nurses from 16 magnet and eight

non-magnet hospitals (N=2,299) was used to validate this measure which resulted in a shorter, 31-item version with five factors known as the Practice Environment Scale of the Nurses Work Index (PES-NWI) (2002).

The five work environment factors of the PES-NWI are: (1) *nursing leadership* (i.e., the extent to which nurses perceive their leader as supportive); (2) *participation in hospital affairs* (i.e., the extent to which nurses believe they have an impact on overall hospital administration); (3) *nurse-MD relations* (i.e., the quality of working relations between doctors and nurses); (4) *nursing model/foundation of care delivery* (i.e., nurses' perception that the hospital supports a nursing model rather than a medical model of care); and (5) *staffing and resource adequacy* (i.e., nurses' evaluation of the adequacy of resources with respect to meeting workloads) (Lake, 2002).

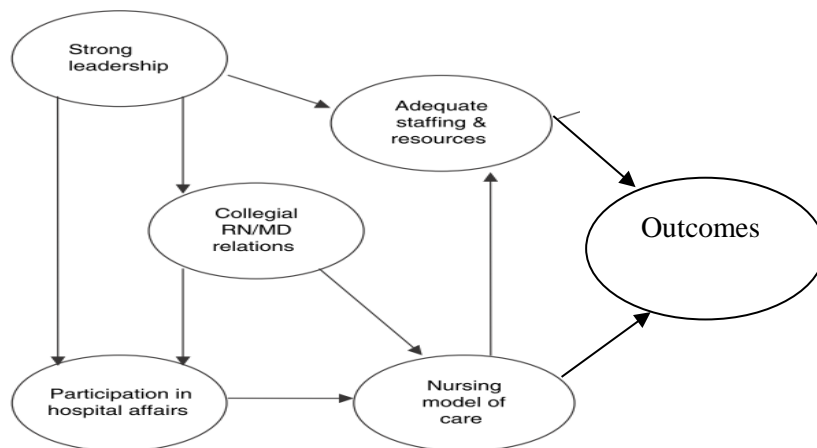


Figure 2. The Nursing Worklife Model

A number of studies, many from Canada, have explored the relationship between the Nursing Worklife Model components, and nurse and patient outcomes (Figure 1). A cross-sectional

Canadian survey study examined the effect of the nursing worklife model components on nurse-reported burnout (Leiter & Laschinger, 2006). The sample included 8,597 nurses working in 292 acute care hospitals in the provinces of Ontario, British Columbia, and Alberta. The impact of the Nursing Worklife Model components was transferred mainly through a path from *adequate staffing and resources* to emotional exhaustion. Emotional exhaustion was a result of inadequate access to resources needed to meet work demands. A secondary path from *nursing model/foundation of care* to personal accomplishment dimension of burnout showed that nurses derived a greater sense of accomplishment as employees of hospitals with greater nursing values, visibility and shared decision-making (Leiter & Laschinger, 2006). Another study by Laschinger and Leiter (2006) examined the mediating effect of nurse burnout on patient adverse events using the former study dataset. Patient adverse events were based on nurses' perceptions of the frequency of occurrence of falls, nosocomial infections, medication errors, and patient complaints over the past year. Although burnout was hypothesized to mediate the relationship between the Nursing Worklife Model components and patient adverse events, the Nursing Worklife Model components were found to directly influence patient adverse events. *Staffing and resource adequacy* and a *nursing model/foundation of care* were the only two model components directly related to patient adverse events (Laschinger & Leiter, 2006). In another study, Laschinger (2008) incorporated structural empowerment (i.e., nurses' perceptions of access to empowering structures such as information and educational opportunities) into the Nursing Worklife Model and examined its effect on nurse reports of quality of nursing care and job satisfaction. A random sample of 234 nurses working in an urban tertiary care hospital in Ontario was used to show that structural empowerment had a direct effect on both outcomes;

indirect effects were channeled mainly through adequate *staffing and resources* (Laschinger, 2008).

Other empirical evidence also noted the importance of work environment factors on quality and safety outcomes. An earlier systematic review of 27 papers published from 1966-2004 examined the relationship between work environment factors and patient mortality. Despite including studies that used various versions of NWI (e.g., PES-NWI, Revised Nursing Work Index (R-NWI)), this systematic review found higher nurse perceptions of *nursing model/foundation of care delivery* was associated with lower patient mortality (Kazanjian, Green, Wong, & Reid, 2005). A Swedish study of 9236 RNs from 79 acute care hospitals found higher nurse perceptions of *staffing and resource adequacy* was the strongest predictor of higher nurse reported patient safety grade followed by *nursing leadership* (Alenius, Tishelman, Runesdotter, & Lindqvist, 2013). This study did not include two work environment factors: *nursing model/foundation of care delivery* and *participation in hospital affairs*. Similarly, a US secondary analysis of 7,000 acute care hospital nurses found higher nurse perceptions of *staffing and resource adequacy, nursing leadership, nursing model/foundation of care, nurse-MD relations*, and *participation in hospital affairs* were the strongest predictors of lower nursing tasks left undone respectively (Hessels, Flynn, Cimiotti, Cadmus, & Gershon, 2015). Hessels and colleagues concluded “the amount of nursing tasks left undone can be decreased by 7.3% to 13.5% by making improvements to the nursing practice environment, with the greatest effect of staffing and resource adequacy measures” (p. 64). Rochefort and Clarke (2010) studied 553 NICU nurses in Quebec, Canada. The study outcomes included nurse reported quality of nursing care, nursing tasks left undone and nurse outcomes such as job satisfaction and emotional

exhaustion. Higher nurse perceptions of *nursing leadership, staffing and resource adequacy*, and *nurse-MD relations* were respectively the most important predictors of higher nurse reported quality of nursing care ratings. Although *staffing and resource adequacy* was found to be the second strongest predictor of nurse reported quality of nursing care, it was the only factor that was consistently significantly related to all outcome variables included in the study. When NICU nurses reported limited staffing and resources, they left tasks undone and focused on completing the most important care elements, such as life support, and patient surveillance. Similar to Alenius et al. (2013), Rochefort and Clarke (2010) did not examine *nursing model/foundation of care delivery and participation in hospital affairs*.

To summarize, key practice environment components, particularly *adequate staffing and resources* and *nursing model/foundation of care delivery*, have been shown to influence nurse outcomes, such as emotional exhaustion, and patient outcomes, such as nurse-reported patient adverse events. Nurses' perceptions of *staffing and resource adequacy* was the strongest positive predictor of quality of nursing care as measured by nurse reports of tasks left undone, quality of nursing care delivery, and their organizations' patient safety grade.

2.8.3 Workload factors.

In addition to nurse demographic characteristics and nursing work environment factors, workload is another known predictor of nurse and patient outcomes (Duffield et al., 2011). Workload is a complex phenomenon, a result of the interplay between adequate workplace resources (e.g., staffing levels) and nursing care responsibilities or demands (Gurses & Carayon, 2007). For this study, workload was operationalized as nurse staffing levels and patient needs.

2.8.3.1 Staffing Levels.

According to Lake, having an adequate number of nurses available to manage the care of assigned patients is one key way to manage nurses' workloads effectively (2002). The adequate number of nurses is referred to as staffing levels and is often operationalized as patient-nurse ratios. Patient-nurse ratios have been examined with respect to nurse-reported quality of care (Aiken et al., 2012), nurse outcomes (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002); and patient outcomes such as patient satisfaction (Kutney-Lee et al., 2009); patient mortality (Aiken et al., 2011; Aiken et al., 2014; Shekelle, 2013); and other patient adverse events (Kane, Shamliyan, Mueller, & Duval, 2007). Many international studies are based on the RN4CAST survey by Aiken and colleagues (Aiken et al., 2012; Aiken et al., 2014; Aiken et al., 2013; Ausserhofer et al., 2014). It should be noted that in these studies, RNs were "professional" nurses with country certification equivalent to the North American RN.

A cross-sectional RN4CAST survey study of 12 European countries and the US found that higher patient-professional nurse ratios were significantly associated with lower patient satisfaction; lower nurse-reported quality of nursing care and hospital patient safety grades; and higher negative nurse outcomes such as burnout, job dissatisfaction and intent to leave (Aiken et al., 2012). A 12-country European survey study with RN4CAST found that hospitals with lower patient-professional nurse ratios had a fewer number of nursing tasks left undone (e.g., medication administration) ($\beta=.09$; $p<.0001$) (Ausserhofer et al., 2014). Another RN4CAST study in nine European countries showed that as a result of a one patient increase per professional nurse, the likelihood of 30-day inpatient mortality increased by 7% (odd ratio: 1.07, 95% *CI*: 1.03-1.11) (Aiken et al., 2014). Similarly a study of 665 US acute care general hospitals

found that as a result of a one patient increase per regulated nurse (RNs and LPNs), the odds of 30-day inpatient mortality and failure to rescue increased by a factor of about 1.04 for both outcomes (95% *CI*: 1.02-1.06) (Aiken et al., 2011).

2.8.3.2 Patient Needs.

Nurse workload is often a function of patient needs. Despite access to similar resources, different nurses working in the same work environment may have different responsibilities, depending on their assigned patients' characteristics, such as patient acuity and dependency. A nurse fatigue survey of 6,312 Canadian nurses reported that the most significant cause of fatigue was workload (reported by 73% of those surveyed), and patient acuity was identified a major cause (Canadian Nurses Association and Registered Nurses Association of Ontario, 2010). Fifty one percent of nurses reported that staffing was insufficient to meet the workloads and patient acuity requirements.

The importance of patient care needs can be seen in different initiatives implemented worldwide with respect to the use of “real-time staffing tools” that determine staffing levels based on specific patient characteristics (MacPhee, 2014). In one safe staffing initiative within BC, a patient needs assessment tool, based on the American Association of Critical Care Nurses' Synergy Model, (Curley, 2007) was used by nurses and management to rate their patients on eight characteristics that are related to acuity (i.e., predictability, stability, complexity, and resilience), and dependency (i.e., vulnerability, capacity to make own decisions, capacity to care for self, and resource availability) (MacPhee, Wardrop, Campbell, & Wejr, 2011). The BC pilot was conducted among eight sites in four different health care sectors (i.e., acute care, long term

care, community care, and mental health). Direct care staff and management collaboratively used the “patient synergy tool” to assign staff to patients based on a match between patient needs and staff competencies. This tool is currently being implemented in acute care settings in other Canadian provinces (MacPhee, personal communications, June 28, 2016). Other health services researchers have identified the importance of categorizing patient needs when determining unit-level staffing assignments (Twigg & Duffield, 2009; Hurst, 2005).

Previous research supports a link between patient needs and patient outcomes. A US study of 13 military hospitals examined the association between nurse staffing and patient adverse events at the shift level—115,062 consecutive shifts over the period 2003 to 2006 constituted the data set. These researchers found that patient acuity was positively related to patient falls ($\beta= 1.13$) and medication errors ($\beta= 1.13$) on medical-surgical units (Patrician et al., 2011). In this study, patient acuity referred to nurses’ score of each patient acuity rating on a scale from 1= minimal care to 6=critical care, based on a list of nursing care activities and nursing time requirements. Needleman et al. (2002), described in the patient outcome literature review section above, operationalized patient acuity as “casemix” based on patient diagnosis-related groups (DRGs). Patients’ probability of having each adverse outcome was corrected for patient’s DRGs as the focus of this study was on the effect of skill mix on patient outcomes. This study did not report any findings pertinent to casemix. Of note is that the DRG method has been criticized when there are co-morbidities (Hurst, 2005). A UK nursing workforce study examined the relationship between patient needs and quality of care among 347 wards (Hurst, 2005). Quality of care was operationalized as a sum score of ratings in four areas: timeliness and completeness of the patient assessment, timeliness and completeness of planned nursing interventions, appropriateness of the

patient's care plan, and patient outcomes. For this study, wards were classified as high quality or low quality wards. Patient dependency was operationalized as patient's reliance on nurses for care needs; patients were rated by nurses on a four-point scale ranging from least=1 to most dependent=4. Patient acuity was measured using a complex algorithm based on patient dependency scores and the amount of direct nursing care patients received. Overall, "acuity is best interpreted as the equivalent number of dependency 1 patients in the ward or in each occupied bed" (Hurst, 2005, p. 80). This study did not find any relationship between patient needs, dependency and acuity scores, and wards' quality of care ratings. This finding may be attributed to "psychometric issues" associated with measurement of patient dependency and acuity. Hurst noted "if ward nurses failed to assess their patients accurately or if nonparticipant observers had labelled direct care interventions improperly then this incremental rise from the least to most dependent patients would falter" (Hurst, 2005, p. 79).

2.9 The Proposed Conceptual Framework

The conceptual framework for this study focuses on a specific portion of the Nursing Worklife Model, *the nursing model/foundation of care delivery*. Lake (2002) described this component as nurses' perception that the hospital supports a nursing model rather than a medical model of care. Supportive work environments have nurse models that clearly specify the roles and accountabilities of nurses with respect to care delivery. In this study, *the nursing model/foundation of care delivery* is operationalized as the mode of nursing care delivery and skill mix. The second Nursing Worklife Model component, *staffing and resource adequacy* is a proxy for nurses' perceptions of workload management (workload) in my version. A key purpose

of providing sufficient staffing and resources in nurses' work environment is to enhance quality of nursing care, nurse and patient outcomes through workload management.

An appropriate model of nursing care delivery may eliminate or mitigate some of the detrimental effects of heavy nursing workloads. More specifically, the mode of nursing care delivery can influence how nurses experience workloads. After reviewing the advantages and disadvantages associated with different modes of nursing care delivery, Shirey (2008) concluded that the appropriateness of a mode of nursing care delivery is dependent on context, e.g., patient population needs and the level of care required. Similarly, nursing skill mix can influence nurse perceptions of workload demands. The delivery of safe and quality nursing care and improved patient and nurse outcomes depends on the availability of the right number and type of nursing professionals.

The conceptual framework for this study is shown below (Figure 3). According to this framework, mode of nursing care delivery and skill mix are hypothesized to inform quality of nursing care, patient and nurse outcomes. Other factors germane to quality of nursing care, patient and nurse outcomes were identified during the course of the literature review. These include, among other elements, nurse characteristics, work environment factors and workload factors. In the conceptual model, nurse characteristics and work environment factors are hypothesized to be key determinants of the three study outcomes (Figure 3)). Nurse characteristics are conceptualized as nurse demographics; work environment factors as attributes of magnet-like hospitals, as defined by the Nursing Worklife Model research (Lake, 2002); and workload factors as staffing levels and patient needs. As described in an earlier section, skill mix

and mode of nursing care delivery are also hypothesized to influence the relationship between workload factors and the three study outcomes. There are four key research questions associated with the proposed conceptual model, which are discussed in the following chapter.

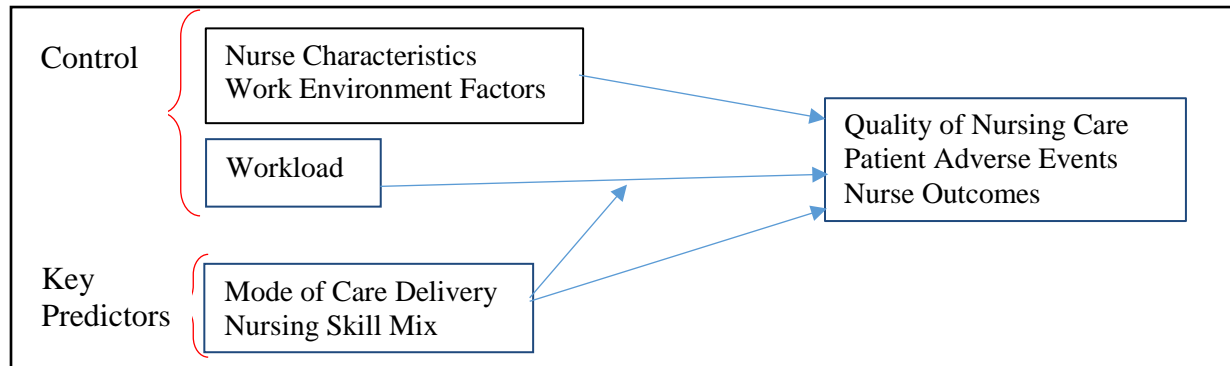


Figure 3. Conceptual model

Chapter 3: Methods

The primary purpose this study was to examine the effect of model of nursing care delivery (i.e., mode of nursing care delivery and skill mix) on quality of nursing care, patient outcomes, and nurse outcomes. In this chapter, I discuss the study methods. This chapter begins with a description of the study design, sampling strategy and sample size requirements, and method of data collection. This section is followed by a discussion of measures used to operationalize the study variables. Next, the data management and data analysis techniques are described in relation to the proposed hypotheses.

As per the conceptual model (Figure 3 in Chapter 2) four research questions were answered in this study:

1. What is the relationship between mode of nursing care delivery and (a) quality of nursing care (i.e., nurse reported quality of nursing care and nursing tasks left undone), (b) patient outcomes (i.e., patient adverse events), and (c) nurse outcomes (i.e., job satisfaction and emotional exhaustion) after controlling for nurse characteristics, nurse workload factors, and work environment factors?
2. What is the relationship between skill mix and (a) quality of nursing care (i.e., nurse reported quality of nursing care and nursing tasks left undone), (b) patient outcomes (i.e., patient adverse events), and (c) nurse outcomes (i.e., job satisfaction and emotional exhaustion) after controlling for nurse characteristics, nurse workload factors, work environment factors, and mode of nursing care delivery?

3. Does mode of nursing care delivery moderate the relationship between nurse workload factors and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes?

4. Does skill mix moderate the relationship between nurse workload factors and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes?

3.1 Research Design

This was a cross-sectional exploratory correlational survey study that drew upon secondary data to examine the effects of model of nursing care delivery on nurses' perceptions of quality of nursing care, patient outcomes, and nurse outcomes among a sample of BC acute care medical and surgical nurses. Study data were collected as part of a larger study funded by BC Nurses' Union (BCNU) and Collaborative Alliances for Nursing Outcomes that examined the effect of workload factors on nurse and patient outcomes (MacPhee & Havaei, 2015).

3.2 Sample

3.2.1 Source of data.

The larger study targeted nurses (RNs, RPNs, and LPNs) who were either direct care providers, educators, or managers working in acute care, residential care, or community care sectors (MacPhee & Havaei, 2015). A proportionate stratified random sample of BCNU nurses was drawn in the larger study. The proportionate stratification was based on health authority and employment status with returns from the acute care sector closely reflecting the intended

proportions¹. BCNU database was used to obtain health authority proportions, and BC regulated nursing workforce statistics from Canadian Institute of Health Information (Canadian Institute for Health Information, 2012) was used to obtain proportions based on employment status.

For the larger study, a total of 20,008 nurses were sent post cards as an initial invitation to participate in the web-based survey. Of the 20,008 invitations sent, 15,702 invitations were sent to nurses working in the acute care sector. Of the 15,702 acute care nurses 1,810 returned the study survey with a response rate of 11.5% for acute care nurses. After obtaining ethics approval from the UBC Behavioral Research Ethics Board (IRB number=H14-00789), postcards with unique passwords were mailed out to home addresses of a random sample of 20,008 nurses through the BCNU from July to August 2015. The postcards prompted individuals to complete the web-based surveys administered via Fluidsurveys. Because follow-up reminders are known to increase response rate (Polit & Beck, 2008), three subsequent e-mail reminders were sent out to non-respondents at two-week intervals. In September, there was a final mail-out of a paper version of the survey to home addresses of a random sample of 1,500 acute care nurses who did not respond to the study invitation. The larger study offered a raffle draw for one mini I pad and one of five \$100 gift coupons as a strategy to increase response rate.

3.2.2 Study sample.

The following inclusion criteria were adopted: RNs working in medical and/or surgical units, who had completed mode of nursing care delivery and skill mix information. RNs with a non-

¹ Appendix A shows the proportions used for stratification as well as responses per health authority and employment status.

practicing status (e.g., on medical or maternity leave) who were not involved in direct provision of patient care (e.g., educators and leaders) were excluded from the study. A step by step application of the inclusion/exclusion criteria is demonstrated in Figure 4. After excluding nurses that did not meet the study inclusion criteria, the final sample for the proposed study consisted of 416 RNs.

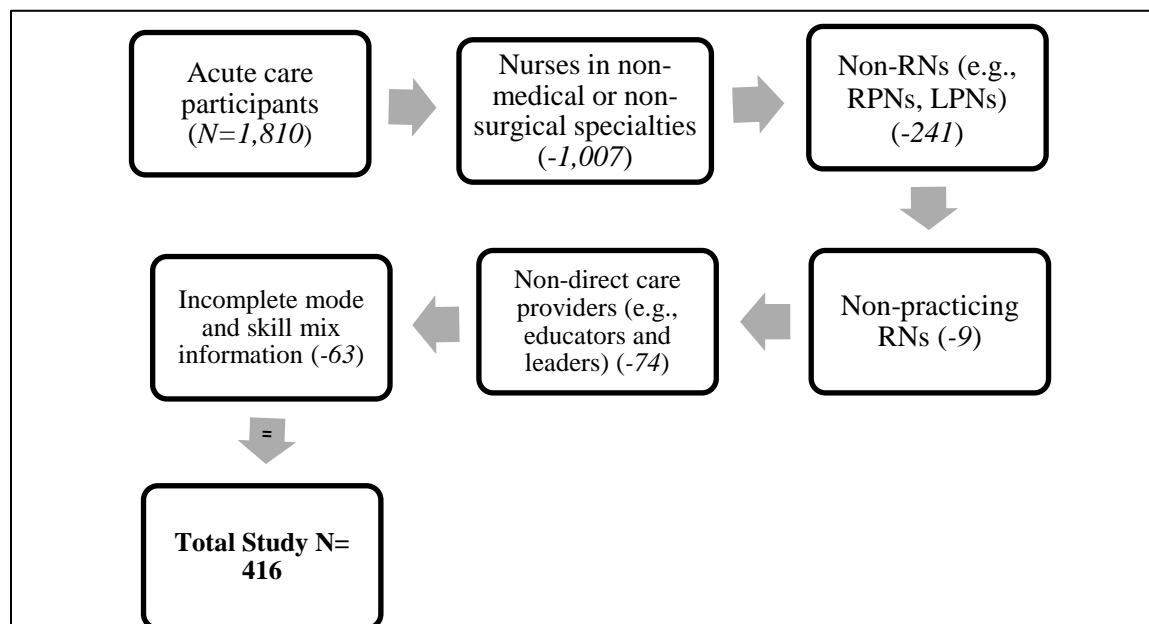


Figure 4. Flow chart of sample selection

The sample size requirement is typically a function of the data analysis technique. According to a-priori power calculation, with approximately 20 independent variables, a sample size of about 226 individuals would provide 80% power to detect small effect sizes (i.e., $R^2 = .10$) for multiple regression analysis at $\alpha = .05$ (Soper, 2011). Therefore, the study sample size of $N = 416$ had sufficient power to detect small effect sizes. The descriptive statistics pertinent to the study sample are shown in Table 1.

Table 1. Descriptive Statistics of the Study Sample

Characteristic	<i>f</i> (%)	<i>M</i>(<i>SD</i>)
Age (years)	-	38.3 (12.0)
Gender		
Male	11 (2.6%)	-
Female	405 (97.4%)	-
Highest Nursing Education		
Diploma	100 (24.0%)	-
Baccalaureate	308 (74.0%)	-
Masters	8 (1.9%)	-
Years of Nursing Experience		10.3 (10.0)
Employment Status		
Full-time	234 (56.3%)	-
Part-time	98 (23.6%)	-
Casual	84 (20.2)	-
Contract		
Permanent	313 (75.4%)	-
Temporary	102 (24.6%)	-
Number of Nursing Jobs		
=1	342 (82.8%)	-
>1	71 (17.2%)	-

Notes. *N*=416

3.3 Measures

The questionnaire that was used in this study consisted of standardized scales based on Aiken's RN4CAST survey and questions developed by the research team that designed the larger study; the research team comprised of University of British Columbia (UBC) researchers and BCNU board of executives. The latter questions are referred to as "researcher developed questions". These questions pertain to nurse characteristics, mode of nursing care delivery, skill mix, and some workload-related factors. These questions were piloted through focus groups with a convenience sample of 50 BCNU direct care RNs and LPNs from the acute care sector and were revised based on nurse focus group feedback. A list of study variables are shown in Table 2 followed by a description of the measures.

Table 2. Study Variables

Study Variables		
Outcome Variables	Quality of Nursing Care <ul style="list-style-type: none">• Nurse-reported quality of nursing care• Nursing tasks left undone	
	Patient Outcomes <ul style="list-style-type: none">• Patient adverse events	
	Nurse Outcomes <ul style="list-style-type: none">• Job satisfaction• Emotional exhaustion	
	<hr/>	
Key Predictors	Mode of Nursing Care Delivery <ul style="list-style-type: none">• TPC vs. TN	
	Skill Mix <ul style="list-style-type: none">• With LPNs vs. Without LPNs	
Control Variables	Nurse Characteristics <ul style="list-style-type: none">• Age• Gender• Nurse education• Nursing experience• Employment status• Contract• Number of nursing jobs	
	Nurse Workload Factors <ul style="list-style-type: none">• Patient acuity• Patient dependency• Patient-RN ratio• Patient-regulated nurse ratio	
	Work Environment Factors <ul style="list-style-type: none">• Staffing and resource adequacy• Nurse MD relations• Nursing leadership• Participation in hospital affairs• Nursing foundation of care delivery²	
	<hr/>	

Notes. TPC= total patient care, TN= team nursing.

² Nursing foundation of care delivery was labeled as model/foundation of nursing care delivery in Chapter 2. This work environment characteristic will be referred to as nursing foundation of care delivery in the remainder of this dissertation.

Table 3. Exploratory Factor Analysis Results of Researcher Developed Outcome Measures

Scales	Factor Loadings	Variance Explained (%)
Quality of Nursing Care		62.8%
In general, how would you describe the quality of nursing care delivered to patients in your primary unit?	.85	
How would you describe the quality of nursing care delivered on your last shift?	.78	
Please give your primary unit an overall grade on patient safety?	.80	
Would you recommend your hospital to your friends and family if they needed care?	.73	
Patient Adverse Events		59.1%
Patient received wrong medication, time or dose	.64	
Pressure ulcers after admission	.77	
Patient falls with injury	.80	
Urinary tract infections	.83	
Bloodstream infections	.75	
Pneumonia	.81	
Other nosocomial infections (e.g. MRSA)	.77	
Job Satisfaction		59.9%
How satisfied are you with your current job?	.87	
In the next year how likely is it that you will leave your current job (reversed)?	.61	
Would you recommend your hospital to a nurse colleague as a good place to work?	.82	

3.3.1 Outcome variables.

The study outcome variables included nurse-reported quality of nursing care, number of nursing tasks left undone, patient adverse events, and two nurse outcomes, job satisfaction and emotional exhaustion.

3.3.1.1 Quality of Nursing Care.

Two outcome variables reflecting quality of nursing care include: (a) nurse-reported quality of nursing care and (b) total number of nursing tasks left undone (Lucero, Lake, & Aiken, 2010).

Nurse-reported quality of nursing care was measured by a composite score that summed four quality of nursing care items. Two items asked nurses' to rate their perceptions of the overall quality of nursing care on their unit and last shift quality of nursing care (1= poor, 4= excellent). The third item asked nurses to give their primary unit an overall grade on patient safety (1=failing/poor, 4= excellent). The fourth item asked nurses to identify the likelihood that they will recommend their hospital to friends and family if they needed care (1= definitely no, 4= definitely yes). These items have been used frequently as indicators of quality of nursing care in Aiken's research (Aiken et al., 2002; Aiken et al., 2012; Aiken et al., 2013; Ball, Pike, Griffiths, Rafferty, & Murrells, 2012; Poghosyan, Clarke, Finlayson, & Aiken, 2010; Sochalski, 2001; Stimpfel & Aiken, 2013). Possible scores ranged from 4 to 16 with higher scores indicating higher levels of quality of nursing care. Exploratory factor analysis (EFA) with principal components analysis and varimax rotation confirmed a unidimensional factor structure (See Table 3). Internal consistency was satisfactory with Cronbach's alpha values of .80.

Nursing tasks left undone was measured with a single item that asked nurses to identify, based on a list of 14 options (0= no, 1=yes), the nursing tasks necessary but left undone over the last shift. Participants could endorse all applicable options with a possible range of scores from 0-14. This item, originally consisted of a list of seven nursing tasks (Sochalski, 2001). These tasks were identified based on focus groups of acute care staff RNs and included the following options: teach patients or family, prepare patients and families for discharge, talk with patients, adequately document nursing care, back rubs and skin care, oral hygiene, and develop or update nursing care plans (Lucero, Lake, & Aiken, 2009). Seven nursing tasks were added to this list including an “other, please specify” response option in the RN4CAST survey (Ball et al., 2012)³. Similar to Lucero et al. (2009), we computed composite scores for each individual representing the total number of tasks left undone. Of note is that previous research has linked number of nursing tasks left undone to patient adverse events (Ball, Murrells, Rafferty, Morrow, & Griffiths, 2013; Duffield et al., 2011; Kalisch, Tschannen, & Lee, 2012; MacPhee, Dahinten, & Havaei, 2016).

3.3.1.2 Patient Adverse Events.

Patient adverse events were measured with items asking about the frequency of occurrence of seven nurse sensitive patient adverse events such as medication errors and falls with injuries using a seven-point response scale (0= never, 6= everyday) (See Table 3). These items came from Sochalski’s (2001) adverse event tool, derived from the American Nurses Association nursing quality indicators (Purdy, Laschinger, Finegan, Kerr, & Olivera, 2010)⁴. This scale has

³ Appendix B provide a complete list of nursing tasks left undone.

⁴ Appendix C provides a complete list of patient adverse events.

been used extensively in large international studies of nurses such as the RN4CAST study (Aiken et al., 2013; Ball et al., 2012; Sochalski, 2004). A Canadian study reported a Cronbach's alpha of 0.78 for this scale (Purdy et al., 2010). Nurses' retrospective reports of adverse events are suggested to provide a reliable estimate of the occurrence of adverse events (Lucero et al., 2010; Purdy, 2011; Sochalski, 2004). Composite patient adverse events scores were computed for each participant with possible scores ranging from 0 to 42. Exploratory factor analysis with principal components analysis and varimax rotation, using the study sample, confirmed a unidimensional factor structure (See Table 3). Internal consistency was satisfactory with Cronbach's alpha values of .88.

3.3.1.3 Job Satisfaction.

Job satisfaction was measured with three items that asked nurses to identify their levels of (a) satisfaction with current job (1= very dissatisfied, 4= very satisfied), (b) intent to leave over the next year (1= very unlikely, 4= very likely), and (c) likelihood to recommend hospital to nursing colleagues as a place to work (1= definitely no, 4= definitely yes). All items were drawn from the RN4CAST survey (Sermeus et al., 2011). The intent to leave item was reverse coded and composite scores were computed with possible scores ranging from 3 to 12. Higher scores indicated higher levels of job satisfaction. Exploratory factor analysis with principal components analysis and varimax rotation confirmed a unidimensional factor structure (See Table 3). Cronbach's alpha was .64. Given that this scale consists of three items, a Cronbach's alpha of .64 suggested the scale has acceptable internal consistency (Paul, 2000).

Table 4. Exploratory Factor Analysis Results of Emotional Exhaustion Subscale of Maslach Burnout Inventory (MBI)

Emotional Exhaustion Subscale of MBI	Factor Loadings	Variance Explained (%)
		65.2%
I feel emotionally drained from my work	.84	
I feel used up at the end of the workday	.80	
I feel fatigued when I get up in the morning and have to face another day on the job	.82	
Working with people all day is really a strain for me	.72	
I feel burned out from my work	.89	
I feel frustrated by my job	.84	
I feel I am working too hard on my job	.83	
Working directly with people puts too much stress on me	.70	
I feel like I'm at the end of my rope	.80	

3.3.1.4 Emotional Exhaustion.

This variable was measured with the Emotional Exhaustion subscale of the Maslach Burnout Inventory-Human Service Scale (MBI-HSS) (Maslach et al., 1996). Emotional Exhaustion describes feelings of psychological depletion due to work burden (Schaufeli, Leiter, & Maslach, 2009). This nine-item measure asked nurses to rate their workplace perceptions on a seven-point scale (0 = never to 6 = daily) (Poghosyan et al., 2010). An example item was “I feel emotionally drained by my work”. Composite scores were computed with a range of 0 to 54. Exploratory

factor analysis with principal components analysis and varimax rotation (forced) was conducted among the study sample and confirmed a unidimensional factor structure (See Table 4). Internal consistency was satisfactory with Cronbach's alpha values of .93.

3.3.2 Key predictors.

3.3.2.1 Mode of Nursing Care Delivery.

Mode of nursing care delivery was measured with a single item that asked nurses to identify which option best described how care was delivered in their primary unit of work over the last shift: (a) Patients were assigned to one nurse (e.g., total patient care, labeled as TPC in chapter 4); (b) Patients were assigned to a nursing team (e.g., team nursing, labeled as TN in chapter 4). These descriptions of total patient care and team nursing modes of care delivery, used by Duffield et al. (2010), were modified to meet the purpose of this study after discussions with subject matter experts such as professional practice officers of the health authorities and BCNU board of executives. We further content validated this item through BCNU focus groups with approximately 50 direct care RNs and LPNs. In this study, 0= TPC and 1= TN.

3.3.2.2 Skill Mix.

Skill mix type was measured using a single item that asked participants to identify the number of each nurse type who provided direct care in their primary unit. Nurse types included RNs, RPNs, and LPNs. Using this information, we identified skill mix type into two categories: (a) a skill mix that does not include LPNs and (b) a skill mix that includes LPNs. In this study, 0= a skill mix without LPNs; 1= a skill mix with LPNs.

3.3.3 Control variables.

3.3.3.1 Nurse Characteristics.

Researcher developed questions were used to measure nurse characteristics with respect to age, gender (0= male, 1=female), highest nursing education (0= diploma, 1= BSN or Masters), years of nursing experience, current employment status (0= full-time, 1= part-time or casual), and type of nursing employment contract (0= permanent, 1= temporary) and number of nursing jobs (0= one job, 1= more than one job).

3.3.3.2 Nurse Workload Factors.

In this study, nurse workload factors pertained to nurse staffing levels, patient acuity and dependency. There were two variables measuring nurse staffing levels in this study: patient-RN ratio, and patient-regulated nurse ratio. These ratios were computed using two researcher developed questions that asked nurses to identify (a) the total number of patients in the unit and (b) the total number direct care nursing staff in the unit. The former ratio was computed by dividing the total number of patients by the total number of direct care RNs in the unit over the last shift; the latter was computed by dividing the total number of patients by the total number of direct care RNs, RPNs and LPNs. This method of computation is known to produce accurate nurse patient ratios. Sochalski (2001) found the average number of patients assigned to nurses obtained through this method of computation was virtually identical to nurse reports of the number of patients assigned to them.

The other two components of nurse workload were measured by questions based on the American Association of Critical Care Nurses' Synergy Model (Curley, 2007). Acuity refers to

instability, complexity, and unpredictability. These patient characteristics require close surveillance, rapid decision-making and coordination of skills (Curley, 2007). Dependency refers to patients' ability/inability to carry out their own activities of daily living and make their own care decisions (Curley, 2007). We provided these definitions on the survey and asked nurses to rate their patients overall levels of acuity (1= not acute at all, 4= very acute) and dependency (1= completely independent, 4= completely dependent) over the last month. For this study, acuity and dependency were recoded into dichotomous variables: For acuity, 0= not at all acute or somewhat acute, 1= moderately acute or very acute. For dependency, 0= very independent or somewhat independent, 1= somewhat dependent or very dependent.

3.3.4 Work environment factors.

Work environment factors were measured using Practice Environment Scale-Nursing Work Index (PES-NWI) (Lake, 2002). The original PES-NWI is a 31-item measure that consists of five subscales: (a) staffing and resource adequacy, (b) nurse-MD relations, (c) nursing leadership, (d) participation in hospital affairs, and (e) nursing foundation of care delivery. The items were rated on a four-point (1= strongly disagree, 4= strongly agree). For this study, a 28 item measure was used after eliminating three items (i.e., use of nursing diagnosis (from nursing foundation of care delivery subscale), mistakes as learning opportunities and no criticism (from nursing leadership subscale), and nursing administrators consult with staff on daily problems (from participation in hospital affairs subscale)). The first two items were eliminated in other Canadian research as they were identified as non-relevant to the Canadian context (Warshawsky & Havens, 2011). The third item was eliminated as the study practice partners did not want to include this item. Mean subscale scores were computed where higher scores indicated a higher quality

environment. Confirmatory factor analysis of the 28 item measure of PES-NWI with the study sample confirmed a mediocre fitting five-factor model ($RMSEA=.08$, $SRMR= .07$, $GFI, .83$, $CFI, .94$, and $NFI= .92$). According to MacCallum and colleagues, an RMSEA of between .08 to .10 provides a mediocre fit (MacCallum, Browne, & Sugawara, 1996). A value of $CFI \geq .95$ is presently recognized as indicative of good fit (Hu & Bentler, 1999). In this study, Cronbach's alphas were satisfactory for each subscale, ranging from .76 to .82.

Table 5. Concepts and Operational Definitions Summary

Concept and Definition	Variables	Operational Definition
Outcomes		
<p>Quality of Nursing Care</p> <p>A quality and safety indicator that refers the degree to which nursing services are consistent with current nursing standards of practice.</p>	<p>Nurse reported quality of nursing care</p>	<p>Summed score of 4 items measured on a 4-point response scale for the total score of 4-16:</p> <ul style="list-style-type: none"> • Overall quality of nursing care • Last shift quality of nursing care ratings • Safety grade • Recommend hospital to family and friends
	<p>Total number of nursing tasks left undone</p>	<p>Total number of nursing tasks left undone over the last shift, based on a single item with 14 response options (yes or no), with possible scores ranging from 0-14. See Table 18 in Appendix for a complete list of these nursing tasks.</p>
<p>Patient Outcomes</p> <p>Quality and safety indicators that encompass patient experiences, such as patient satisfaction; and patient incidents such as falls, UTIs, hospital acquired pneumonia, pressure ulcers</p>	<p>Patient adverse events</p>	<p>Summed score of 7 items measured on a 7-point response scale for the total score of 0-42:</p> <ul style="list-style-type: none"> • Medication error • Pressure ulcers • Falls with injuries • UTIs • Bloodstream infections • Pneumonia • Other nosocomial infections

Concept and Definition	Variables	Operational Definition
<p>Nurse Outcomes</p> <p>Quality and safety indicators that encompass positive and negative nurse related experiences such as job satisfaction, organizational commitment, burnout and turnover.</p>	Job satisfaction	<p>Summed score of 3 items measured on a 4-point response scale for the total score of 3-12:</p> <ul style="list-style-type: none"> • Satisfaction with current job • Intent to leave over the next year (reverse coded) • Likelihood to recommend hospital to nursing colleagues as a place to work
	Emotional exhaustion	<p>Summed score of 9 items, based on the Emotional Exhaustion subscale of the Maslach Burnout Inventory-Human Service Scale (MBI-HSS), measured on a 7-point response scale for the total score of 0-54.</p>
Key Predictor Variables		
<p>Model of Nursing Care Delivery</p> <p>A structured approach for organizing and providing nursing care to clients</p>	Mode of nursing care delivery	<p>A single item that asked nurses to identify the option that best describes how care was delivered in their primary unit of work over the last shift. Responses were recoded into a dichotomous variable:</p> <ul style="list-style-type: none"> • 0= patients were assigned to one nurse (TPC) • 1= patients were assigned to a nursing team (TN)
	Skill mix	<p>A single item that asked participants to identify the number of each nurse type (i.e., RNs, RPNs, LPNs) who provided direct care in their primary unit. Responses were recoded into a dichotomous variable:</p> <ul style="list-style-type: none"> • 0= a skill mix without LPNs • 1= a skill mix with LPNs
Control Variables		

Concept and Definition	Variables	Operational Definition
Nurse Characteristics Information related to the nurse characteristics such as age, gender, education.	Age	A single item asking to identify the year and month of birth. Age in years was computed.
	Gender	A single item asking to identify gender: <ul style="list-style-type: none"> • 0= male • 1= female
	Nursing education	A single item asking to identify one's highest level of nursing education. Responses were recoded into a dichotomous variable: <ul style="list-style-type: none"> • 0= diploma • 1= BSN or Masters
	Nursing experience	A single item that ask each nurse to identify years and months of nursing experience.
	Employment status	A single item asking to identify one's current employment status. Responses were recoded into a dichotomous <ul style="list-style-type: none"> • 0= full-time • 1= part-time or casual
	Contract	A single item asking to identify one' employment type (i.e., permanent vs. temporary): <ul style="list-style-type: none"> • 0= permanent • 1= temporary
	Number of nursing jobs	A researcher developed item that ask nurses to identify whether they have more than one nursing job (0= no, 1= yes).

Concept and Definition	Variables	Operational Definition
<p>Nurse Workload Factors</p> <p>A result of the interplay between resources (e.g., staffing levels) and responsibilities or demands (e.g., patient needs)</p>	Patient acuity	<p>A sing item asking to how they would, on average, rate their patients' level of acuity over the last month. Response options were originally on a 4- point scale but were recoded into a dichotomized variable for this study:</p> <ul style="list-style-type: none"> • 0= not at all acute or somewhat acute • 1= moderately acute or very acute
	Patient dependency	<p>A sing item asking to how they would, on average, rate their patients' level of dependency over the last month. Response options were originally on a 4- point scale but were recoded into a dichotomized variable for this study:</p> <p>0= very independent or somewhat independent 1= somewhat dependent or very dependent</p>
	Patient-RN ratio	<p>Information from 2 items were used to compute this ratio as:</p> <ul style="list-style-type: none"> • Total number of patients on the unit over the last shift/Total number of direct care RNs on the unit over the last shift
	Patient-regulated nurse ratio	<p>Information from 2 items were used to compute this ratio as:</p> <ul style="list-style-type: none"> • Total number of patients on the unit over the last shift/Total number of direct care RNs, RPNs, and LPNs on the unit over the last shift
<p>Nursing Work Environments</p> <p>Organizational characteristics of a work setting that facilitate or constraint professional nursing practice</p>	PES-NWI subscales	<p>PES-NWI consisted of 28 items measured on a 4 point response scale. Mean scores were computed for each subscale:</p> <ul style="list-style-type: none"> • Staffing and resource adequacy • Nurse-MD relations • Nursing leadership • Participation in hospital affairs • Nursing foundation of care delivery

3.4 Data Analysis

Data for this study were extracted from the larger study database into a password protected SPSS v.22 database. No personal identifiers were included in the data. Data were recoded for the purpose of this study. Histograms and box plots were obtained to examine the distribution of the scores. Because outliers can seriously bias the results by modifying the regression line in a particular direction, Field's standardized score strategy was used to deal with the outliers: Each continuous variable was converted into a standardized score (i.e., Z score), and extreme outliers (i.e., Z scores >3.29 or Z scores <-3.29) were excluded from the analysis (Field, 2009).

After cleaning the data, descriptive statistics including frequencies, percentages, means, standard deviations and ranges were obtained for each study variable. Descriptive statistics were obtained based on raw scores. Chi-Square analysis was used to examine the between-group differences in proportions of skill mix with LPNs and without LPNs among total patient care and team nursing modes of care delivery. Bivariate correlation analysis, in particular Pearson r, was used to examine the relationship between pairs of variables.

Hierarchical multiple regression was the main method of data analysis used to answer examine the study research questions. The general purpose of hierarchical multiple regression is to learn more about the relationship between several independent variables on a dependent variable using a least square method of estimation (Dawson, 2014). In this study, five multiple regression analyses were conducted to examine the relationships between key independent variables, mode of nursing care and skill mix, and each of the five outcome variables: (a) nurse reported quality

of nursing care (b) number of nursing tasks left undone, (c) patient adverse events, (d) job satisfaction, and (e) emotional exhaustion after controlling for the effect of nurse characteristics, workload and work environment factors. In hierarchical regression, known predictors that have been identified in the literature or are conceptually justified are controlled for by being entered in the equation first followed by key study predictors.

Moderated hierarchical multiple regression analyses were used to examine the moderating effects of mode of nursing care and skill mix on five study outcomes. “A moderator is any variable that affects the association between two or more other variables. Moderating is the effect the moderator has on this association” (Dawson, 2014, p. 1). When testing moderating effects, an interaction term is obtained and typically included in the last model of hierarchical multiple regression analysis. Interaction terms refer to the product of a moderating variable and a predictor variable. To reduce the effects of multicollinearity, raw scores of continuous independent variables are typically standardized when moderating effects are examined (Aguinis, Gottfredson, & Wright, 2011; Dawson, 2014). Thus, independent variables that were at a continuous level of measurement were converted into Z scores prior to being introduced into the hierarchical multiple regression analyses.

In each of the five multiple regression analyses, beta coefficients, R^2 and R^2 change statistics were examined to determine if a relationship existed and the magnitude of the relationship. The beta coefficients indicate the change in dependent variable for one standard deviation increase in each independent variable. The R^2 change statistic indicates the percentage of variance in the outcome variable that can be attributed to each variable, and the R^2 statistic identifies the

percentage of variance in the outcome variable attributed to the full model. In order to ensure an accurate estimation of regression coefficients, the assumptions of multiple regressions were examined and found to be sufficiently met. Multiple regression analysis is based on five key assumptions: normally distributed variables; a linear relationship between independent and dependent variables; little or no multicollinearity between independent variables; independent residuals (i.e., little or no autocorrelation); and equal residuals along the regression line (i.e., homoscedasticity) (Field, 2009).

For each of the five outcome variables, nurse characteristics, workload, and work environment factors were treated as control variables and, therefore, were entered in the first model of hierarchical multiple regression analysis. The unique effect of mode of care delivery, over and above the effect of control variables (Research question 1), was examined by entering this variable into the second model of all five hierarchical multiple regression analyses. Skill mix was entered into the third model to determine the unique effect of skill mix over and above the effect of nurse characteristics, nurse workload, work environment factors and mode of nursing care delivery (Research question 2).

The third and fourth research questions asked whether mode of nursing care delivery and skill mix moderated the relationship between workload factors and the five outcome variables. A total of eight interaction terms were examined in each of the five hierarchical multiple regression analysis. Four interaction terms were obtained between mode of nursing care delivery and workload factors (Research question 3), and four interaction terms were obtained between skill mix and workload factors (Research question 4). Each interaction term was examined separately

and entered into the last multiple regression model (model 4 in this study) after skill mix. To maximize the power of the tests, only interaction terms that were significant in individual regression equations were kept in the final models. A statistically significant interaction term can account for additional variance beyond a single variable alone and shows that a moderating effect is present. A moderating effect indicates that the moderating variable (i.e., mode of nursing care delivery and/or skill mix) has the ability to enhance or reduce the effects of workload factors on study outcomes.

Chapter 4: Findings

In this chapter, study findings are examined in three key sections. In the first section, descriptive statistics and bivariate correlations between study predictors and outcome variables are reported. In the second section, multiple regression findings are discussed with respect to each study outcome variable, and where applicable, interaction effects are plotted and reviewed. In the third section, multiple regression findings are summarized and examined based on each study hypothesis.

4.1 Descriptive Statistics

The descriptive statistics on workload, work environment factors and nursing care delivery model components (i.e., nursing mode and skill mix), are shown in Table 6. A majority of nurse participants rated their patients as moderately acute (57.3%) and very acute (23.1%). Similarly, a large proportion of the participants rated their patients as somewhat dependent (49.1%) and very dependent (36.5%). Nurse-patient ratio computations showed that there were an average of 6.6 ($SD= 4.3$) patients per RN and 4.4 ($SD= 1.8$) patients per regulated nurse. With respect to work environment factors, nurse-MD relations ($M=2.8$, $SD= .5$, $Range= 1-4$), nursing foundation of care delivery ($M=2.6$, $SD= .4$, $Range= 1-4$), and nursing leadership ($M=2.4$, $SD= .6$, $Range= 1-4$) were more favorably scored compared to staffing and resource adequacy ($M=2.1$, $SD= .6$, $Range= 1-4$) and participation in hospital affairs ($M=2.1$, $SD= .5$, $Range= 1-3.5$). With respect to mode of nursing care delivery, 76.9% of nurse participants reported providing care based on a total patient care (TPC) mode; 23.1% reported a team nursing (TN) approach to care delivery. With respect to skill mix, 68% of participants reported working in a skill mix that included LPNs; 32% had no LPNs on their primary unit of work over the last shift.

Table 6. Description of Work Environment, Workload, and Model of Nursing Care Delivery

Characteristic	M(SD)	f (%)
Patient Acuity		
Not At All Acute	-	5 (1.2%)
Somewhat Acute	-	76 (18.4%)
Moderately Acute	-	236 (57.3%)
Very Acute	-	95 (23.1%)
Patient Dependency		
Very Independent	-	18 (4.4%)
Somewhat Independent	-	41 (10.0%)
Somewhat Dependent	-	202 (49.1%)
Very Dependent	-	150 (36.5%)
Nurse-Patient Ratios		
Patient-RN	6.6 (4.3)	-
Patient-regulated nurse	4.4 (1.8)	-
Nursing Work Index Subscales		
Staffing and Resources Adequacy	2.1 (.6)	-
Nurse-MD Relation	2.8 (.5)	-
Nursing Leadership	2.4 (.6)	-
Participation in Hospital Affairs	2.1 (.5)	-
Nursing Foundation of Care Delivery	2.6 (.4)	-
Mode of nursing care delivery		
TPC	-	320 (76.9%)
TN	-	96 (23.1%)
Skill Mix		
Without LPNs (i.e., All-RNs or RNs/CAs)	-	133 (32.0%)
With LPNs (i.e., RNs/LPNs or RNs/LPNs/CAs)	-	283 (68.0 %)

Note. N=416. TPC= total patient care, TN= team nursing, CAs= care aides.

Descriptive statistics and composite scores were also computed for study outcome variables (See Table 7). Quality of nursing scores ranged from 4-16; number of nursing tasks left undone ranged from 0-13; patient adverse events ranged from 0-32; job satisfaction scores ranged from 3-12; and emotional exhaustion scores ranged from 0-54.

Table 7. Descriptive Statistics for Outcome Variables

Outcome Variables	M(SD)
Quality of Nursing Care	10.7 (2.5)
Nursing Tasks Left Undone	4.4 (3.2)
Patient Adverse Events	11.0 (6.2)
Job Satisfaction	7.7 (2.1)
Emotional Exhaustion	27.3 (12.9)

Notes. N=416

Chi-Square analyses showed there were no statistically significant differences in participants' reports of skill mix between total patient care and team nursing modes of care delivery ($X^2=.36, p >.05$). Among participants that identified their mode of care delivery as total patient care, 67% reported working in a skill mix with LPNs in comparison to 33% that reported working in a skill mix without LPNs. Among participants that identified their mode of care delivery as team nursing, 72% reported working in a skill mix with LPNs in comparison to 28% that reported working in a skill mix without LPNs (Table 8).

Table 8. Between-group Differences in Skill Mix based on Mode

	Total Patient Care	Team Nursing	X^2
Skill mix Without LPNs	106 (33%)	27 (28%)	.36
Skill Mix with LPNs	214 (67%)	69 (72%)	
Total	320	96	

4.2 Bivariate Correlations

The relationships between study variables were examined using Pearson correlation analyses (See Table 9). According to Cohen, correlation coefficients in the order of .10 are “small,” those of .30 are “medium,” and those of .50 are “large” in terms of magnitude of effect sizes (Cohen, 1988, p. 77–81).

With respect to nursing care delivery model components, mode of nursing care delivery and skill mix had a negative small relationship such that nurses delivering care based on a TPC mode worked in a skill mix with LPNs. Both mode of nursing care delivery and skill mix were associated with some study outcome variables. Mode of nursing care delivery had a small negative relationship with quality of nursing care ($r = -.14, p < .01$) and job satisfaction ($r = -.17, p < .01$) which suggests that a TN mode of care delivery was associated with lower quality of nursing care and job satisfaction scores. Mode of nursing care delivery had a small positive relationship with number of nursing tasks left undone ($r = .15, p < .01$). This suggests that nurses reported higher number of nursing tasks left undone in a TN mode of care delivery. Mode of nursing care delivery was not related to frequency of patient adverse events and emotional exhaustion. Skill mix had a small negative relationship with quality of nursing care ($r = -.14, p < .01$) which suggests that nurses working in a skill mix with LPNs reported lower quality of nursing care.

Skill mix had a small positive relationship with number of nursing tasks left undone ($r = .16, p < .01$), and patient adverse events ($r = .21, p < .001$) which suggests that nurses working in a skill mix with LPNs reported higher number of nursing tasks left undone and higher frequency of

patient adverse events. Skill mix was not significantly related to job satisfaction and emotional exhaustion.

With respect nurse characteristics, gender, employment status and type of contract were related to study outcome variables. Gender had a small negative relationship with number of nursing tasks left undone ($r = -.10, p < .01$); male nurses reported higher number of nursing tasks left undone. Employment status ($r = -.17, p < .01$) and type of contract ($r = -.14, p < .01$) had a small negative relationship with nurse emotional exhaustion which suggests that part-time or casual nurses who worked in temporary positions had lower emotional exhaustion scores.

With respect to workload factors, patient acuity, and dependency, patient-RN, and patient-regulated nurse ratios were related to study outcome variables. Patient acuity had a small negative relationship with quality of nursing care ($r = -.11, p < .05$), and job satisfaction ($r = -.15, p < .01$) and showed a small positive relationship with number of nursing tasks left undone ($r = .14, p < .01$), patient adverse events ($r = .17, p < .01$), and nurse emotional exhaustion ($r = .22, p < .001$). Similarly, patient dependency had a small negative relationship with quality of nursing care ($r = -.11, p < .05$), and a small positive relationship with number of nursing tasks left undone ($r = .16, p < .01$), and patient adverse events ($r = .18, p < .001$). Patient-RN ratio had a small negative relationship with quality of nursing care ($r = -.11, p < .05$), and a small positive relationship with number of nursing tasks left undone ($r = .15, p < .01$), and patient adverse events ($r = .12, p < .05$). Patient-regulated nurse ratio had a small positive relationship only with patient adverse events ($r = .14, p < .01$).

With respect to work environment factors, all PES-NWI subscales were related to all study outcome variables in the expected direction. Staffing and resource adequacy subscale had a medium to large positive relationship with quality of nursing care ($r = .51, p < .001$) and job satisfaction ($r = .48, p < .001$), but a medium to large negative relationship with number of nursing tasks left undone ($r = -.53, p < .001$), patient adverse events ($r = -.32, p < .001$), and nurse emotional exhaustion ($r = -.53, p < .001$). Nurse-MD relations subscale had a positive small to medium relationship with quality of nursing care ($r = .35, p < .001$) and job satisfaction ($r = .25, p < .001$), but a small negative relationship with number of nursing tasks left undone ($r = -.21, p < .001$), patient adverse events ($r = -.14, p < .01$), and emotional exhaustion ($r = -.17, p < .001$). Nursing leadership subscale had a medium positive relationship with quality of nursing care ($r = .44, p < .05$) and job satisfaction ($r = .38, p < .05$), but it had a small to medium negative relationship with number of nursing tasks left undone ($r = -.32, p < .001$), patient adverse events ($r = -.27, p < .001$), and emotional exhaustion ($r = -.40, p < .001$). Participation in hospital affairs subscale had a positive medium relationship with quality of nursing care ($r = .41, p < .001$) and job satisfaction ($r = .43, p < .001$), but a small to medium negative relationship with number of nursing tasks left undone ($r = -.35, p < .001$), frequency of adverse events ($r = -.23, p < .001$), and emotional exhaustion ($r = -.44, p < .001$). Nursing foundation of care delivery subscale had a positive medium to large relationship with quality of nursing care ($r = .52, p < .001$) and job satisfaction ($r = .44, p < .001$) but a negative medium relationship with number of nursing tasks left undone ($r = -.43, p < .001$), patient adverse events ($r = -.35, p < .001$), and emotional exhaustion ($r = -.37, p < .001$).

Table 9. Correlations between Major Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1.Age	--																						
2. Gender	-.10	--																					
3.Education	-.70	.05	--																				
4.N Exp	.86	-.03	-.70	--																			
5.Emp STTS	-.13	.05	.05	-.10	--																		
6.Contract	-.20	-.05	.15	-.18	.50	--																	
7.N Jobs	-.10	.04	.12	-.09	.22	.20	--																
8.Acuity	-.05	-.04	.02	-.05	-.05	-.08	-.13	--															
9. Depend	-.08	.07	.06	-.09	-.08	-.02	-.05	.11	--														
10.Pt-RN	.02	.05	.00	.01	-.08	.03	.04	-.12	.03	--													
11.Pt-reglt	-.01	.03	.01	-.01	-.01	.06	.08	-.13	.00	.73	--												
12.SRA	-.03	.05	.04	.00	.06	.05	.03	-.24	-.20	-.17	-.11	--											
13.NMD	.03	-.07	.04	-.01	.03	.01	-.01	-.05	-.05	-.02	.02	.28	--										
14.N Lead	-.15	.03	.19	-.18	.11	.11	.04	-.15	-.15	-.05	-.02	.52	.34	--									
15.Hosp Aff	-.15	.07	.10	-.16	.15	.13	-.01	-.12	-.05	-.16	-.07	.53	.28	.66	--								
16.N Fnd	-.06	.11	.07	-.11	.09	.05	-.06	-.13	-.11	-.16	-.07	.58	.38	.60	.66	--							
17.Mode	.10	.05	-.08	.14	.01	-.01	.03	.01	-.07	.20	.05	-.09	-.08	-.05	-.20	-.16	--						
18.Skill mix	-.10	-.02	.13	-.11	.03	.02	.00	.05	.12	.36	.05	-.19	-.01	-.08	-.08	-.14	.05	--					
19.QNC	.02	.03	.02	.00	.02	-.03	.00	-.11	-.11	-.11	-.09	.51	.35	.44	.41	.52	-.14	-.14	--				
20.Tasks	-.05	-.10	.05	-.09	.02	.09	.03	.14	.16	.15	.07	-.53	-.21	-.32	-.35	-.43	.15	.16	-.51	--			
21.Adv eve	-.05	-.05	-.03	.00	-.04	-.08	.02	.17	.18	.12	.14	-.32	-.14	-.27	-.23	-.35	.03	.21	-.42	.33	--		
22.EE	-.04	-.01	-.02	-.03	-.17	-.14	-.04	.22	.07	.07	.01	-.53	-.17	-.40	-.44	-.37	.05	.09	-.42	.46	.31	--	
23.JS	.01	-.03	.03	.01	-.01	-.04	-.03	-.15	.03	-.09	-.09	.48	.25	.38	.43	.44	-.17	-.04	.59	-.40	-.25	-.58	--

Note. N=416. Statistically significant correlations are boldface. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), N Exp= years of nursing experience, Emp STTS= employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), N Jobs= number of

nursing jobs (0=one job, 1= more than one job), Acuity= patient acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Depend
=patient dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Pt-RN= Patient-RN ratio, Pt-reglt= patient-
regulated nurse ratio, SRA= staffing and resource adequacy, NMD= nurse MD relations, N Lead= nursing leadership, Hosp Aff= participation in hospital affairs,
N Fnd= Nursing foundation of care delivery. Mode= mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs), QNC= quality
of nursing care, Tasks= number of nursing tasks left undone, Adv eve= patient adverse events, EE= emotional exhaustion, JS= job satisfaction.

4.3 Multiple Regression Findings

In this section, the multiple regression findings are reported for each of the five outcome measures. For each multiple regression analysis, statistically significant interaction terms were plotted.

4.3.1 Quality of nursing care: nurse reported.

With respect to quality of nursing care, the results of the final model (i.e., Model 3) of multiple regression analysis are reported in Table 10⁵. None of the nurse characteristics or workload factors were found to be statistically significant, but all work environment factors except for participation in hospital affairs were related to nurse reported quality of nursing care. Neither mode of nursing care delivery nor skill mix were related to nurse reported quality of nursing care. In addition, none of the interaction terms examined were significantly related to nurse reported quality of nursing care and hence were dropped from the regression model. The final model, Model 3, explained 40% of the variance in nurse reported quality of nursing care ratings ($F(18, 294) = 11.07, p < 0.001$). Overall, there were not statistically significant changes in R^2 between models 1, 2, and 3⁵.

The four statistically significant work environment variables were positively related to nurse reported quality of nursing care. The two strongest predictors of nurse reported quality of nursing care were staffing and resource adequacy ($\beta = .26, p < .001$) and the nursing foundation of care delivery subscales of the PES-NWI ($\beta = .24, p < .001$). The positive beta coefficients associated

⁵ The results of full models of multiple regression analysis can be found in Appendix D.

with these subscales suggested that as a result of one standard deviation increase in nurse perceptions of staffing and resource adequacy and nursing foundation, quality of nursing care ratings increased by .26 and .24 standard deviations respectively. The lack of a significant interaction term suggested that mode of nursing care delivery and skill mix did not moderate the relationship between workload factors and nurse reported quality of nursing care.

Table 10. Hierarchical Regression Analysis Results for Variables Predicting Nurse Reported Quality of Nursing Care

	B	SE B	Beta	CI (95%)	R ²
					40.4
Age	-.20	.25	-.08	-.69 — .30	
Gender	-.25	.70	-.02	-1.62 — 1.13	
Education	.05	.40	.01	-.75 — .84	
Nursing Experience	.22	.24	.09	-.26 — .70	
Employment Status	-.11	.27	-.02	-.65 — .42	
Contract	-.28	.31	-.05	-.88 — .32	
Nursing Jobs	.10	.31	.02	-.51 — .71	
Acuity	.26	.32	.04	-.36 — .89	
Dependency	.04	.34	.01	-.63 — .70	
Patient-RN	.29	.39	.06	-.48 — 1.06	
Patient-Regulated Nurse	.01	.32	.00	-.62 — .64	
Staffing & Resource Adequacy	.69	.16	.26***	.38 — 1.00	
Nurse MD Relation	.42	.12	.17*	.18 — .66	
Nursing Leadership	.37	.16	.14*	.04 — .69	
Participation in Hospital Affairs	.05	.17	.02	-.28 — .38	
Nursing Foundation of Care Delivery	.64	.17	.24***	.30 — .98	
Mode of Nursing Care Delivery	-.48	.29	-.08	-1.04 — .09	
Skill Mix	-.39	.28	-.07	-.94 — .17	

Note. N=416. The results are for model 3 only. β = standardized beta coefficient. CI (95%) = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 3: $F(18, 294) = 11.07, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

4.3.2 Quality of nursing care: number of nursing tasks left undone.

With respect to number of nursing tasks left undone, the results of the final model (i.e., Model 3) multiple regression analysis are reported in Table 11⁶. None of the nurse characteristics or workload factors were related to number of nursing tasks left undone in models 1 or 2, although contract became statistically significant in Model 3, after the addition of skill mix⁶. With respect to work environment factors, only staffing and resource adequacy and nursing foundation of care delivery were found to be statistically significant. Mode of nursing care, entered in Model 2, also showed an association with number of nursing tasks left undone, but resulted in a statistically significant change in R^2 . Skill mix was not related to number of nursing tasks left undone. None of the interaction terms were found to be statistically significant and, therefore, were dropped from the model. Overall, in model 3, type of employment contract, staffing and resource adequacy, nursing foundation of care delivery factors, and mode of nursing care delivery were associated with number of nursing tasks left undone. The final model explained 35% of variance in number of nursing tasks left undone ($F(18, 297) = 8.91, p < .001$). Overall, the R^2 increased 1% from model 1 to model 2, but there was no statistically significant change in R^2 from model 2 to model 3⁶.

Type of contract and mode of nursing care delivery were positively related to undone tasks which suggested that temporary nurses and nurses working in a TN mode had higher number of nursing tasks left undone. The two significant environment characteristics were negatively related to number of nursing tasks left undone. Similar to nurse reported quality of nursing care,

⁶ The results of the full model of multiple regression analysis can be found in Appendix E.

staffing and resource adequacy ($\beta = -.37, p < .001$) and nursing foundation of care delivery ($\beta = -.16, p < .05$) were the two strongest predictors of nursing tasks left undone. The negative beta suggested that for each one standard deviation increase in staffing and resource adequacy and nursing foundation of care delivery perceptions, the number of nursing tasks left undone decreased by .37 and .16 standard deviations respectively. Type of contract ($\beta = .11, p < .05$) was slightly more strongly related to number of nursing tasks left undone than mode of nursing care delivery ($\beta = .10, p < .05$). The positive betas associated with these variables suggested that the number of nursing tasks left undone was .11 and .10 standard deviation units higher for temporary vs. permanent employment contracts and TN vs. TPC mode of nursing care delivery. Staff nurses with a temporary type of employment contract tended to leave more nursing tasks undone than did their colleagues in permanent positions. Similarly, nurses who reported working in a TN mode of care delivery also reported higher number of nursing tasks left undone compared to those working in TPC mode of care delivery. The lack of a significant interaction term suggested that mode of nursing care delivery and skill mix did not moderate the relationship between workload factors and number of nursing tasks left undone.

Table 11. Hierarchical Regression Analysis Results for Variables Predicting Total Number of Nursing Tasks Left Undone Over the Last Shift

	B	SE B	Beta	CI (95%)	R²
					35.1
Age	-.05	.32	-.02	-.68 — .58	
Gender	-1.18	.90	-.06	-2.95 — .59	
Education	-.21	.52	-.03	-1.23 — .82	
Nursing Experience	-.24	.31	-.08	-.86 — .37	
Employment Status	.11	.35	.02	-.57 — .80	
Contract	.78	.39	.11*	.01 — 1.55	
Nursing Jobs	-.02	.40	.00	-.81 — .77	
Acuity	.17	.41	.02	-.64 — .97	
Dependency	.63	.43	.07	-.21 — 1.47	
Patient-RN	-.25	.50	-.04	-1.24 — .73	
Patient-Regulated Nurse	.20	.41	.03	-.62 — 1.01	
Staffing & Resource Adequacy	-1.18	.20	-.37***	-1.57 — -.78	
Nurse MD Relation	-.13	.16	-.04	-.45 — .18	
Nursing Leadership	.17	.21	.05	-.25 — .59	
Participation in Hospital Affairs	-.28	.22	-.09	-.70 — .15	
Nursing Foundation of Care Delivery	-.54	.22	-.16*	-.98 — -.10	
Mode of Nursing Care Delivery	.75	.37	.10*	.02 — 1.47	
Skill Mix	.47	.36	.07	-.24 — 1.19	

Note. N=416. The results are for model 3 only. β = standardized beta coefficient. CI (95%) = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 3: $F(18, 297) = 8.91, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

4.3.3 Patient outcomes: patient adverse events.

With respect to patient adverse events, the results of the final model (i.e., Model 4) of multiple regression analysis are reported in Table 12⁷. With the exception of patient dependency and nursing foundation of care delivery, no other variables were related to patient adverse events in model 1⁷. In model 2, these two variables remained significant after the addition of the mode of nursing care delivery. Nursing mode of care delivery was not related to patient adverse events in

⁷ The results of the full model of multiple regression analysis can be found in Appendix F

this model. In model 3, patient dependency became non-significant but patient-regulated nurse ratio became significantly related to patient adverse events after the addition of skill mix in model 3⁷. Skill mix showed a significant association in this model and resulted in a statistically significant change in R^2 . After the addition of the interaction term, acuity*mode of nursing care delivery, mode of nursing care delivery also became significant in model 4. Patient-regulated nurse ratio, nursing foundation of care delivery and skill mix remained significant in this model. The interaction term between acuity and mode of nursing care delivery was also found to be statistically significant, indicating that mode of nursing care delivery was moderating the detrimental effects of acuity on patient adverse events. The addition of the interaction term in model 4 also resulted in a statistically significant change in R^2 . The final model, Model 4, explained 21% of variance in frequency of patient adverse events ($F(19, 291) = 3.98, p < .001$). Overall, there was not statistically significant change in R^2 from model 1 to model 2, the R^2 increased by 1.8% and 2.1% from models 2 to 3 and models 3 to 4 respectively⁷.

Nursing foundation of care delivery and mode of nursing care delivery were negatively related, patient-regulated nurse ratio, and skill mix and acuity*mode of nursing care delivery were positively related to patient adverse events. Among primary effects, the two strongest predictors of patient adverse events were mode of nursing care delivery ($\beta = -.34, p < .05$), patient-regulated nurse ratio ($\beta = .17, p < .05$), and nursing foundation of care delivery ($\beta = -.17, p < .05$). The positive beta associated with patient regulated nurse ratio suggested that as a result of one standard deviation increase in this ratio, nurse reported patient adverse events increased by .17 standard deviations. An inverse relationship was found between nursing foundation of care delivery and patient adverse events. The positive beta coefficient associated with skill mix ($\beta =$

.16, $p < .05$) suggests that the frequency of patient adverse events is .16 standard deviations higher for a skill mix with LPNs compared with a skill mix without LPNs.

The interaction term, acuity*mode, was significantly related to patient adverse events ($\beta = .39$, $p < .01$). Plotting the interaction term, it was observed that at higher levels of acuity, nursing staff who worked from a TN approach reported higher levels of patient adverse events on their unit than did nurses who provided TPC (Figure 4). On the other hand, nurse reports of the frequency of patient adverse events were relatively stable across varying levels of acuity for nurses who reported working in a TPC mode of care delivery.

Table 12. Hierarchical Regression Analysis Results for Variables Predicting Nurse Reports of Patient Adverse Events

	B	SE B	Beta	CI (95%)	R²
					20.6
Age	-1.37	.73	-.22	-2.80 — .06	
Gender	.33	2.03	.01	-3.66 — 4.32	
Education	-1.89	1.18	-.13	-4.21 — .42	
Nursing Experience	.60	.71	.09	-.79 — 2.00	
Employment Status	.38	.79	.03	-1.18 — 1.94	
Contract	-1.64	.89	-.12	-3.39 — .12	
Nursing Jobs	.87	.92	.05	-.93 — 2.67	
Acuity	-.31	1.02	-.02	-2.32 — 1.69	
Dependency	1.74	.97	.10	-.18 — 3.66	
Patient-RN	-1.40	1.13	-.11	-3.63 — .83	
Patient-Regulated Nurse	2.00	.93	.17*	.16 — 3.84	
Staffing & Resource Adequacy	-.56	.46	-.08	-1.45 — .34	
Nurse MD Relation	.16	.36	.02	-.55 — .88	
Nursing Leadership	-.26	.48	-.04	-1.20 — .68	
Participation in Hospital Affairs	-.26	.49	-.04	-1.22 — .70	
Nursing Foundation of Care Delivery	-1.18	.51	-.17*	-2.18 — .18	
Mode of Nursing Care Delivery	-5.04	2.08	-.34*	-9.14 — .95	
Skill Mix	2.09	.82	.16*	.48 — 3.71	
Acuity * Mode of Nursing Care Delivery	6.27	2.24	.39**	1.87 — 10.68	

Note. $N=416$. The results are for model 4 only. β = standardized beta coefficient. CI (95%) = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 4: $F(19, 291) = 3.98$, $p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

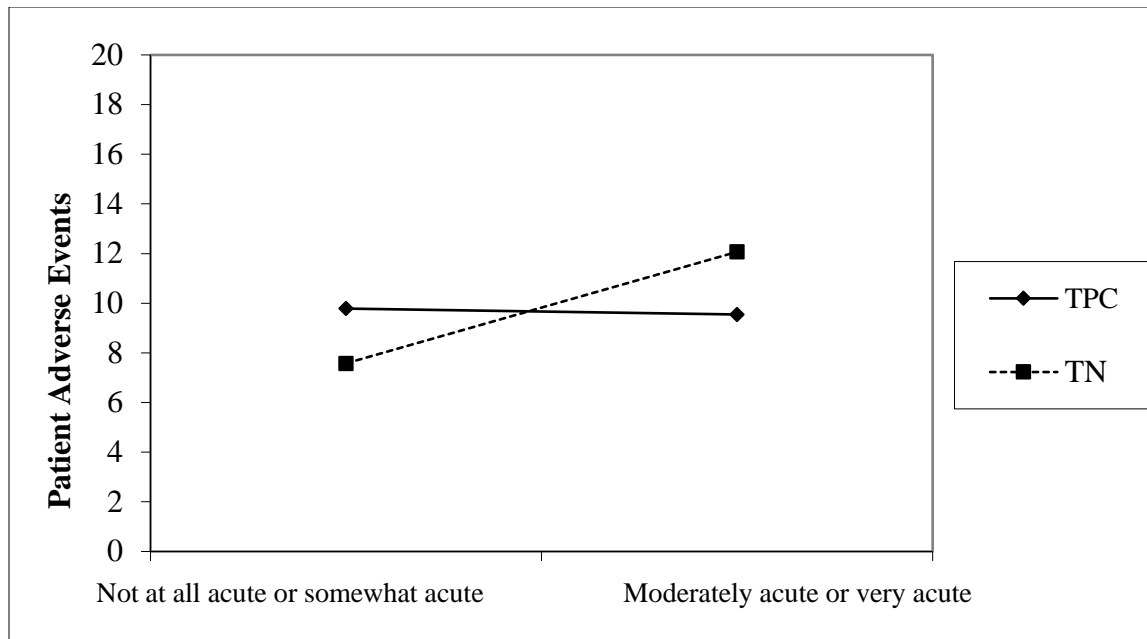


Figure 5. The moderating effect of mode of nursing care delivery on the relationship between patient acuity and patient adverse events

4.3.4 Nurse outcomes: job satisfaction.

With respect to job satisfaction, the results of the final model (i.e., Model 3) of multiple regression analysis are reported in Table 13⁸. With the exception of patient dependency, other nurse characteristics and workload factors were not related to job satisfaction in none of the models. With respect to work environment factors, staffing and resource adequacy, participation in hospital factors, and nursing foundation of care delivery were related to job satisfaction across all three models. Mode of nursing care delivery and skill mix were not related to job satisfaction in models 2 and/or 3 and did not result in a statistically significant change in R^2 ⁸None of the interaction terms were significantly related to job satisfaction and hence were dropped from the regression model. Overall, in model 3, patient dependency, staffing and resource adequacy,

⁸ The full model of multiple regression analysis can be found in Appendix G.

participation in hospital affairs, and nursing foundation of care delivery were related to job satisfaction. The final model explained 35% of variance in job satisfaction ($F(18, 295) = 8.84$, $p < .001$). Overall, there were no statistically significant change in R^2 between models 1, 2, and 3⁸.

All significant variables were positively related to job satisfaction. The two strongest predictors were staffing and resource adequacy ($\beta = .25$, $p < .001$) and participation in hospital affairs ($\beta = .19$, $p < .01$). The positive beta coefficients suggests that as a result of one standard deviation increase in staffing and resource adequacy and participation in hospital affairs, job satisfaction increases by .25 and .19 standard deviations respectively. Surprisingly patient dependency was also positively related to job satisfaction ($\beta = .12$, $p < .05$) which suggested that as a result of one standard deviation increase in patient dependency, job satisfaction increases by .12 standard deviations. The lack of a significant interaction term suggested that mode of nursing care delivery and skill mix did not moderate the relationship between workload factors and job satisfaction.

Table 13. Hierarchical Regression Analysis Results for Variables Predicting Job Satisfaction

	B	SE B	Beta	CI (95%)	R²
Model 3:					35.0
Age	.10	.23	.05	-.34 — .55	
Gender	-.60	.63	-.05	-1.84 — .64	
Education	.14	.37	.03	-.58 — .86	
Nursing Experience	.05	.22	.03	-.38 — .49	
Employment Status	-.14	.24	-.03	-.62 — .34	
Contract	-.50	.27	-.10	-1.04 — .04	
Nursing Jobs	.02	.28	.00	-.53 — .57	
Acuity	-.30	.29	-.05	-.86 — .26	
Dependency	.76	.30	.12*	.16 — 1.35	
Patient-RN	.37	.35	.08	-.32 — 1.06	
Patient-Regulated Nurse	-.37	.29	-.09	-.94 — .20	
Staffing & Resource Adequacy	.57	.14	.25***	.29 — .84	
Nurse MD Relation	.19	.11	.08	-.03 — .40	
Nursing Leadership	.15	.15	.07	-.15 — .44	
Participation in Hospital Affairs	.41	.15	.19**	.12 — .71	
Nursing Foundation of Care Delivery	.34	.16	.15*	.03 — .64	
Mode of nursing care delivery	-.33	.26	-.06	-.84 — .18	
Skill Mix	-.09	.25	-.02	-.59 — .42	

Note. $N=416$. The results are for model 3 only. β = standardized beta coefficient. $CI (95\%) = 95\%$ confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 3: $F(18, 295) = 8.84, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

4.3.5 Nurse outcomes: emotional exhaustion.

With respect to emotional exhaustion, the results of the final model (i.e., Model 4) of multiple regression analysis are reported in Table 14⁹. With the exception of age, staffing and resource adequacy, and participation in hospital affairs, no other nurse characteristics, workload factors, and work environment factors were related to nurse emotional exhaustion in model 1⁹. In model 2, these variables remained significant after the addition of mode of nursing care delivery; mode of nursing care delivery did not result in a statistically significant change in R^2 ⁹. In model 3, the

⁹ The results of the full model of multiple regression analysis can be found in Appendix H.

same three predictors remained significant after the addition of skill mix. But, skill mix was not related to emotional exhaustion and did not result in a statistically significant change in R^2 in model 3⁹. Skill mix and acuity showed a significant association after the addition of the interaction term, acuity*skill mix in model 4. The interaction between acuity and skill mix was also found to be statistically significantly indicating that skill mix was moderating the negative effect of acuity on emotional exhaustion. Overall, in model 4, age, patient acuity, staffing and resource adequacy, participation in hospital affairs, skill mix and patient acuity*skill mix were related to emotional exhaustion. The final model, model 4, explained 38.2% of variance in emotional exhaustion ($F(19, 295) = 9.41, p < .001$). Overall, there were not statistically significant change in R^2 between models 1, 2, and 3. However, the R^2 increased by 1.1% from model 3 to model 4⁹.

With the exception of patient acuity and skill mix, other significant variables were negatively related to emotional exhaustion. Among primary effects, staffing and resource adequacy ($\beta = -.40, p < .001$) and skill mix ($\beta = .27, p < .05$) were the strongest predictors of emotional exhaustion. The negative beta associated with staffing and resource adequacy suggested that as a result of one standard deviation increase in staffing and resource adequacy, emotional exhaustion decreases by .40 standard deviations.

The interaction term between patient acuity and skill mix was found to be statistically significant ($\beta = -.31, p < .05$). This finding suggested that skill mix moderated the relationship between patient acuity and nurse emotional exhaustion. Figure 5 indicates that at higher levels of acuity,

nurses who worked with LPNs reported lower levels of emotional exhaustion than their peers who worked without LPNs.

Table 14. Hierarchical Regression Analysis Results for Variables Predicting Nurse Emotional Exhaustion

	B	SE B	Beta	CI (95%)	R²
					37.7
Age	-2.87	1.35	-.22*	-5.53 — -.21	
Gender	1.97	3.78	.03	-5.48 — 9.41	
Education	-2.36	2.20	-.08	-6.69 — 1.97	
Nursing Experience	.45	1.31	.03	-2.13 — 3.03	
Employment Status	-2.28	1.47	-.09	-5.18 — .62	
Contract	-2.24	1.67	-.07	-5.52 — 1.04	
Nursing Jobs	.46	1.70	.01	-2.89 — 3.81	
Acuity	7.08	2.93	.20*	1.32 — 12.85	
Dependency	-3.23	1.79	-.09	-6.75 — .29	
Patient-RN	1.14	2.12	.04	-3.02 — 5.31	
Patient-Regulated Nurse	-2.01	1.75	-.08	-5.46 — 1.43	
Staffing & Resource Adequacy	-5.46	.84	-.40***	-7.11 — -3.80	
Nurse MD Relation	.27	.67	.02	-1.04 — 1.59	
Nursing Leadership	-1.31	.90	-.10	-3.07 — .45	
Participation in Hospital Affairs	-2.45	.91	-.19**	-4.23 — -.66	
Nursing Foundation of Care Delivery	.03	.93	.00	-1.81 — 1.86	
Mode of Nursing Care Delivery	-.32	1.55	-.01	-3.36 — 2.73	
Skill Mix	7.51	3.35	.27*	.92 — 14.11	
Acuity * Skill Mix	-8.11	3.57	-.31*	-15.14 — -1.08	

Note. N=416. The results are for model 4 only. β = standardized beta coefficient. CI (95%) = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 4: $F(19, 295) = 9.41, p < .001$.
 * $p < .05$, ** $p < .01$, *** $p < .00$.

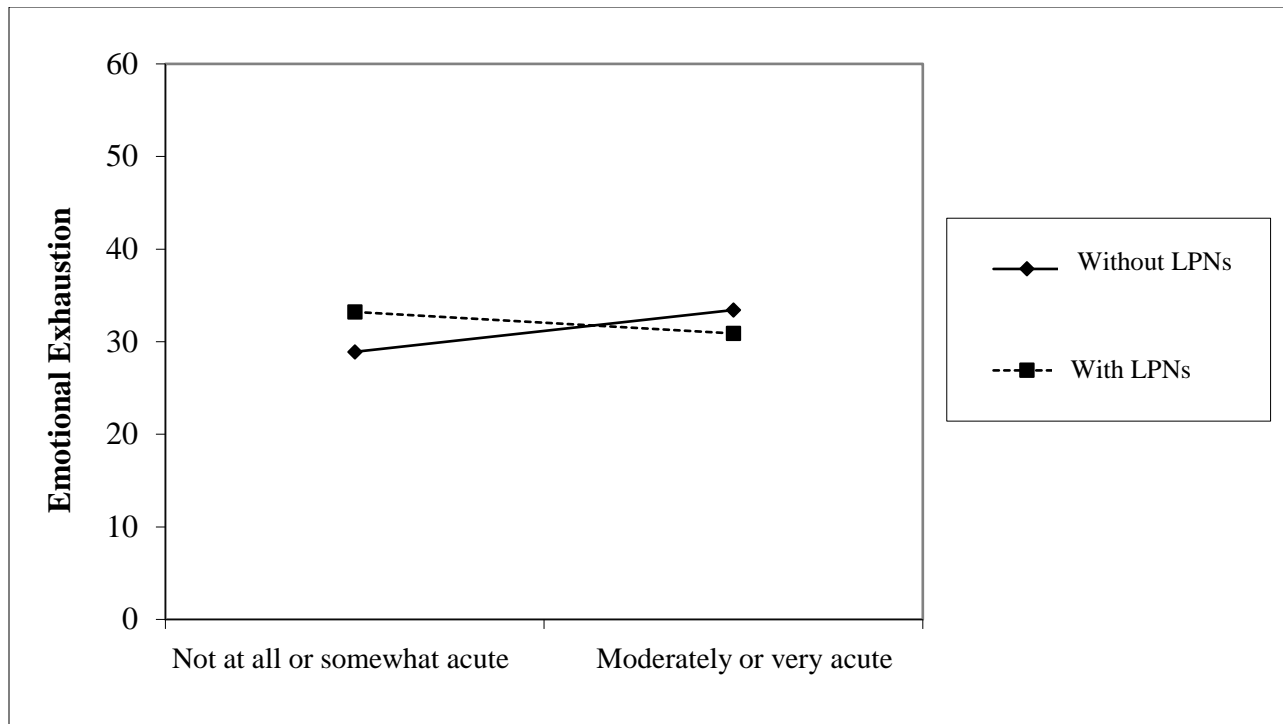


Figure 6. The moderating effect of skill mix on the relationship between patient acuity and nurse emotional exhaustion

4.4 Summary Findings based on Study Research Questions

In this section, the key findings described above are summarized with respect to the study research questions and are shown in Table 14.

Table 15. Summary Findings

	Mode Beta	Skill Mix Beta	Acuity*Mode Beta	Acuity*Skill Mix Beta
Nurse reported quality of nursing care	ns	ns	-	-
Number of nursing tasks left undone	.10*	ns	-	-
Patient adverse events	-.34*	.16*	.39**	-
Job satisfaction	ns	ns	-	-
Emotional exhaustion	ns	.27*	-	-.31*

Note. N=416. ns = non-significant.

* $p < .05$, ** $p < .01$, *** $p < .00$.

1. What is the relationship between mode of nursing care delivery and (a) quality of nursing care (i.e., nurse reported quality of nursing care and nursing tasks left undone), (b) patient outcomes (i.e., patient adverse events), and (c) nurse outcomes (i.e., job satisfaction and emotional exhaustion) after controlling for nurse characteristics, nurse workload factors, and work environment factors?

(a) Mode of nursing care delivery was found to be unrelated to nurse reported quality of nursing care but related to number of nursing tasks left undone. This means that although quality of nursing care scores were not different between nurses working in both modes of care delivery, nurses reported higher numbers of nursing tasks left undone when they worked in a team nursing compared to a total patient care mode of care delivery. (b) Mode of nursing care delivery was found to be related to patient adverse events. However, this primary effect cannot be interpreted because of a moderating effect of mode of nursing care delivery in this analysis which will be explained with respect to the third research question more thoroughly. (c) Mode of nursing care delivery was not related to job satisfaction and emotional exhaustion; no differences were found in job satisfaction scores and emotional exhaustion scores of nurses who worked in a team nursing mode compared to those who worked in a total patient care mode of nursing care delivery.

2. What is the relationship between skill mix and (a) quality of nursing care (i.e., nurse reported quality of nursing care and nursing tasks left undone), (b) patient outcomes (i.e., patient adverse events), and (c) nurse outcomes (i.e., job satisfaction and emotional

exhaustion) after controlling for nurse characteristics, nurse workload, work environment factors, and mode of nursing care delivery?

(a) Skill mix was found to be unrelated to nurse reported quality of nursing care and number of nursing tasks left undone. This means quality of nursing care scores and number of nursing tasks left undone were not different between nurses who described working in skill mix with LPNs versus one without LPNs. (b) Skill mix was related to patient adverse events suggesting that nurses working in a skill mix with LPNs had higher reports of patient adverse events compared to those working in a skill mix without LPNs. (c) Skill mix was not related to job satisfaction which suggests that job satisfaction scores were not different between nurses who worked in a skill mix with LPNs compared to a skill mix without LPNs. Although skill mix was found to be related to emotional exhaustion, this primary effect cannot be interpreted because of a moderating effect of skill mix in this analysis which will be explained with respect to the fourth research question more thoroughly.

3. Does mode of nursing care delivery moderate the relationship between nurse workload factors and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes?

(a) Mode of nursing care delivery did not moderate the relationship between any of the workload factors and quality of nursing care. This means that the relationship between workload factors and quality of nursing care were not different between team nursing and total patient care mode of care delivery. (b) Mode of nursing care delivery was found to have a moderating effect on the relationship between patient acuity and patient adverse events. The effect of patient acuity on

patient adverse events was different for the team nursing vs. total patient care mode of care delivery. For moderately and very acute patients, nursing staff who described working in a team nursing mode, reported higher levels of patient adverse events on their unit compared to nurses who described working in a total patient care mode. (c) Mode of nursing care delivery did not moderate the relationship between any of the workload factors and nurse outcomes. This means that the relationship between workload factors and nurse outcomes, job satisfaction and emotional exhaustion, was not different between nurses who worked in a team nursing mode compared to those who worked in a total patient care mode of care delivery.

4. Does skill mix moderate the relationship between nurse workload factors and (a) quality of nursing care, (b) patient outcomes, and (c) nurse outcomes?

(a) Skill mix did not moderate the relationship between any of the workload factors and quality of nursing which suggests that the relationship between workload factors and quality of nursing care was not different between a skill mix with LPNs compared to a skill mix without LPNs. (b) Skill mix did not moderate the relationship between any of the workload factors and patient outcomes. This means that the relationship between workload factors and patient adverse events are not different between a skill mix with LPNs compared to a skill mix without LPNs. (c) Skill mix did not moderate the relationship between any of the workload factors and job satisfaction suggesting that the relationship between workload factors and job satisfaction was not different between a skill mix with LPNs compared to a skill mix without LPNs. Skill mix, however, moderated the relationship between patient acuity and emotional exhaustion. The negative effect of patient acuity on emotional exhaustion was different for the skill mix with LPNs vs. without

LPNs. For moderate to very acute patients, nurses who worked with LPNs reported lower levels of emotional exhaustion than their colleagues who worked in a skill mix without LPNs.

Chapter 5: Discussion

The purpose of this study was to examine the unique effects of nursing skill mix and mode of care delivery with respect to quality of nursing care, patient and nurse outcomes. In this chapter, key study findings are explained and interpreted. This chapter consists of five sections. The first section provides a summary of key mode of nursing care delivery and skill mix findings.

Strengths and limitations associated with this study will be addressed in the second section. In the third and fourth sections, expected and unexpected study findings are discussed with respect to the two key study predictors followed by three control variables—work environment factors, workload factors, and nurse demographic characteristics. Last, the practice, policy, and research implications of these findings are discussed.

5.1 Key Findings

There were several key findings with respect to skill mix and mode of nursing care delivery. A skill mix including LPNs was associated with higher frequency of patient adverse events but lower levels of emotional exhaustion among nurses, especially, in the case of the latter, when caring for more acute patients. Team nursing was associated with higher patient adverse events when caring for more acute patients; and with higher number of nursing tasks left undone. There was low prevalence of team nursing mode of care delivery (23%) where skill mix with LPNs would have been expected. Instead, 67% of nurses using total patient care mode of delivery reported working with LPNs. This is contrary to previous literature that had equated total patient care with an all-RN skill mix. These findings will be further discussed and interpreted in the mode of nursing care delivery and skill mix findings section.

5.2 Strengths and Limitations

There are four key strengths associated with this study. The first strength relates to examining the effect of both mode of nursing care delivery and skill mix on quality and safety outcomes. This is especially important as the findings of many previous studies were confounded by failing to take into account the effects of both model of care delivery components. Second, this study controlled for the potential effect of confounding variables such as work environment and workload factors, and demographic characteristics. Similarly, many of the previous mode and skill mix studies failed to control for these factors. The third strength relates to the operationalization of mode of nursing care delivery as total patient care versus team nursing and skill mix as a skill mix without LPNs versus with LPNs. These operationalizations are consistent with the care delivery model redesign that has been occurring in BC acute care settings. Fourth, a priori power calculation guided the study sample size. Thus, it is believed that adequate sample size provided the study with sufficient power to detect small effects.

Despite the study strengths, the findings should be interpreted cautiously due to four key limitations. First, for confidentiality reasons, nurses were not asked to identify their units of work: subsequently, there were no links between individual nurses and particular units. Although nurses should have been aggregated within units for comparisons within and across units, nurses' data were analyzed at an individual level. Disaggregation of data ignores the presence of between-group variance which in turn increases the possibility of detecting a false relationship (i.e., Type I error) (Woltman, Feldstain, MacKay, & Rocchi, 2012). Having said that, another study based on this data set determined that there were inadequate numbers of nurses per hospital for hierarchical analysis. A second limitation is low response rate. To increase response rate,

several strategies were conducted during the study: advertisements through union media, email reminders to non-respondents, incentives, and hard copy send-outs to a random sample of nurses (Havaei, Dahinten, & MacPhee, 2015). The low response rate of the study leads to concerns of sample bias and generalizability of the findings. High response rates, however, do not guarantee representation and vice versa: researchers need to look beyond survey response rates to factors such as non-response error. Non-response error occurs when a significant number of people in the survey sample do not respond and have different characteristics from those who do respond (MacDonald, Newburn-Cook, Schopflocher, & Richter, 2009). As cited in Havaei et al. (2015), the total study sample was compared with Canadian Institute for Health Information reports of provincial nurse demographics. We found that this study sample is similar to the BC nursing workforce with respect to age, gender, and employment status (Canadian Institute for Health Information, 2012). The third study limitation is related to some of the study measures. It is possible that measures of patient acuity and dependency did not capture the true variance in medical-surgical patient acuities and dependencies. The findings may have been different if more accurate measures were used, and thus there is a need for more discriminant and objective measures of patient acuity and dependency. Similarly, some of the study measures asked nurses' perceptions of a phenomenon over the last month or last year. Thus, there is measurement error, attributed to recall bias, associated with these measures. Ideally, nurse self-reports of quality and safety status should be compared with administrative data. Unfortunately, access to these data is limited in BC. As shown by McHugh and Stimpfel (2012), when administrative data are lacking, nurse perceptions and self-reports are a useful proxy. As noted in previous research on team-based care delivery, nurses do not always use consistent labels or agree on the types of care delivery they are using (McGillis Hall & Doran, 2004). Operational definitions were provided

for modes of care delivery on this study's survey, and questions were content validated with acute care nurses. There is a possibility, however, that these definitions did not conform to nurses' understanding of team-based delivery versus total patient care. Lastly, no cause and effect can be established between predictors and outcomes as this was an exploratory cross-sectional survey study.

5.3 Mode of Nursing Care Delivery and Skill Mix Findings

There were several key findings with respect to two key predictors, skill mix and mode of nursing care delivery. Although some of these findings were consistent with the previous literature, a majority of them were surprising. A key skill mix finding consistent with the previous literature was higher patient adverse events reported by RNs working in a skill mix including LPNs. There are two possible explanations for this finding. A staff composition with more RNs is referred to as a richer skill mix in the literature (Estabrooks et al., 2005; Harris & McGillis Hall, 2012). Other research has also shown how more RNs or a richer skill mix is associated with better patient outcomes (Bolton et al., 2007b; Cho et al., 2003; McGillis Hall et al., 2003; Needleman et al., 2002; Seago et al., 2006; West et al., 2012) and nurse outcomes (Staggs & Dunton, 2012). The superiority of a richer skill mix is most likely associated with higher education and skill levels of RNs compared to other nursing types. In Canada, RNs typically are university prepared and LPNs receive diploma degrees (Born, Dhalla, & Ferguson-Pare, 2013). Thus, it is possible that a skill mix without LPNs resulted in a higher proportion of RNs with greater formal education.

A second explanation may relate to possible role confusion between Canadian RNs and LPNs (White et al., 2008; MacPhee, 2014). Scope of practice documents do not clearly differentiate between BC RNs' and LPNs' roles and responsibilities (College of Practical Nurses of BC, 2016; College of Registered Nurses of BC, 2016a). "First, as traditional roles and functions change, confusion and disagreements can challenge professionals' identities and engender conflicts among practitioners and occupational groups" (Dubois & Singh, 2009 p. 6). Role confusion results from a lack of or inconsistent information which subsequently compromises clarity in a specific job position (Schmidt, Roesler, Kusserow, & Rau, 2014). Role confusion has previously been linked to poor nurse outcomes which in turn have been directly or indirectly linked to poor patient outcomes. A longitudinal study of nurses from eight European countries linked higher nursing role confusion to lower levels of organizational commitment and higher levels of workplace violence— from supervisors, colleagues and patients (Camerino, Estryne-Behar, Conway, van Der Heijden, & Hasselhorn, 2008). Higher levels of workplace violence among nurses have been previously linked to increased nurse reported patient adverse events (Laschinger, 2014). Thus, it is possible that role confusion for RNs working in a skill mix with LPNs compromised their perceptions of their ability to provide safe patient care. This finding is particularly worrisome as only a minority of the participating RNs (about 32%) reported working in a skill mix without LPNs.

Another skill mix finding was that RNs in a skill mix with LPNs had lower emotional exhaustion scores when caring for more acute patients compared to those in a skill mix without LPNs. One explanation for this finding may be that RNs appreciated the opportunity to share their feelings and receive support from their LPN colleagues when there was high workload imposed on them

as a result of high patient acuity. As Maslach (1978) described in her seminal work, collegial support may be important because “burnout rates are lower for health care practitioners who actively express, analyze, and share their personal feelings with their colleagues (Maslach, 1978, p. 116). Previous empirical evidence supports a negative association between co-worker support and the three dimensions of burnout (i.e., emotional exhaustion, depersonalization, and personal accomplishment). A Spanish cross-sectional survey study of 210 nurses found that those who received higher levels of support from their colleagues at work also reported lower levels of emotional exhaustion (Albar Marín & Garcia-Ramirez, 2005). In fact, among different types of support (from kin, supervisor, and colleagues), collegial support was the strongest negative predictor of this burnout dimension. Similarly, a Swedish cross-sectional study of 1561 RNs and nursing assistants found that support received from co-workers was the strongest predictor of all three dimensions of burnout (Sundin, Bildt, Lisspers, Hochwälder, & Setterlind, 2006). Similar to Albar Marín et al. (2005), Sundin et al. (2006) also found that collegial support was more important than other types of support (e.g., supervisory support). Thus, it is possible that the presence of LPNs gave RNs greater perceptions of collegial support, buffering against emotional exhaustion when caring for patients with high acuity.

Two surprising mode of nursing care delivery findings were that team nursing was associated with higher number of nursing tasks undone and patient adverse events. These findings are surprising because a large body of evidence has linked effective teamwork with improved patient and nurse outcomes (Kalisch & Lee, 2010; Kalish et al., 2010; Manser, 2009). Among this body of evidence is a classic US report by the Institute of Medicine (IOM) (2004) that recommended a team-based approach for patient care delivery, inspiring a shift in BC acute care settings towards

using team-based care delivery intra-and inter-professionally (British Columbia Ministry of Health, 2014).

Despite a provincial shift towards team-based care delivery, in this study, BC medical-surgical RNs involved in team-based nursing reported leaving more nursing tasks left undone. This finding may be attributable to the difference between nurses' perceptions of team-based care delivery and effective, collaborative teamwork as reported in the literature. Assigning a group of patients to a group of nurses (i.e., team nursing) does not necessarily constitute effective collaboration and teamwork. An extensive review of over 130 teamwork studies introduced a framework in which elements of effective teamwork among all studies were condensed into five core attributes: a) team leadership, b) collective orientation, c) mutual performance monitoring, d) backup behavior, and e) adaptability (Salas, Sims, & Burke, 2005). These five elements are fostered through the creation of three coordinating mechanisms: a) shared mental models, b) closed loop communications, and eventually, c) trust formation (Salas et al., 2005). In other words, it is the extent to which these five core attributes and three coordinating mechanisms are present or absent that determines effective teamwork. A previous qualitative study has shown the applicability of all eight elements of Salas et al. (Salas et al., 2005) framework to the team functioning of acute care nursing teams (Kalisch, Weaver; & Salas, 2009). With respect to Salas's framework, BC medical-surgical team-based nurses may not be engaged in collaborative teamwork due to missing evidence-based attributes (e.g., adaptability) and coordinating mechanisms (e.g., effective communications). Thus, it is likely that in ineffective teams, nurses spent more of their time on resolving team-related challenges and limitations, taking time away from patient care delivery.

Ineffective teamwork may be more harmful during times of high stress/workload. This assumption may account for another mode of nursing care delivery finding: nurses working in team-based mode reported higher frequencies of patient adverse events when they cared for higher acuity patients. This finding is consistent with a previous study on missed care delivery by team-based nurses (Kalisch et al., 2009). According to Kalisch and Lee (2013): “Although teamwork can increase productivity, there has to be enough time for the team to develop shared mental models as well as being available to watch and help one another as needed” (p. 7). In health care, where emergencies are commonplace, ineffective teamwork can lead to deadly outcomes. Hunziker and colleagues noted the importance of teamwork during cardiopulmonary resuscitations. “Emerging evidence suggests that in addition to technical skills of individual rescuers, human factors such as teamwork and leadership affect adherence to algorithms and hence the outcomes of CPR” (Hunziker et al., 2011, p.2381). Thus, when caring for more acute patients, ineffective teams may not have the time to adequately respond to complex care demands, resulting in patient adverse events.

Two other concerns need to be raised with respect to mode of care delivery and skill mix findings from this study. A small proportion of RN participants reported their mode of nursing care delivery as team nursing despite institutional reports of organized transitions from total patient care to team nursing in acute care settings (British Columbia Ministry of Health, 2014). This finding may signal the slow transition from total patient care to team nursing in BC medical-surgical settings owing to limited sustained organizational supports and resources that enable this transition. Among RNs who identified their mode of care delivery as total patient

care, a majority reported working in a skill mix with LPNs. This finding is surprising given that total patient care has been previously equated with an all-RN skill mix (Duffield et al., 2010; Shirey, 2008) and may suggest that some BC medical-surgical LPNs have their own independent patient assignments¹⁰. In addition, over 80% of RNs in this study reported that their patient acuities were moderately to very high. Given that LPNs encountered similar patient acuities¹¹, questions are raised about LPNs' working beyond their scope of practice. In BC, LPNs are self-regulated, but they are required to work under the supervision of an RN or another authorized health care professional (e.g., nurse practitioner, physician) especially when they care for unstable and complex patients (College of Practical Nurses of BC, 2016). This study found that higher frequencies of patient adverse events were reported by RNs working in a skill mix including LPNs. This finding is plausible in situations where LPNs are working beyond their legal scope of practice in care delivery settings where collaborative teamwork and supervision are absent. In a qualitative study of Ontario RNs and LPNs, Baumann and colleagues found that in clinical settings with low patient acuity and stable, predictable patients, LPNs were able to make most decisions autonomously (Baumann, Blythe, Norman, & Crea-Arsenio, 2014). However, in higher acuity settings with complex and unpredictable patients, LPNs required RN support and leadership. Although Baumann et al. (2014) did not study the consequences of lack of RN supervision, their findings are consistent with nursing professional standards of practice guidelines which mandate LPNs to function interdependently with RN support and supervision in high acuity settings (College of Practical Nurses of BC, 2016).

¹⁰ For a different study, the research team found that 59% of medical-surgical LPNs identified their mode of care delivery as total patient care.

¹¹ 61% of medical-surgical LPNs identified their patients' acuities as moderately acute or very acute.

There were other unexpected mode of nursing care delivery and skill mix findings. This study failed to find a relationship between the two model of care delivery components and nurse reported quality of nursing care and job satisfaction. One possible explanation may be the surprisingly strong effects of some of the control variables on these study outcomes. In particular, work environment factors were the most important predictors of all five study outcomes. For example, four of the five and three of the five work environment factors were related to nurse reported quality of nursing care and job satisfaction respectively. This means mode of nursing care delivery and skill mix were not related to both outcome variables over and above the effect of other control variables in particular work environment factors. This finding is consistent with the statistically significant bivariate correlations found between each of the model of care delivery components and nurse reported quality of nursing care; and mode of nursing care delivery and job satisfaction.

5.4 Work Environment, Workload, Nurse Demographic Findings

Work environment factors were measured by the PES-NWI as described in the third chapter. The relationships between work environment factors and quality and safety outcomes and their order of importance were expected. Consistent with the previous literature (Laschinger & Leiter, 2006; Leiter & Laschinger, 2006), nurse perceptions of staffing and resource adequacy and nursing foundation of care delivery were the two most important work environment factors predicting quality and safety outcomes respectively. In particular, RNs' perceptions of these two work environment factors were found to be related to four of the five study outcomes. Registered nurses' perceptions of participation in hospital affairs was the third most important work

environment factor related to two nurse outcomes, job satisfaction and emotional exhaustion. These three work environment factors demonstrated small to moderate effects on quality and safety outcomes ($\beta = .16 - .40$).

Among PES-NWI studies reviewed, only Hessel et al. (2015) examined all five PES-NWI factors using multiple regression analysis. Hessel et al. (2015) found large effect sizes for the three work environment factors (i.e., staffing and resource adequacy, nursing foundation of care delivery, and participation in hospital affairs) and nursing tasks left undone ($\beta = .47-.77$). Other studies either excluded some PES-NWI factors and/or used data analysis methods other than multiple regression, making their effect sizes incomparable. Inconsistent with the previous literature, this study failed to find a relationship between two work environment factors, nursing leadership and nurse-MD relations, and four of the five study outcomes. In the following section, findings pertinent to these work environment factors will be discussed. In particular, empowerment theory research will be drawn upon to explain these study findings.

Among all study predictors, RNs' perceptions of staffing and resource adequacy was the strongest predictor of four of the five study outcomes; specifically, higher perceptions of staffing and resource adequacy were found to be related to higher nurse reported quality of nursing care ratings and job satisfaction scores; and lower number of nursing tasks left undone and emotional exhaustion scores. Staffing and resource adequacy, a unit-level phenomenon, refers to nurses' evaluation of the adequacy of resources in their workplace with respect to meeting workload demands in their jobs (Lake, 2002; Warshawsky & Havens, 2011). When nurses perceive higher staffing and resource adequacy in their unit, they can more effectively manage their workload

and hence can provide better care and feel more satisfied in their jobs. Previous evidence also supports the relationship between higher staffing and resource adequacy perceptions and better quality and safety outcomes (Hessels et al., 2015; Laschinger, 2008; Leiter & Laschinger, 2006; Rochefort & Clarke, 2010).

The conceptualization of the work environment factor, staffing and resource adequacy, is similar to Kanter's notion of structural empowerment, which refers to nurses' perceptions of access to certain work structures in their unit of work such as information, support and resources necessary to meet nursing work demands (Kanter, 1993; Laschinger, 2008). Canadian researchers have repeatedly established a positive link between structural empowerment and improved quality and safety outcomes (Armstrong & Laschinger, 2006; Laschinger, 2008; Laschinger, Finegan, & Wilk, 2009; Laschinger & Leiter, 2006). An exploratory Canadian study conducted Structural Equation Modeling to examine the effects of work environment factors (measured by PES-NWI) and structural empowerment on nurse reported quality of nursing care. This study found that only staffing and resource adequacy and structural empowerment were directly related to this outcome variable with similar magnitudes of relationships ($\lambda=.29$ and $.27$ respectively) (Laschinger, 2008). Thus, in addition to similar conceptual definitions, empirical evidence suggests a conceptual overlap between structural empowerment and staffing and resource adequacy.

After adequacy of staffing and resource perceptions, RNs' perceptions of nursing foundation of care delivery was found to be the second strongest predictor of quality of nursing care and patient outcomes, and the third strongest predictor of job satisfaction. As expected, higher

perceptions of this work environment factor were related to lower number of nursing tasks left undone and frequency of patient adverse events; and higher nurse reported quality of nursing care ratings and job satisfaction scores. Nursing foundation of care delivery, an organizational level phenomenon, refers to the profile of nursing within an organization: a nursing philosophy of care and professional model of care delivery are present and valued by the organization (Hessels et al., 2015; Warshawsky & Havens, 2011). When nurses perceive more value placed on their care delivery by their organization, they are motivated to provide better quality and safe care and hence feel more satisfied in their job (Laschinger & Leiter, 2006; Leiter & Laschinger, 2006). Previous evidence also supports the relationship between higher perceptions of nursing foundation of care delivery and better quality and safety outcomes such as fewer patient adverse events and higher levels of nurse job satisfaction (Armstrong, Laschinger, & Wong, 2009; Hessels et al., 2015; Laschinger, 2008; Laschinger & Leiter, 2006; Leiter & Laschinger, 2006).

Nursing foundation of care delivery is similar to Spreitzer's notion of psychological empowerment, particularly with respect to its cognition of meaning (1995). Psychological empowerment is described as an employee's intrinsic sense of motivation to complete their work and is composed of four cognitions of meaning, impact, autonomy and competence. Meaning involves a fit between an individual's values/goals and organizational values/goal (Spreitzer, 1995). Canadian researchers have repeatedly established a positive link between psychological empowerment and improved quality and safety outcomes (Faulkner & Laschinger, 2008; Laschinger, Leiter, Day, & Gilin, 2009; Stander & Rothmann, 2009). Although no empirical research has examined the relationship between nursing foundation of care delivery and the cognition of meaning, a conceptual overlap may exist. When nurses perceive a match between

organizational values and their nursing values (i.e., professional standards, code of ethics), they are inspired to perform more effectively and productively hence the end result is better quality and safety outcomes. This assumption is supported by empirical evidence. In an unpublished study based on the same data as this study, when nurses compromised professional standards of practice more frequently, they reported higher emotional exhaustion scores and lower jobs satisfaction scores (MacPhee et al., 2016).

Another work environment factor important to quality and safety outcomes was nurses' perceptions of participation in hospital affairs. Higher perceptions of participation in hospital affairs was the second and the fourth strongest predictors of higher job satisfaction and lower emotional exhaustion scores respectively. Participation in hospital affairs, an organizational level phenomenon, refers to opportunities for direct care RNs to provide input into organizational decisions on practice and policy (Lake, 2002; Warshawsky & Havens, 2011). When nurses believe they have a voice in organizational decisions, they are more satisfied in their jobs and less emotionally exhausted. Previous evidence also supports the relationship between participation in hospital affairs and quality and safety outcomes (Hessels et al., 2015).

The work environment findings of this study suggest the importance of a majority of work environment factors at the unit and hospital levels for quality and safe care delivery. Although staffing and resource adequacy represents a unit-level phenomenon, nursing foundation of care delivery and participation in hospital affairs represent hospital-level phenomena. Of concern is that despite their importance, two of these work environment factors, staffing and resource adequacy and participation of hospital affairs, were least favorably scored by study participants.

A majority of workload findings were surprising. Inconsistent with the previous literature, staffing levels did not predict four of the five outcomes in the regression analyses even though staffing levels, in particular patient-RN ratios, showed bivariate relationships with three of the study outcomes (i.e., both nurse reported quality of nursing care outcomes and patient adverse events). This finding means that staffing levels do not have an independent effect on quality and safety outcomes over and above the effect of other study predictors.

Only patient-regulated nurse ratios were positively related to patient adverse events; RNs that reported higher patients per regulated nurses in their unit, also reported higher frequency of patient adverse events. This finding is consistent with previous literature that linked higher patient-regulated nurse ratios to better quality and safety outcomes (Aiken et al., 2011). What remains unexpected is this study's failure to find relationships between both staffing level measures (patient-RN and patient-regulated nurse ratios) and other study outcomes. These unexpected findings can be partially explained by human factors engineering evidence.

Researchers in human factors engineering acknowledge that the mechanism by which staffing levels influence outcomes is complex and not very well understood. This body of research suggests the importance of more granular examinations of types of workload factors at different systems levels (e.g., unit-level, job-level, and task-level). The following table (Table 16) illustrates a few human factors associated with nursing workload (Holden et al., 2011). At the unit-level, for instance, nursing workload is directly influenced by patient acuity needs and staffing and resource adequacy. These factors are particularly relevant to nurse managers and

their capacity to adjust staffing levels and assignments based on patient care needs and available staff. The second level, job-level workload, refers to general and specific demands of the job including the overall amount of work to be done per shift, the difficulty of the work and the amount of concentration or attention required to do it. The third level, task-level workload, reflects specific task demands. For example, if a nurse is preparing medications, frequent interruptions may adversely influence the nurse’s capacity to safely carry out this task. At this level, nurses may also prioritize tasks based on their importance to patient outcomes (e.g., patient monitoring versus patient comfort measures). In examining this framework, Holden et al. (2011) found that only task-level workload was related to nurse-reported medication errors. Consistent with Holden et al., (2011) findings, it is possible that staffing levels were unrelated to four of the five quality and safety outcomes as patient-nurse ratios alone cannot capture what is happening during day-to-day job and specific task demands. This speculation is also supported by the small bivariate relationships that this study found between both measures of staffing levels and nurses’ perceptions of staffing and resources adequacy in the work environment suggesting these perceptions are informed by multiple workload factors.

Table 16. Levels of Nursing Workload

Levels of Workload	Examples
Unit-level	Nurse-patient ratio Patient acuity Staffing and resource adequacy
Job-level	Amount and kind of work required /specific job demands
Task-level	Interruptions during specific tasks Mental concentration required for specific tasks

There were other unexpected workload factor findings. In particular, this study failed to find any relationships between patient acuity and dependency and a majority of study outcomes. Although

inconsistent with the previous literature (Patrician et al., 2011; Twigg & Duffield, 2009), these findings may also be explained in light of the human factors engineering evidence described above (Holden et al., 2011). Similar to staffing levels, patient acuity and dependency alone cannot capture what is happening during day-to-day and specific task demands in nurses' jobs. These unexpected non-significant relationships may also be attributed to the poor discriminant ability of the measures of patient acuity and dependency used in this study. These measures were originally rated on a four-point scale but were later recoded into binary variables because of the negatively skewed distribution of the variables. Therefore, as described in the limitation section, it is likely that these measures did not capture the true variance in medical-surgical patient acuities and dependencies which in turn resulted in non-significant relationships between these workload factors and a majority of quality and safety outcomes.

One surprising workload finding was the relationship between patient dependency and job satisfaction. RNs who reported caring for more dependent patients were more satisfied in their jobs. Although inconsistent with the previous literature (Curley, 2007; Hurst, 2005; Twigg & Duffield, 2009), this unexpected finding can be explained by recent nursing movements that recognize the importance of fundamentals of care, "care activities that are required for every person, regardless of their clinical condition or health care setting" (Kitson, 2016, p. 10-11). Kitson noted that fundamentals of care includes helping people with eating, drinking, elimination, ambulation and mobilization. Although these fundamentals of care are considered foundation of professional nursing, over time, and with increased patient acuities, dependency functions have shifted away from nurses to unlicensed care assistants or care aides in hospital settings. Registered nurses are often overburdened with caring for high acuity patients, while the

basics of professional care have been delegated to others (Kitson, 2016). Thus, it is possible that caring for more dependent patients gives RNs a greater sense of job satisfaction as it enables them to be at the bedside in one-on-one interactions with the patient where the focus goes from cognitive demands (acuity) to compassionate interactions (dependency). Recent nursing literature has begun to acknowledge the importance of RNs' re-engagement with the fundamentals of care. Needleman (2016) conducted an economic analysis of nurses' return to fundamentals of care. He found that when nurses focus on holistic care delivery that encompasses provision of fundamentals of care, less essential tasks are missed and the quality, safety and cost-effectiveness of care delivery improves (Needleman, 2016). Thus, as noted in this study, nurses may be more satisfied in their work when they can care for more dependent patients who require foundational, fundamental nursing care.

In addition to workload factors, other control variables examined in this study included nurse demographic characteristics. With respect to these characteristics, there were two expected findings: temporary nurses left higher number of nursing tasks undone and older nurses reported lower emotional exhaustion scores. There were no other relationships between nurse demographic characteristics and quality and safety outcomes.

The first important nurse demographic finding was the relationship between temporary nurses and higher levels of missed care. There have been recent movements away from standard full-time work to more flexible forms of non-standard work such as temporary employment contracts in particular in healthcare. This is known as casualization in the nursing literature (Becker, McCutcheon, & Hegney, 2010). In BC, full-time and part-time nurses can have a permanent or a

temporary contract. When a permanent staff nurse is on leave, a temporary position (with a pre-specified time frame) may be filled by another permanent or casual staff (Sorensen, personal communications, May 5, 2014). Temporary nursing or casualization has been linked to poor patient outcomes (Aiken et al., 2007; Estabrooks et al., 2005), nurse outcomes (Rheume et al., 2011), and organizational outcomes (e.g., increased cost) (Johnson, Butler, Harootunian, Wilson, & Linan, 2016; Seo & Spetz, 2010).

The relationship between temporary nursing and higher number of nursing tasks left undone can be attributed to unequal opportunities and unfamiliarity of temporary nurses with the unit of work. A critical ethnography that explored temporary nursing concluded that temporary nurses were marginalized as traditional work modes were designed for the permanent full-time staff (Batch & Windsor, 2015). One aspect of this marginalization was lack of staff development opportunities for temporary nurses with the potential for skills erosion. Thus, it would be expected that temporary nurses' ability to complete essential nursing tasks was compromised in this study. Moreover, temporary nurses' ability to provide quality and safety patient care may also be negatively affected due to less familiarity with important aspects of their work environment such as the patient population, geographic layout, team members, policies and protocols. A British study that compared units with all-permanent staff with units with a mix of permanent/temporary staff found that nurses in the latter units spent less time with patients and had more non-productive down-time (Hurst & Smith, 2011); perhaps because they spent more time familiarizing themselves with unit layout and unit-specific policies and procedures. Thus, it is possible, in this study, that temporary nurses' ability to complete essential nursing tasks and

provide quality, safe care were compromised more than nurses on permanent employment contracts.

Another important nurse demographic finding was the higher levels of emotional exhaustion found among younger RNs. This finding is consistent with the previous literature (Erickson & Grove, 2007; Lavery & Patrick, 2007; Ma, Lee, Yang, & Chang, 2009) and can be explained in light of limited coping skills and experience of younger nurses. Erickson and Grove (2007) attributed the significant negative relationship they found between age and emotional exhaustion to less effective coping strategies of younger nurses compared with their older colleagues. In an old but seminal work, Maslach and colleagues found that among all the demographic variables that have been examined with respect to burnout, age has been the most consistent predictor of burnout (Maslach, Schaufeli, & Leiter, 2001). They noted “age is confounded with work experience, so burnout appears to be more of a risk earlier in one’s career” (p. 409). This assumption is also supported by the strong bivariate correlation found between BC medical-surgical RNs’ age and their years of nursing experience. This study’s findings suggest that younger BC medical-surgical RNs may have less nursing experience and coping skills which in turn increases their likelihood of suffering from emotional exhaustion compared with older RNs.

What remains unexpected is this study’s failure to find a relationship between other demographic characteristics, in particular education and years of nursing experience, and all quality and safety outcomes. This study had expected to find better quality and safety outcomes for nurses with higher levels of education and more years of nursing experience. The failure to find these relationships can be attributed to possible multicollinearity between nursing education, years of

nursing experience, and age. Multicollinearity occurs when the regression model includes multiple factors that are highly correlated to each other. In other words, there is some level of redundancy between predictors. Multicollinearity is known to overinflate standard errors of the regression coefficient which in turn may result in a type II error (Grewal, Cote, & Baumgartner, 2004). Although the multicollinearity indices, VIF and tolerance, associated with each regression model did not indicate any extreme multicollinearity (10 and .1 respectively) (Field, 2009), the strong bivariate correlations between these three predictors support this speculation.

5.5 Practice, Policy and Research Implications

The findings of this study have several implications pertinent to policy, practice and research. With respect to skill mix, it is possible that there is some role confusion between RNs and LPNs which may account for some of the negative quality and safety outcomes associated with a skill mix including LPNs. The study findings also suggest that some BC medical-surgical LPNs provide total patient care without receiving RN supervision and support. Both of these issues point to the urgency of resolving scope of practice challenges within the nursing profession. In Canada, there are no standard regulations regarding scopes of practice: titles and licensure criteria for different nursing classifications (e.g., RNs, LPNs) vary across jurisdictions. “[A] clear scope of practice is important because it is the base from which governing bodies prepare standards of practice, education institutions prepare curricula, and employers prepare job descriptions” (Nelson et al., 2014, p. 21). The Canadian Academy of Health Science commissioned a report aimed at determining the optimum scope of practice for each health care profession, including nursing (Nelson, 2014). The authors recommended strategies to optimize

the scope of practice based on a ‘fit’ between nurse competencies and qualifications and patient needs.

Confronting nursing scope of practice challenges requires multi-level interventions. At the policy level, regulatory bodies such as College of Registered Nurses of BC (CRNBC) and College of Licensed Practical Nurses of BC (CLPNBC) must collaborate with academics, researchers, health authorities, and the government to examine and clarify the respective scopes of practice for different classifications of nurses. These stakeholders of public health and well-being share a common goal to provide clear and consistent guidelines for quality, safe care delivery. A recent BC Coalition of Nurses Associations (BCCNA) has been established between the provincial government and various nursing stakeholders (e.g., Association of Registered Nurses of BC, Licensed Practical Nurses Association, Nursing Education Council of BC) to engage nurses from various professional nursing groups in discussion around important topics to nursing. Clarifying nurses’ roles and scopes of practice are among the recommendations made to move the health care system forward (BC Coalition of Nursing Associations, 2015).

Policy development is a long-term process, but in the meantime, health care organizations and individual nurses are responsible for ensuring the right provider gives the best possible care in the most appropriate way. One way health care organizations can do this is to investigate the match between skill mix and mode of care delivery at the unit-level. This is especially important as this study’s findings suggest that LPNs may be working beyond their legal scope of practice in BC medical-surgical settings. Individual nurses are also accountable. Every RN and LPN has a professional responsibility to learn about their own professional and organizational scopes of practice and those of their colleagues. If placed in an ambiguous situation, nurses must refuse to

provide care outside of their scope of practice until they obtain clarification as to what they can and cannot do as mandated by their professional body and organization. A recent example is the legalization of medical-assisted dying (MAD) in Canada. Despite federal and provincial laws permitting MAD, there was a six-month lag in legal clarification for RNs' professional accountabilities (College of Registered Nurses of BC, 2016b). A Canadian qualitative study on high functioning RN/LPN teams, found that nurses who were clear on RN/LPN scope of practice were more likely to function as team players and to promote a supportive team environment of mutual trust and respect (Baumann et al., 2014). Thus, it is important to continue to educate nurses about scope of practice issues during training and clinical practice. Future research should examine how available health human resources are best optimized during the provision of nursing care for specific patient population needs.

Team nursing mode of care delivery was associated with more negative outcomes than total patient care. Ineffective teamwork may explain the poor quality and safety outcomes associated with this mode of care delivery particularly when workload is high. The study findings suggest that health care organizations have been particularly slow in transitioning from total patient care to team nursing: the transition may be resource-dependent. According to Salas and Rosen (2013), organizational conditions, which are influenced significantly by the quality of leadership, can inform the quality of teamwork. One of these conditions refers to the extent to which health care administrators take teamwork and safety seriously and are prepared to invest, time and resources, in them (Salas & Rosen, 2013).

Effective collaboration and teamwork can be fostered through the use of team building interventions and educational opportunities. Kalisch and colleagues found their team building intervention targeting nurses on an oncology unit resulted in decreased incidence of patient falls, and a decreased prevalence of nurse turnover and vacancy rates (Kalisch, Culey, Stefanov, 2007). The authors attributed the success of the intervention to an initial needs assessment and the inclusion of all nursing staff throughout the development of values, vision, and goals to guide the intervention (Kalisch et al., 2007). Kalisch and colleagues also tested the effectiveness of a train the trainer approach for nurse team building, and they found that this approach resulted in lower number of nursing tasks left undone and higher job satisfaction (Kalisch, Xie, & Ronis, 2013). Salas and Rosen (2013) identified other team-building interventions, such as standardized communication protocols, such as briefing and debriefing checklists and handover protocols. They also recommended structural changes to team composition—to ensure the right mix of competencies for specific healthcare contexts. Thus, skill mix considerations and modes of care delivery need to be addressed through policies and practices within healthcare organizations where teamwork is valued. The bottom line is that the mode of nursing care delivery must be flexibly selected in light of the available nursing human resources, their skills and competencies.

Within complex healthcare systems, workload management requires more than patient-nurse ratios. Hence, staffing policies and protocols must attend to other workload factors at different levels (e.g., unit-level, task-level, and job-level) (Holden et al., 2011). At practice level, the use of real-time staffing tools is recommended. An example includes the Synergy tool that engages nurses and management in determining patient acuity/dependency needs, followed by employment of staffing guidelines that have been collaboratively developed by nurses and

management (MacPhee et al., 2011; MacPhee, 2014). Another example is a comprehensive staffing decision-making framework, developed by Canadian Nurses' Association, that considers multiple workload factors at various levels. Examples include patient numbers, health care needs (e.g., acuity and dependency), and the mode of care delivery at the unit-level; general amount and kind of work required based on the range of patient conditions; and the extent of nursing skill and experience to perform a specific tasks (Canadian Nurses Association, 2012). This framework considers a multitude of other factors at the hospital and unit level as well as the bedside level when assessing, implementing and evaluating nurse staffing decisions .

At the level of the bedside, nurse job satisfaction is related to the delivery of essential tasks, or nursing care interventions that are considered foundational, i.e., “basic,” to professional nursing practice. The issue of missed or inadequately provided foundational nursing care represents an educational problem (MacMillan, 2016). “Without being aware of it, educators and practicing nurses may be teaching nursing students that fundamental nursing care is unimportant, uncomplicated and not really nursing’s responsibility” (MacMillan, 2016, p. 37). Thus, for educators in academe and clinical practice, an important first step is reflection on the nursing profession’s core values, and the initiation of dialogue (as evidenced by the recent formation of the BCCNA), to establish over-arching principles and practices for BC nurses that supersedes current boundaries between different stakeholder groups (e.g., professional associations, regulatory bodies, health authorities).

Most healthcare environments have challenges related to the quality of the work environment at the unit and hospital levels—in particular, staffing and resource adequacy, nursing foundation of

care delivery, and participation in hospital affairs. These are key components of magnet-like environments which were found to most strongly influence quality and safety outcomes in this study. The PES-NWI can be used as an indicator of ‘healthy’ or ‘quality’ work environments. Organizations should use healthy work environment/magnet assessment tools to determine areas for improvement. There are a variety of resources available to guide organizations that seek to become more magnet-like. Most recently, Mount Sinai Hospital in Toronto became magnet certified, a gold standard distinction based on a rigorous accreditation process. As stated by the CEO: “I believe that Mount Sinai was able to meet the extraordinary high standards set by the Magnet Recognition Program because we understand the transformative impact that every single nurse has in shaping care at our hospital. Ours is an environment that empowers nurses to lead and deliver the very highest standards in patient care and experience” (Mount Sinai Hospital, 2015, para 2). Mount Sinai Hospital began its “magnet journey” approximately four years ago, beginning with a thorough evaluation of its work environment from the perspective of its nurses (Mount Sinai Hospital, 2015). In 2007, over 500 hospitals in the US reported using the PES-NWI to assess the quality of their nursing work environments (Lake, 2007). The PES-NWI is one validated tool that is accepted by the Magnet Recognition Program as a credible source of unit-level work environment conditions.

With respect to policy, provincial Ministries of Health should require regular work environment assessments as part of a battery of validated Q/S indicators. These data need to be open and transparent—public score cards to drive Q/S performance standards for Canadian healthcare organizations. Other countries are also aware of the importance of openness and transparency with respect to health care data. For example, Patient CareLink (also known as Patient First) is

the first US initiative, a partnership between the Massachusetts Hospital Association and multiple other stakeholders, that began in 2005; this joint effort resulted in a public website that publishes “unit-specific hospital staffing information, quality and safety goals and accomplishments, as well as other important information” necessary to quality and safety care (Patient CareLink, 2015, p. 1). There have been similar efforts pertinent to openness and transparency of the UK’s health care organizations’ data. The redesign of nursing care delivery in the National Health Service (NHS) and the Mid Staffordshire General Hospital NHS Trust resulted in government commissioned inquiries available to the public. These inquiries resulted in recommendations to routinely publish information pertinent to organizational conditions (e.g., staffing levels) (MacPhee, 2014) with a view to ensure “openness, transparency, and candor throughout the system” (Francis, 2013, p. 4).

From a research perspective, Q/S data, particularly at unit levels, is needed to better understand the structures and processes related to quality, safe patient care delivery. Health services research is significantly disadvantaged from lack of standardized, operational definitions for Q/S indicators; and data are frequently aggregated at national, provincial, and hospital levels—making it difficult to determine key interventions for unit-level care delivery enhancements; “hospital-, state-, or national-level analyses will mask true patterns of care and their consequences” (Duffield et al., 2011, p. 253). Lack of open, transparent, valid and reliable health services data (e.g., patient and nurse outcome data) hampers internal and external benchmarking efforts among healthcare organizations and adversely influences the quality of research. In Canada for instance, lack of access to valid and reliable administrative and human resources data, in particular at the unit level, currently necessitates the use of surveys.

One demographic characteristic, such as having a temporary contract (versus a permanent contract) was associated with more nursing tasks left undone. Casualization, using more temporary workers, is often justified as a necessary evil during periods of nursing shortage and financial constraint. Recent economics studies have found that regularly employed RNs (versus temporary RNs) are more cost-effective, and they provide better quality care (Johnson et al., 2016; Seo & Spetz, 2010). Better strategies (than casualization) for controlling costs and maximizing human resources are flexible work practices (MacPhee & Borra, 2012). Flexible work options (e.g., self-scheduling, flexible shift lengths) need to be integral to workplace policies and protocols to enhance inter-generational nurse recruitment and retention. Johnson et al. (2016) found that a large source of experienced RNs have left nursing (i.e., non-practicing) due to work-related stressors. Proper incentives, including flexible work options, are needed to draw them back into the workforce. Ongoing research is needed to determine what workplace incentives matter the most to nurses, particularly in sectors with significant shortages of experienced RNs.

This study and others have demonstrated how younger nurses, in particular, are at risk of emotional exhaustion and eventual burnout (Erickson & Grove, 2007; Lavery & Patrick, 2007); possibly due to limited experience and coping strategies (Maslach et al., 2001). Thus, educational institutions and healthcare organizations need to collaboratively prepare new nurses for the difficult transition to practice. Among new graduate transition strategies include strong orientation by the same mentor/preceptor. A study of 342 new graduate RNs from Ontario found several organizational support factors pertinent to new graduate transition were related to job and career satisfaction and turnover intentions (Laschinger, 2012). The more the new graduate needs

were addressed during orientation, the higher job satisfaction and lower intention to leave scores were reported. This finding is consistent with previous evidence that supported the need for strong nurse orientation to both the organization and to the nursing profession (Scott, Engelke, & Swanson, 2008). An interesting finding was that new graduate nurses with higher number of preceptors reported lower career satisfaction and higher intent to leave (Laschinger, 2012). This shows the importance of mentorship/preceptorship opportunities by the same individual(s). Scott et al. found that new graduate nurses who experienced a longer orientation that met all of their needs also experienced higher job satisfaction. Scott et al. advocated for standardized internships and residencies such as transition-to-work-programs in many BC health care organizations. Perhaps coping strategies and techniques can be offered to younger less experienced nurses during these programs.

5.6 Conclusion

In complex health care systems, quality and safety of nursing care is dependent on multiple factors: nursing care delivery model, workload, work environment, and nursing human resource characteristics. In this study, a skill mix with LPNs was associated with more frequent patient adverse events, but less emotional exhaustion scores especially during times of high workload in case of the latter. Despite nurses' appreciation of having collegial support, LPNs in the skill mix seem to put additional burdens on RNs who are already struggling with heavy workloads. Clarifying nursing scope of practice may alleviate some of these struggles. Team nursing mode of care delivery was associated with decreased quality and safety outcomes, such as more nursing tasks left undone and more patient adverse events especially when patient acuity was high. According to research evidence, effective teamwork yields superior results. Organizational

practices and policies must support intra-and inter-professional collaborative teamwork. In the literature, nurse-patient ratios or staffing levels are often used as an indication of workload management. But, recent evidence suggests there are many factors, beyond staffing levels that influence nurses' perceptions of workload at different systems levels (i.e., unit, job and task-levels). In addition, the work environment context matters. Health care administrators must strive for magnet-like work environments with qualities such as adequate staffing and resources and a nursing philosophy and voice within the organization. Routine assessment of nurses' work environments, in an open and transparent manner, is necessary to maintain and improve quality and safety of patient care. And finally, nurse characteristics matter too. Emotional exhaustion and eventual burnout can be ameliorated through policies and practices that support new graduate nurse transition to the workplace. Quality of nursing care can be enhanced through flexible work practices for younger and older nurses.

Ultimately, high quality and safe care delivery is dependent on many factors. A key factor is a flexible mode of care delivery that is informed in light of unit-level nursing human resources and their skills and their competencies. Research, policy and best practices must ensure the right nurse with the right competencies adopts the right mode of care delivery in the right place to address patients' care needs.

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Appendices

Appendix A

Table 17. Sampling Proportions per Health Authority and Employment Status for Acute Care Sector

Stratification	Stratified Proportions	Returned Proportions
Health Authority		
Fraser Health	31%	31%
Interior Health	18%	17%
Northern Health	6%	5%
Provincial Health Services	5%	5%
Vancouver Coastal Health	18%	18%
Vancouver Island Health	17%	17%
Providence Health Care	5%	7%
Employment Status		
Full-time	49%	56%
Part-time	24%	26%
Casual	27%	19%

Note. (N=1,768).

Appendix B

Table 18. Nursing Tasks Left Undone Over the Last Shift

Nursing Tasks Necessary but Left Undone Over the Last Shift	<i>f</i> (%)
Adequate patient surveillance	132 (31.7%)
Skin care	125 (30.0%)
Oral hygiene	192 (46.2%)
Pain management	16 (3.8%)
Comfort/talk with patients	268 (64.4%)
Educating patients and family	178 (42.8%)
Treatment and procedures	35 (8.4%)
Administer medications on time	105 (25.2%)
Preparing patients and families for discharge	78 (18.8%)
Adequately document nursing care	124 (29.8%)
Develop/update nursing care plans/care pathways	268 (64.4%)
Frequent changing of patient/	165 (39.7%)
Discharge planning	136 (32.7%)
Other	29 (7.0%)

Notes. $N=416$.

Appendix C

Table 19. Descriptive Statistics of Individual Patient Adverse Events

Patient Adverse Events	<i>Median</i>	<i>Range</i>
Medication errors	1.0	0-6
Pressure ulcers	1.0	0-5
Patient Falls	1.0	0-5
Urinary Tract Infections	2.0	0-6
Bloodstream Infections	1.0	0-4
Pneumonia	1.0	0-5
Other nosocomial infections (e.g., MRSA)	1.0	0-5

Notes. N=416.

Appendix D

Table 20. Hierarchical Regression Analysis Results for Variables Predicting Nurse Reported Quality of Nursing Care

	B	SE B	Beta	CI (95%)	R ²	Δ R ²
Model 1:					39.4	39.4***
Age	-.21	.25	-.08	-.70 — .29		
Gender	-.29	.70	-.02	-1.66 — 1.09		
Education	-.05	.40	-.01	-.85 — .74		
Nursing Experience	.19	.24	.08	-.29 — .67		
Employment Status	-.18	.27	-.04	-.71 — .35		
Contract	-.25	.31	-.04	-.86 — .35		
Nursing Jobs	.11	.31	.02	-.50 — .73		
Acuity	.24	.32	.04	-.39 — .87		
Dependency	.03	.34	.00	-.63 — .70		
Patient-RN	-.05	.35	-.01	-.73 — .64		
Patient-Regulated Nurse	.19	.31	.04	-.41 — .80		
Staffing & Resource Adequacy	.72	.16	.28***	.41 — 1.03		
Nurse MD Relation	.43	.12	.17*	.19 — .67		
Nursing Leadership	.35	.16	.14*	.03 — .68		
Participation in Hospital Affairs	.06	.17	.02	-.27 — .39		
Nursing Foundation of Care Delivery	.67	.17	.25***	.33 — 1.01		
Model 2:					40.0	0.6
Age	-.21	.25	-.09	-.71 — .28		
Gender	-.22	.70	-.02	-1.60 — 1.15		
Education	-.01	.40	.00	-.80 — .79		
Nursing Experience	.23	.24	.09	-.24 — .71		
Employment Status	-.15	.27	-.03	-.68 — .38		
Contract	-.26	.31	-.05	-.86 — .34		
Nursing Jobs	.12	.31	.02	-.49 — .74		
Acuity	.27	.32	.04	-.36 — .89		
Dependency	-.01	.34	.00	-.67 — .65		
Patient-RN	.04	.35	.01	-.64 — .73		
Patient-Regulated Nurse	.14	.31	.03	-.46 — .75		
Staffing & Resource Adequacy	.72	.16	.28***	.41 — 1.02		
Nurse MD Relation	.41	.12	.16*	.17 — .65		
Nursing Leadership	.38	.16	.15*	.06 — .70		
Participation in Hospital Affairs	.03	.17	.01	-.30 — .36		
Nursing Foundation of Care Delivery	.63	.17	.24***	.29 — .98		
Mode of Nursing Care Delivery	-.48	.29	-.08	-1.05 — .08		
Model 3:					40.4	0.4
Age	-.20	.25	-.08	-.69 — .30		
Gender	-.25	.70	-.02	-1.62 — 1.13		
Education	.05	.40	.01	-.75 — .84		
Nursing Experience	.22	.24	.09	-.26 — .70		
Employment Status	-.11	.27	-.02	-.65 — .42		
Contract	-.28	.31	-.05	-.88 — .32		
Nursing Jobs	.10	.31	.02	-.51 — .71		
Acuity	.26	.32	.04	-.36 — .89		

	B	SE B	Beta	CI (95%)	R²	Δ R²
Dependency	.04	.34	.01	-.63 — .70		
Patient-RN	.29	.39	.06	-.48 — 1.06		
Patient-Regulated Nurse	.01	.32	.00	-.62 — .64		
Staffing & Resource Adequacy	.69	.16	.26***	.38 — 1.00		
Nurse MD Relation	.42	.12	.17*	.18 — .66		
Nursing Leadership	.37	.16	.14*	.04 — .69		
Participation in Hospital Affairs	.05	.17	.02	-.28 — .38		
Nursing Foundation of Care Delivery	.64	.17	.24***	.30 — .98		
Mode of Nursing Care Delivery	-.48	.29	-.08	-1.04 — .09		
Skill Mix	-.39	.28	-.07	-.94 — .17		

Note. $N=416$. β = standardized beta coefficient. $CI (95\%)$ = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 3: $F (18, 294) = 11.07, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Appendix E

Table 21. Hierarchical Regression Analysis Results for Variables Predicting Total Number of Nursing Tasks Left Undone Over the Last Shift

	B	SE B	Beta	CI (95%)	R²	Δ R²
Model 1:					33.8	33.8***
Age	-.04	.32	-.01	-.67 — .60		
Gender	-1.11	.91	-.06	-2.89 — .67		
Education	-.07	.52	-.01	-1.09 — .96		
Nursing Experience	-.19	.31	-.06	-.81 — .42		
Employment Status	.21	.35	.03	-.48 — .89		
Contract	.74	.39	.11	-.03 — 1.52		
Nursing Jobs	-.04	.40	.00	-.83 — .76		
Acuity	.20	.41	.02	-.61 — 1.01		
Dependency	.63	.43	.07	-.21 — 1.47		
Patient-RN	.18	.44	.03	-.70 — 1.05		
Patient-Regulated Nurse	-.04	.40	-.01	-.81 — .74		
Staffing & Resource Adequacy	-1.21	.20	-.38***	-1.61 — -.82		
Nurse MD Relation	-.15	.16	-.05	-.46 — .16		
Nursing Leadership	.20	.21	.06	-.22 — .62		
Participation in Hospital Affairs	-.31	.22	-.10	-.73 — .12		
Nursing Foundation of Care Delivery	-.59	.22	-.18**	-1.03 — -.15		
Model 2:					34.7	0.9*
Age	-.03	.32	-.01	-.66 — .60		
Gender	-1.21	.90	-.07	-2.98 — .57		
Education	-.14	.52	-.02	-1.16 — .88		
Nursing Experience	-.26	.31	-.08	-.88 — .35		
Employment Status	.16	.35	.03	-.52 — .84		
Contract	.75	.39	.11	-.03 — 1.52		
Nursing Jobs	-.05	.40	-.01	-.84 — .74		
Acuity	.17	.41	.02	-.64 — .97		
Dependency	.68	.43	.08	-.15 — 1.52		
Patient-RN	.05	.45	.01	-.83 — .92		
Patient-Regulated Nurse	.03	.39	.01	-.74 — .81		
Staffing & Resource Adequacy	-1.21	.20	-.38***	-1.60 — -.82		
Nurse MD Relation	-.12	.16	-.04	-.43 — .19		
Nursing Leadership	.16	.21	.05	-.26 — .57		
Participation in Hospital Affairs	-.26	.22	-.08	-.68 — .17		
Nursing Foundation of Care Delivery	-.54	.22	-.16*	-.98 — -.10		
Mode of nursing care delivery	.76	.37	.10*	.03 — 1.48		
Model 3:					35.1	0.4
Age	-.05	.32	-.02	-.68 — .58		
Gender	-1.18	.90	-.06	-2.95 — .59		
Education	-.21	.52	-.03	-1.23 — .82		
Nursing Experience	-.24	.31	-.08	-.86 — .37		
Employment Status	.11	.35	.02	-.57 — .80		
Contract	.78	.39	.11*	.01 — 1.55		
Nursing Jobs	-.02	.40	.00	-.81 — .77		
Acuity	.17	.41	.02	-.64 — .97		
Dependency	.63	.43	.07	-.21 — 1.47		

	B	SE B	Beta	CI (95%)	R²	Δ R²
Patient-RN	-.25	.50	-.04	-1.24 — .73		
Patient-Regulated Nurse	.20	.41	.03	-.62 — 1.01		
Staffing & Resource Adequacy	-1.18	.20	-.37***	-1.57 — -.78		
Nurse MD Relation	-.13	.16	-.04	-.45 — .18		
Nursing Leadership	.17	.21	.05	-.25 — .59		
Participation in Hospital Affairs	-.28	.22	-.09	-.70 — .15		
Nursing Foundation of Care Delivery	-.54	.22	-.16*	-.98 — -.10		
Mode of Nursing Care Delivery	.75	.37	.10*	.02 — 1.47		
Skill Mix	.47	.36	.07	-.24 — 1.19		

Note. $N=416$. β = standardized beta coefficient. $CI (95\%)$ = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 3: $F (18, 297) = 8.91, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Appendix F

Table 22. Hierarchical Regression Analysis Results for Variables Predicting Nurse Reports of Patient Adverse Events

	B	SE B	Beta	CI (95%)	R²	Δ R²
Model 1:					16.6	16.6***
Age	-1.23	.74	-.20	-2.69 — .22		
Gender	.16	2.07	.00	-3.91 — 4.22		
Education	-1.47	1.19	-.10	-3.82 — .87		
Nursing Experience	.51	.72	.08	-.90 — 1.92		
Employment Status	.53	.80	.04	-1.05 — 2.11		
Contract	-1.70	.91	-.12	-3.48 — .09		
Nursing Jobs	.91	.93	.06	-.92 — 2.75		
Acuity	.90	.94	.05	-.95 — 2.75		
Dependency	2.00	.99	.11*	.06 — 3.94		
Patient-RN	-.11	1.02	-.01	-2.10 — 1.89		
Patient-Regulated Nurse	1.38	.90	.12	-.40 — 3.15		
Staffing & Resource Adequacy	-.81	.46	-.12	-1.72 — .09		
Nurse MD Relation	.07	.37	.01	-.65 — .79		
Nursing Leadership	-.41	.48	-.06	-1.36 — .54		
Participation in Hospital Affairs	-.09	.49	-.01	-1.07 — .88		
Nursing Foundation of Care Delivery	-1.09	.51	-.16*	-2.10 — .08		
Model 2:					16.7	0.1
Age	-1.23	.74	-.20	-2.69 — .23		
Gender	.12	2.07	.00	-3.96 — 4.19		
Education	-1.50	1.19	-.10	-3.85 — .85		
Nursing Experience	.48	.72	.08	-.95 — 1.90		
Employment Status	.51	.81	.04	-1.08 — 2.09		
Contract	-1.70	.91	-.12	-3.49 — .09		
Nursing Jobs	.91	.93	.06	-.92 — 2.75		
Acuity	.88	.94	.05	-.97 — 2.73		
Dependency	2.02	.99	.11*	.08 — 3.97		
Patient-RN	-.16	1.03	-.01	-2.19 — 1.86		
Patient-Regulated Nurse	1.41	.91	.12	-.38 — 3.19		
Staffing & Resource Adequacy	-.81	.46	-.12	-1.72 — .09		
Nurse MD Relation	.09	.37	.01	-.64 — .81		
Nursing Leadership	-.43	.49	-.07	-1.39 — .53		
Participation in Hospital Affairs	-.07	.50	-.01	-1.05 — .91		
Nursing Foundation of Care Delivery	-1.07	.52	-.16*	-2.08 — -.05		
Mode of Nursing Care Delivery	.34	.85	.02	-1.33 — 2.02		
Model 3:					18.5	1.8*
Age	-1.34	.74	-.22	-2.79 — .11		
Gender	.23	2.05	.01	-3.81 — 4.26		
Education	-1.80	1.19	-.12	-4.14 — .54		
Nursing Experience	.59	.72	.09	-.82 — 2.01		
Employment Status	.30	.80	.02	-1.28 — 1.87		
Contract	-1.56	.90	-.11	-3.34 — .21		
Nursing Jobs	1.04	.93	.06	-.78 — 2.87		
Acuity	.90	.93	.05	-.94 — 2.73		
Dependency	1.77	.99	.10	-.17 — 3.71		

	B	SE B	Beta	CI (95%)	R²	Δ R²
Patient-RN	-1.51	1.15	-.12	-3.77 — .74		
Patient-Regulated Nurse	2.15	.94	.19*	.29 — 4.01		
Staffing & Resource Adequacy	-.67	.46	-.10	-1.58 — .24		
Nurse MD Relation	.04	.36	.01	-.68 — .75		
Nursing Leadership	-.36	.48	-.06	-1.31 — .59		
Participation in Hospital Affairs	-.15	.49	-.02	-1.12 — .82		
Nursing Foundation of Care Delivery	-1.08	.51	-.16*	-2.09 — -.08		
Mode of Nursing Care Delivery	.30	.85	.02	-1.36 — 1.96		
Skill Mix	2.13	.83	.16*	.49 — 3.76		
Model 4:					20.6	2.1**
Age	-1.37	.73	-.22	-2.80 — .06		
Gender	.33	2.03	.01	-3.66 — 4.32		
Education	-1.89	1.18	-.13	-4.21 — .42		
Nursing Experience	.60	.71	.09	-.79 — 2.00		
Employment Status	.38	.79	.03	-1.18 — 1.94		
Contract	-1.64	.89	-.12	-3.39 — .12		
Nursing Jobs	.87	.92	.05	-.93 — 2.67		
Acuity	-.31	1.02	-.02	-2.32 — 1.69		
Dependency	1.74	.97	.10	-.18 — 3.66		
Patient-RN	-1.40	1.13	-.11	-3.63 — .83		
Patient-Regulated Nurse	2.00	.93	.17*	.16 — 3.84		
Staffing & Resource Adequacy	-.56	.46	-.08	-1.45 — .34		
Nurse MD Relation	.16	.36	.02	-.55 — .88		
Nursing Leadership	-.26	.48	-.04	-1.20 — .68		
Participation in Hospital Affairs	-.26	.49	-.04	-1.22 — .70		
Nursing Foundation of Care Delivery	-1.18	.51	-.17*	-2.18 — .18		
Mode of Nursing Care Delivery	-5.04	2.08	-.34*	-9.14 — .95		
Skill Mix	2.09	.82	.16*	.48 — 3.71		
Acuity * Mode of Nursing Care Delivery	6.27	2.24	.39**	1.87 — 10.68		

Note. $N=416$. β = standardized beta coefficient. $CI (95\%)$ = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 4: $F (19, 291) = 3.98, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Appendix G

Table 23. Hierarchical Regression Analysis Results for Variables Predicting Job Satisfaction

	B	SE B	Beta	CI (95%)	R²	Δ R²
Model 1:					34.6	34.6***
Age	.10	.23	.05	-.34 — .55		
Gender	-.64	.63	-.05	-1.88 — .60		
Education	.10	.36	.02	-.61 — .81		
Nursing Experience	.03	.22	.01	-.40 — .46		
Employment Status	-.17	.24	-.04	-.65 — .31		
Contract	-.49	.27	-.10	-1.03 — .04		
Nursing Jobs	.02	.28	.00	-.53 — .57		
Acuity	-.32	.29	-.06	-.88 — .24		
Dependency	.77	.30	.13*	.18 — 1.36		
Patient-RN	.26	.31	.06	-.34 — .87		
Patient-Regulated Nurse	-.31	.27	-.08	-.85 — .23		
Staffing & Resource Adequacy	.57	.14	.26***	.30 — .85		
Nurse MD Relation	.19	.11	.09	-.02 — .41		
Nursing Leadership	.13	.15	.06	-.16 — .42		
Participation in Hospital Affairs	.43	.15	.20**	.14 — .72		
Nursing Foundation of Care Delivery	.36	.15	.16*	.06 — .67		
Model 2:					35.0	0.4
Age	.10	.23	.05	-.34 — .54		
Gender	-.60	.63	-.05	-1.83 — .64		
Education	.13	.36	.03	-.58 — .85		
Nursing Experience	.06	.22	.03	-.37 — .49		
Employment Status	-.15	.24	-.03	-.63 — .33		
Contract	-.50	.27	-.10	-1.03 — .04		
Nursing Jobs	.02	.28	.00	-.53 — .58		
Acuity	-.30	.29	-.05	-.86 — .26		
Dependency	.75	.30	.12*	.16 — 1.34		
Patient-RN	.32	.31	.07	-.29 — .93		
Patient-Regulated Nurse	-.34	.28	-.08	-.88 — .20		
Staffing & Resource Adequacy	.57	.14	.26***	.30 — .85		
Nurse MD Relation	.18	.11	.08	-.03 — .40		
Nursing Leadership	.15	.15	.07	-.14 — .44		
Participation in Hospital Affairs	.41	.15	.19**	.11 — .70		
Nursing Foundation of Care Delivery	.34	.16	.15*	.03 — .64		
Mode of nursing care delivery	-.33	.26	-.06	-.84 — .18		
Model 3:					35.0	0.0
Age	.10	.23	.05	-.34 — .55		
Gender	-.60	.63	-.05	-1.84 — .64		
Education	.14	.37	.03	-.58 — .86		
Nursing Experience	.05	.22	.03	-.38 — .49		
Employment Status	-.14	.24	-.03	-.62 — .34		
Contract	-.50	.27	-.10	-1.04 — .04		
Nursing Jobs	.02	.28	.00	-.53 — .57		
Acuity	-.30	.29	-.05	-.86 — .26		
Dependency	.76	.30	.12*	.16 — 1.35		
Patient-RN	.37	.35	.08	-.32 — 1.06		

	B	SE B	Beta	CI (95%)	R²	Δ R²
Patient-Regulated Nurse	-.37	.29	-.09	-.94 — .20		
Staffing & Resource Adequacy	.57	.14	.25***	.29 — .84		
Nurse MD Relation	.19	.11	.08	-.03 — .40		
Nursing Leadership	.15	.15	.07	-.15 — .44		
Participation in Hospital Affairs	.41	.15	.19**	.12 — .71		
Nursing Foundation of Care Delivery	.34	.16	.15*	.03 — .64		
Mode of nursing care delivery	-.33	.26	-.06	-.84 — .18		
Skill Mix	-.09	.25	-.02	-.59 — .42		

Note. $N=416$. β = standardized beta coefficient. $CI (95\%)$ = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 3: $F (18, 295) = 8.84, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Appendix H

Table 24. Hierarchical Regression Analysis Results for Variables Predicting Nurse Emotional Exhaustion

	B	SE B	Beta	CI (95%)	R²	Δ R²
Model 1:					36.6	36.6***
Age	-3.00	1.35	-.23*	-5.66 — -.34		
Gender	1.32	3.79	.02	-6.13 — 8.77		
Education	-2.91	2.18	-.09	-7.20 — 1.37		
Nursing Experience	.39	1.31	.03	-2.18 — 2.96		
Employment Status	-2.14	1.47	-.08	-5.03 — .74		
Contract	-2.43	1.67	-.08	-5.72 — .85		
Nursing Jobs	.94	1.69	.03	-2.39 — 4.27		
Acuity	1.66	1.72	.05	-1.72 — 5.05		
Dependency	-3.11	1.79	-.08	-6.63 — .41		
Patient-RN	2.04	1.86	.08	-1.62 — 5.69		
Patient: Regulated Nurse	-2.72	1.65	-.11	-5.97 — .53		
Staffing & Resource Adequacy	-5.48	.84	-.40***	-7.13 — -3.82		
Nurse MD Relation	.16	.66	.01	-1.14 — 1.47		
Nursing Leadership	-1.11	.89	-.08	-2.86 — .63		
Participation in Hospital Affairs	-2.50	.90	-.19**	-4.27 — -.73		
Nursing Foundation of Care Delivery	.07	.93	.01	-1.76 — 1.91		
Model 2:					36.6	0.0
Age	-3.00	1.35	-.23*	-5.67 — -.34		
Gender	1.38	3.80	.02	-6.10 — 8.85		
Education	-2.87	2.19	-.09	-7.17 — 1.44		
Nursing Experience	.43	1.32	.03	-2.16 — 3.02		
Employment Status	-2.11	1.47	-.08	-5.01 — .78		
Contract	-2.44	1.67	-.08	-5.72 — .85		
Nursing Jobs	.95	1.69	.03	-2.39 — 4.28		
Acuity	1.69	1.73	.05	-1.71 — 5.08		
Dependency	-3.14	1.79	-.08	-6.67 — .38		
Patient-RN	2.12	1.88	.08	-1.58 — 5.82		
Patient-Regulated Nurse	-2.76	1.66	-.11	-6.03 — .51		
Staffing & Resource Adequacy	-5.48	.84	-.40***	-7.13 — -3.82		
Nurse MD Relation	.15	.67	.01	-1.16 — 1.46		
Nursing Leadership	-1.09	.89	-.08	-2.84 — .67		
Participation in Hospital Affairs	-2.53	.91	-.19**	-4.32 — -.74		
Nursing Foundation of Care Delivery	.04	.94	.00	-1.81 — 1.89		
Mode of Nursing Care Delivery	-.49	1.55	-.02	-3.54 — 2.57		
Model 3:					36.6	0.0
Age	-3.04	1.36	-.23*	-5.71 — -.36		
Gender	1.42	3.80	.02	-6.07 — 8.90		
Education	-2.97	2.20	-.10	-7.29 — 1.36		
Nursing Experience	.47	1.32	.03	-2.13 — 3.06		
Employment Status	-2.19	1.48	-.08	-5.11 — .73		
Contract	-2.38	1.68	-.08	-5.68 — .92		
Nursing Jobs	.99	1.70	.03	-2.35 — 4.34		
Acuity	1.69	1.73	.05	-1.71 — 5.09		
Dependency	-3.22	1.80	-.09	-6.77 — .32		

	B	SE B	Beta	CI (95%)	R²	Δ R²
Patient-RN	1.65	2.12	.06	-2.52 — 5.83		
Patient-Regulated Nurse	-2.51	1.75	-.10	-5.95 — .94		
Staffing & Resource Adequacy	-5.42	.85	-.40***	-7.09 — -3.75		
Nurse MD Relation	.13	.67	.01	-1.19 — 1.45		
Nursing Leadership	-1.06	.90	-.08	-2.83 — .70		
Participation in Hospital Affairs	-2.56	.91	-.19**	-4.35 — -.77		
Nursing Foundation of Care Delivery	.03	.94	.00	-1.82 — 1.88		
Mode of Nursing Care Delivery	-.50	1.56	-.02	-3.56 — 2.56		
Skill Mix	.74	1.54	.03	-2.29 — 3.76		
Model 4:					37.7	1.1*
Age	-2.87	1.35	-.22*	-5.53 — -.21		
Gender	1.97	3.78	.03	-5.48 — 9.41		
Education	-2.36	2.20	-.08	-6.69 — 1.97		
Nursing Experience	.45	1.31	.03	-2.13 — 3.03		
Employment Status	-2.28	1.47	-.09	-5.18 — .62		
Contract	-2.24	1.67	-.07	-5.52 — 1.04		
Nursing Jobs	.46	1.70	.01	-2.89 — 3.81		
Acuity	7.08	2.93	.20*	1.32 — 12.85		
Dependency	-3.23	1.79	-.09	-6.75 — .29		
Patient-RN	1.14	2.12	.04	-3.02 — 5.31		
Patient-Regulated Nurse	-2.01	1.75	-.08	-5.46 — 1.43		
Staffing & Resource Adequacy	-5.46	.84	-.40***	-7.11 — -3.80		
Nurse MD Relation	.27	.67	.02	-1.04 — 1.59		
Nursing Leadership	-1.31	.90	-.10	-3.07 — .45		
Participation in Hospital Affairs	-2.45	.91	-.19**	-4.23 — -.66		
Nursing Foundation of Care Delivery	.03	.93	.00	-1.81 — 1.86		
Mode of Nursing Care Delivery	-.32	1.55	-.01	-3.36 — 2.73		
Skill Mix	7.51	3.35	.27*	.92 — 14.11		
Acuity * Skill Mix	-8.11	3.57	-.31*	-15.14 — -1.08		

Note. $N=416$. β = standardized beta coefficient. $CI (95\%)$ = 95% confidence intervals. Gender (0= male, 1= female), Education (0= diploma, 1= Baccalaureate or Masters), Employment status (0= full-time, 1= part-time or casual), Contract (0= permanent, 1= temporary), Number of nursing jobs (0=one job, 1= more than one job), Acuity (0= not at all acute or somewhat acute, 1= moderately acute or very acute), Dependency (0= very independent or somewhat independent, 1= somewhat dependent or very dependent), Mode of nursing care delivery (0= TPC, 1= TN), Skill mix (0=without LPNs, 1= with LPNs). Model 4: $F (19, 295) = 9.41, p < .001$.

* $p < .05$, ** $p < .01$, *** $p < .00$.