

Evidence to Inform Staff Mix Decision-making: A Focused Literature Review

Prepared for the Canadian Nurses Association

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ACKNOWLEDGEMENTS

We would like to acknowledge Jane Fahey-Walsh and Sean Clarke for their contributions to earlier drafts of this review.

The opinions and interpretations in this publication are those of the authors and do not necessarily reflect those of the Government of Canada.

Funded by the Government of Canada's Foreign Credential Recognition Program.



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March 2012

ISBN 978-1-55119-377-9

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Glossary

Nursing care delivery model is a system for organizing and delivering nursing care to clients and their families and represents both the structural and contextual elements of nursing practice (Fowler, Hardy & Howarth, 2006).

Nursing-sensitive outcomes are those that are “based on nurses’ scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome” (Doran, 2003, vii).

Nurse staffing is the practice of determining and deploying an acceptable quantity and skill mix of personnel required to meet the care needs of patients in a particular health-care setting (Dechant, 2006).

Outcomes are the changes observed in patients’ health conditions that result from the care provided (Donabedian, 1966). Outcomes can include those at the patient, provider and system level, and are measured in order to understand their relationship with different structures and processes of care (Sidani, Doran & Mitchell, 2004).

Staff mix is the combination of different categories of health-care personnel employed for the provision of direct patient care (McGillis Hall, 2005). For the purposes of this report, the term *staff mix* also refers to *skill mix* and *nurse staffing*.

1.0 Executive Summary

For decades, health-care researchers and decision-makers have recognized the role of nurse staffing in delivering safe and appropriate patient care. More recently, in light of nursing shortages (Buchan, 2009), increased patient acuity (Preston, 2009) and amplified economic pressures, many local, regional and national health-care systems are re-evaluating and re-designing staff and skill mix to optimize use of human resources (Mitchell, 2009). However, given the various types of health-care providers, determining a suitable mix of staff skills, qualifications, expertise and experience to maximize patient, nurse and organizational outcomes continues to be a challenging process (Kane, Shamliyan, Mueller, Duval & Wilt, 2007).

In 2004, the Canadian Nurses Association (CNA) undertook a literature search to examine the relationship between patient outcomes and various care providers — including registered nurses, licensed practical nurses, registered psychiatric nurses and unregulated care providers. This synthesis informed the development of the *Evaluation Framework to Determine the Impact of Nursing Staff Mix Decisions* (CNA, Canadian Council for Practical Nurse Regulators, Registered Psychiatric Nurses of Canada & Canadian Practical Nurses Association, 2005). The aim of the evaluation framework was to support decision-makers in determining how effectively they were using their nursing resources.

Since the development of the evaluation framework, a number of new topics and themes have emerged in staffing-outcomes literature. For example, nursing care delivery models are increasingly emphasizing teamwork and interprofessional collaboration. In addition, newer staff mix decision-making tools focus on skill and competency matching, as well as tracking standardized nursing quality indicators to support a business case for investments in nurse staffing. Given these recent trends, this new literature review has been undertaken to guide revisions to the evaluation framework with the goal of supporting evidence-based decision-making regarding nursing staff mix in today's health-care system.

The review found that current research has extended the field of knowledge regarding nursing care delivery models, providing evidence of the need to capture other aspects of care — such as communication and continuity — in studies linking nurse staffing to patient outcomes. This is especially important given that models of care are emerging that emphasize maximizing the effectiveness of health-care worker deployment. Moreover, traditional care delivery models, such as primary nursing and functional nursing, appear to have mixed effects on patient and nurse outcomes, highlighting the importance of considering specific populations and care settings.

In terms of nurse staffing and outcomes, the complexities of measuring staff mix are far more evident in this updated review of the literature. While a substantial amount of study has occurred, researchers continue to use a variety of measures of staffing, including patient-to-nurse ratios, staff mix and nursing hours per patient day (HPPD) — which can take the form of either care delivered by all types of staff (registered nurses, licensed practical nurses and unregulated care providers) or by only licensed staff (registered nurses and licensed practical nurses). What is clear is that no gold standard

for the measurement of nurse staffing exists. This poses a challenge for policy leaders and decision-makers who require sound information to guide them.

This literature synthesis strengthens our understanding of the elements that influence staff mix decision-making, including patient, provider and organizational factors. In addition, it provides further evidence to support the evaluation framework (CNA et al., 2005) that is broadly structured using those three components. While some progress has been made toward the development and implementation of tools and processes to inform staff mix decision-making, substantial gaps in this area remain. In effect, this represents the ‘uptake’ or ‘utilization’ of the research linking nursing staff mix to clinical outcomes.

Overall, the evaluation framework provides one organizing model that settings can use to apply staffing research to practice environments. While researchers continue to produce literature in this field that contains variable findings, the results can be used to broadly inform decisions around nurse staffing. As such, administrators and researchers must continue to measure outcomes in a meaningful and consistent manner to enhance evidence regarding safe and effective nurse staffing practices.

2.0 Introduction

This document reports the findings of a focused literature review undertaken to provide evidence to inform and update the *Evaluation Framework to Determine the Impact of Nursing Staff Mix Decisions* (Canadian Nurses Association [CNA], Canadian Council for Practical Nurse Regulators, Registered Psychiatric Nurses of Canada & Canadian Practical Nurses Association, 2005). The evaluation framework was created to guide and facilitate evidence-based decision-making regarding nursing staff mix. Specifically, it aimed to support health-care decision-makers in making judgments regarding nurse care delivery models, including the appropriate mix and use of registered nurses (RNs), licensed practical nurses (LPNs)¹ and registered psychiatric nurses (RPNs)² in Canada. The role of unregulated care providers (UCPs)³ as members of the care delivery system will also be explored. This literature review is one of the activities undertaken to update the 2005 evaluation framework including focus groups, an on-line survey, an invitational roundtable and a national Delphi survey.

The literature search (CNA, 2004) that was conducted to support the evaluation framework (CNA et al., 2005) provided the foundation for this 2011 review. The earlier synthesis drew on 10 years of research (1994-2004) to examine and describe the relationship between various care providers (RNs, LPNs and, to a lesser extent, UCPs) and patient outcomes. Overall, a substantial body of research was found linking staff mix to nursing-sensitive patient outcomes. In particular, higher levels of regulated nursing staff (including RNs and LPNs) in the acute care setting were linked with improved patient outcomes. However, the findings suggested that further work was needed to gather more comprehensive and reliable data regarding patient, nurse and organizational factors, not only in the acute care setting but also in other environments, such as long-term care and community care. Moreover, the need for additional validation of common tools for determining staff mix, such as patient-classification systems, was identified. Because of the complexities involved when determining the appropriate mix of staff, the review concluded that decision-making should be conducted at the unit level and use an evidence-based approach.

Although the previous review remains relevant in today's context, a number of new topics and themes have emerged in the staffing-outcomes literature in recent years. As such, this current synthesis updates the evidence previously reported, while also expanding on key elements that will inform current staff mix⁴ decision-making.

¹ Licensed practical nurse or LPN is a term used in most of Canada. This category is called registered practical nurse in Ontario and infirmier auxiliaire/infirmière auxiliaire in Quebec. LPN as used in this paper includes these two categories.

² Registered psychiatric nurses or RPNs are regulated in Canada's four western provinces — Manitoba, Saskatchewan, Alberta and British Columbia — as well as in the Yukon. RPN as used in this paper describes this category of nurse.

³ Unregulated care provider or UCP is used to describe paid health-care providers who are not registered with a regulatory body. It should be noted that UCPs are known by many other titles and include, but are not limited to: health-care aides; resident aides and home support workers.

⁴ For the purposes of this paper, staff mix also refers to skill mix and nurse staffing. For more information, please refer to the glossary.

3.0 Methodology and Limitations

An electronic search was conducted to identify appropriate literature. Given that the 2004 literature review captured key research up until 2003, this search was limited to English language manuscripts published between 2004 and 2011. Computer database searches included the Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE and the Cochrane Library using various permutations of the following subject headings and keywords:

- nurses
- skill mix
- RN mix
- staffing models
- care delivery models
- outcomes/outcomes assessment (health care)
- quality indicators (health care)
- patient safety
- patient satisfaction
- job satisfaction

A total of 526 articles were retrieved in CINAHL and 208 in MEDLINE. Titles and abstracts were reviewed for relevancy, resulting in a total of 126 articles from the databases. Two recent and pertinent Cochrane reviews were also included (Butler et al., 2011; Hodgkinson, Haesler, Nay, O'Donnell & McAuliffe, 2011). Google and Google Scholar databases were searched to obtain related reports, policy documents and organizational publications (e.g., from professional and regulatory bodies) that were not captured in the primary search strategy. Moreover, systematic reviews and meta-analyses identified during the exploration were screened to identify further articles for inclusion. During the literature review, levels of evidence were considered. However, to capture a broad base of literature and in light of the significant variation in the design and methodology of the research studies, articles were not categorized based on their design quality or level of evidence. As such, this review includes a variety of studies representing the continuum of evidence. Seminal articles, studies suggested by experts in the field and methodologically sound systematic reviews and meta-analyses were also retrieved and reviewed.

We acknowledge several limitations to this review. It only includes studies published in English and does not include studies from other countries where there may be different health-care and/or education systems. It does not include advanced nursing practice studies as part of the nursing staff mix and nursing care delivery models. Moreover, it is constrained by the scarcity of empirical research on LPNs, and even more so, RPNs, including their contributions to patient care and research-validated impact and outcomes.

4.0 Context

There is a recognition that nursing shortages (Buchan, 2009), increased patient acuity and complexity (Preston, 2009), along with amplified economic pressures, have prompted many local, regional and national health-care systems to re-evaluate and redesign staff and skill mix (Mitchell, 2009). More specifically, the use of task shifting — that is, “a process whereby specific tasks are moved, where appropriate, to health workers with shorter training and fewer qualifications” (World Health Organization [WHO], 2008, p. 7) — is being employed to address widespread health human and financial resource shortages. In addition, recent North American studies and reports have emphasized the need to improve patient safety (Baker et al., 2004; Berwick, 2002) as it relates to staffing (Kohn, Corrigan & Donaldson, 2000), highlighting the critical relationship between nursing work characteristics and the delivery of quality care (Clarke & Donaldson, 2008; Ellis, Priest, MacPhee & Sanchez McCutcheon, 2006; Hickam et al., 2003; Page, 2004). In light of these demands, organizations, such as the International Council of Nurses (ICN), recognize that “a common challenge facing HR [Human Resources] managers is determining the most effective mix of staff and skills needed to deliver quality and cost-effective patient care” (ICN, 2006a, p. 10).

In Canada, three categories of regulated professional nurses are responsible for the delivery of safe and appropriate nursing care: RNs, LPNs and RPNs. As of 2009, there were 348,499 regulated nurses working in Canada of whom 76.4% were RNs, 22.1% LPNs and 1.5% were RPNs (Canadian Institute for Health Information [CIHI], 2010). Each group of nurses functions within its defined scope of practice and meets the standards of practice of its respective regulatory body whose mandate is to protect the public. With additional training, RNs may also function in advanced roles, such as nurse practitioners and clinical nurse specialists, that promote excellence in nursing clinical practice, education, research and leadership (CNA, 2008a; 2009a; 2009b). Although they are not licensed, UCPs are increasingly being employed to provide direct patient care. Despite the increased interest in this group of providers, there is limited and inconsistent information regarding the number and type of UCPs in Canada (CIHI, 2008).

Given the various types of health-care providers, determining a suitable mix of staff skills, qualifications, expertise and experience to maximize patient, nurse and organizational outcomes is challenging (Kane, Shamliyan, Mueller, Duval & Wilt, 2007). Historically, research regarding staffing has calculated nursing mix and levels — that is, the number of RNs, LPNs (and, occasionally, UCPs) who provide care to a population of patients, expressed in measures such as patient-to-nurse ratios, care hours per patient day (HPPD) — which can take the form of either care delivered by all types of staff (RNs, LPNs and UCPs) or by only licensed staff (RNs and LPNs) — and total nursing hours (Spetz, Donaldson, Aydin & Brown, 2008). However, there is increasing recognition that patient outcomes are not simply dependent on staffing numbers, but also on nursing care processes including nursing assessments and interventions (Lucero, 2008). As well, care delivery models (e.g., team or total patient care nursing) have been explored, given that they

represent the mechanism for arranging and delivering units of care (LeClerc, Doyon, Gravelle, Hall & Roussel, 2008; Neisner & Raymond, 2002).

Although there is an abundance of approaches to measuring and understanding staff mix, such as quantifying nursing workload and comparing different blends of staff, Dubois and Singh (2009) emphasized that the overarching goal of decision-making should be to achieve optimal patient care. With that goal in mind, this literature review discusses the different structures, processes and tools that the literature findings associated with patient, nurse and organizational outcomes.

5.0 Nursing Care Delivery Models

5.1 Traditional Care Delivery Models

Historically, four classic models have been used to organize the delivery of nursing care: patient allocation or total patient care; functional or task-oriented nursing; team nursing; and primary nursing (Duffield, Roche, Diers, Catling-Paull & Blay, 2010). Each model varies in work allocation, accountability and communication patterns, and informs a different staff mix (Fairbrother, Jones & Rivas, 2010). There is no consensus in the literature that one particular model is most prevalent, suggesting that the use of nursing care delivery models is subject to local (unit and organization) circumstances. However, some studies have proposed that the level and type of staff, as well as work environment characteristics, might influence which particular models are used and subsequent quality of care (Duffield et al., 2010; McGillis Hall & Doran, 2004). For example, a recent Australian study of clinical nurse specialists, RNs, LPNs and nursing aides found that staff mix, experience and workload had an effect on the model of care in use (Duffield et al., 2010). As well, wards with a greater proportion of RNs were more likely to employ a patient allocation model, while floors with varying types of health-care personnel were more likely to practise team nursing (Duffield et al., 2010).

Overall, evaluation of traditional models of care is weak, with most literature confined to anecdotal reports. Several authors have explored the benefits and drawbacks of these well-established models and have summarized their effect on different outcomes, such as patient satisfaction and cost (Fowler, Hardy & Howarth, 2006; Neisner & Raymond, 2002; Tiedeman & Lookinland, 2004). However, empirical evidence linking care delivery models and quality of nursing care remains sparse (LeClerc et al., 2008; McGillis Hall & Doran, 2004; Zimmerman, 2007), particularly as it relates to the incorporation of UCPs (Tiedeman & Lookinland, 2004). As well, some suggest that patient outcomes are related less to specific models, but rather through the promotion and preservation of other elements, including team communication and continuity of care (Tiedeman & Lookinland, 2004). Therefore, the evaluation of care delivery models must include considerations not only of the type and arrangement of staff, but also factors influencing the way in which team members interact.

The first and oldest model, patient allocation or total patient care, refers to one nurse assuming responsibility for the full care of a group of patients over the course of a shift (Duffield et al., 2010). Arguably dating back to the time of Florence Nightingale (Meehan, 2003), this model has been popular because of its consistent use of qualified staff (Wagner & Bear, 2009). It has also been described as an efficient delivery model because it minimizes the need for communication and organization between staff (Tiedeman & Lookinland, 2004). As well, a recent study of nurses' perceptions of hospital work environments found that, compared with other models of nursing care delivery, total patient care was associated with lower job pressure (McGillis Hall & Doran, 2007). But, an earlier study by McGillis Hall and Doran (2004) suggests that nurses do not view total patient care as an effective mechanism for attaining quality and improved communication. As well, this

model has been criticized for not assuring continuity of care throughout the patient's stay, as well as for creating an environment where there is limited opportunity to teach and support new staff (Tran, Johnson, Fernandez & Jones, 2010).

Functional nursing, sometimes known as task-oriented nursing, came about during the expansion of hospital systems in the 1940s to support the introduction of less-skilled ancillary staff to deal with staffing shortages (Fairbrother et al., 2010). Here, the focus is on dividing specific tasks among a variety of health-care staff based on their level of knowledge and complexity of the assignment (Tiedeman & Lookinland, 2004). It relies heavily on procedures, protocols and regulation and is typically equated with production-line techniques and cost-effectiveness. Not surprisingly, opponents argue that this model of care contributes to fragmentation, lower quality of care and poor patient satisfaction (Duffield et al., 2010)

In response to the impersonal nature of the functional model, team nursing appeared in the 1950s. Similar to functional nursing, team nursing focuses largely on the use and integration of various staff and skill mixes, including RNs, LPNs and UCPs (Neisner & Raymond, 2002). Team members assume care responsibilities based on their individual scopes of practice and providers work collaboratively, with a team leader overseeing activities of the group. Thus, this model allows for care to be delivered by a smaller number of RNs and has the potential to maximize the use of each member's skills (Tran et al., 2010). Even so, evidence regarding team nursing and cost, quality of care and patient satisfaction is conflicting — with some citing higher costs and disjointed care provided by less-skilled workers, and other praising it for its cost-saving, efficient use of all staff (Tiedeman & Lookinland, 2004). Yet, recent evidence has suggested that team-based care may offset the burden of heavy workloads (Sexton et al., 2006) and improve nurses' job satisfaction (Fairbrother et al., 2010).

Finally, primary nursing is quite similar to the total patient care model in that one RN is responsible for a patient's care throughout their entire stay (Fowler et al., 2006). However, where these models differ is in terms of continuity of care as nurses in a primary model assume ongoing, 24-hour responsibility for coordinating a patient's care. As well, this model has been described as providing the nurse with full autonomy to plan a patient's care, both during the patient's stay, and for subsequent visits (Lyon, 1993). Primary nursing was originally developed in the late 1960s/early 1970s in response to changes in nursing academic preparation (Fairbrother et al., 2010) and, more recently, has been indirectly linked to positive patient outcomes, given the model's increased use in Magnet-designated hospitals in the United States (Aiken, Sloane, Lake, Sochalski & Weber, 1999). Moreover, a recent review of literature regarding models of care and patient outcomes in nursing home settings recommended consistent patient assignment as routine practice (Rahman, Straker & Manning, 2009). However, research regarding the relationship between primary nursing and quality of care remains inconclusive and skeptics contend that this model is neither efficient nor cost-effective (Neisner & Raymond, 2002).

5.2 New and Emerging Trends in Care Delivery Models

Due to recent economic and human resource pressures, organizations are now looking for innovative ways of organizing work and defining care delivery models (Chiarella, 2007). Reports at the national (Commission on the Future of Health Care in Canada, 2002) and international (WHO, 2006) levels suggest that health-care providers are not being effectively employed, highlighting the need to enable them to practise to their full scope. Therefore, care delivery approaches such as task-shifting (WHO, 2008), job redesign (White et al., 2009) and other substitutive and complementary staff models (originally described in McGillis Hall, 1997) are being implemented (Sibbald, Shen & McBride, 2004).

With the move toward maximizing health-care worker deployment, authors are increasingly describing the role of assistive personnel in care delivery teams. For example, in an integrative review regarding non-traditional models of care, rather than organizing their search around specific new nursing models, Lookinland, Tiedeman and Crosson (2005) chose to categorize models based on their skill mix of regulated and non-regulated staff. These models included: partnered (where UCPs are partnered with a licensed nurse); non-partnered (where UCPs provide direct patient care but are not assigned to specific licensed staff members); and integrated models (where UCPs provide support to regulated workers through direct care, as well as non-clinical activities). Thus, this study highlights the move toward greater inclusion of UCPs in the health-care workforce.

Research also shows a trend toward the use of flexible, collaborative frameworks and more ‘blended’ models of care — whereby various elements of traditional nursing care models are combined with current paradigms based on patient-centred care (Batcheller, Burkman, Armstrong, Chappell & Carelock, 2004; Fowler et al., 2006; Jost, Bonnell, Chacko & Parkinson, 2010). Moreover, newer models in the literature focus on smoothing patient transitions (Skillings & McLeod, 2009; Vlasses & Smeltzer, 2007), improving patient partnerships (Wiggins, 2008), facilitating intra- and interprofessional collaboration (LeClerc et al., 2008), leveraging technology (Kimball, Joynt, Chemer & O’Neil, 2007) and creating roles that allow for experienced and advanced practice nurses to assume clinical leadership roles to support newer staff (Burrirt, Wallace, Steckel & Hunter, 2007; Smith & Dabbs, 2007; Smith, Manfredi, Hagos, Drummond-Huth & Moore, 2006; Venturato & Drew, 2010). In Canada, a Nova Scotia initiative has suggested there is value in using collaborative models of care to positively influence patient and nurse outcomes (Tomblin Murphy, Alder, Mackenzie & Rigby, 2010).

Overall, although most models described in the literature demonstrated improved outcomes for nurses (Allen & Vitale-Nolen, 2005) and patients (Burrirt et al., 2007; LeClerc et al., 2008; Smith & Dabbs, 2007), these reports are largely simply descriptive and do not include rigorous quantitative comparisons. Despite the lack of methodological rigour, many other authors note that integrated models facilitated a paradigm shift from an individual to team mindset (Venturato & Drew, 2010). This shift is important to consider, given that nurses increasingly work in health-care teams of regulated and unregulated care providers.

6.0 Staff Mix Design and Outcomes

Over the past two decades, researchers have been studying the relationship between nurse staffing and patient, personnel and organizational outcomes. However, after the Institute of Medicine (IOM) concluded (Wunderlich, Sloan & Davis, 1996) that evidence remained scant, there has been substantial growth in the field of staffing-outcomes research (Clarke & Donaldson, 2008). The identification and development of nursing-sensitive outcomes — that is, “processes and outcomes that are affected, provided, and/or influenced by nursing personnel” (Page, 2004) — has progressively gained widespread attention in an attempt to demonstrate the role of nursing in affecting patient safety and quality of care. Seminal articles emerged in the late 1990s and early 2000s, providing preliminary evidence regarding nursing staffing characteristics and improved outcomes (Aiken, Clarke, Sloane, Sochalski & Silber, 2002; Blegen, Goode & Reed, 1998; Lichtig, Knauf & Milholland, 1999; McGillis Hall et al., 2003; McGillis Hall et al., 2001; Needleman, Buerhaus, Mattke, Stewart & Zelevinsky, 2002; Sochalski, Aiken & Fagin, 1997; Tourangeau, Giovannetti, Tu & Wood, 2002).

Measurement of the relationship between nurse staffing and outcomes has evolved over time to include a broad range of indicators; however, more recent evidence specifically uses nursing-sensitive measures that represent the structure (e.g., supply and skill level of staff), process (e.g., nursing interventions) and outcome (e.g., patient mortality) data elements, as per Donabedian’s (1966) structure-process-outcome framework (Doran, Mildon & Clarke, 2011). Measurement of nurse staffing has typically considered both quantity and qualifications, with common evaluations including HPPD, patient-to-nurse ratios, use of contract staff and skill mix distinctions among RNs, LPNs and UCPs, including levels of education and expertise (Spetz et al., 2008). Clinical and safety outcomes have typically been conceptualized in negative terms and include, but are not limited to: mortality, failure-to-rescue, length of stay (LOS) and functional status, as well as rates of medication errors, falls, pressure ulcers, urinary tract infections (UTIs), pneumonia and post-operative wound infections (Butler et al., 2011; McGillis Hall, Doran & Pink, 2004). However, international experts agree that positive outcomes that reflect the intended effects of nursing care should be employed more frequently in outcomes research (McGillis Hall et al., 2003; Van den Heede, Clarke, Sermeus, Vleugels & Aiken, 2007).

Although various efforts are underway to produce evidence linking nursing staffing to outcomes, the specific quantity and mix of staff required to optimize quality of patient care remains elusive. Some have argued that this is a result of past research focusing primarily on structural variables (e.g., number and type of nurses), rather than equally important elements, such as nursing processes (Mark, 2002). For example, Sidani, Doran and Mitchell (2004) have further described nursing processes⁵ at the individual patient and functional nursing levels, including more broad considerations of how nurses’ detection, monitoring and coordination abilities may affect patient care. As well, critics of staffing-outcomes research contend that many of the large, well-known studies use data at the

⁵ Process has been defined as “a series of operations or actions conducing to an end... [including] the actual interpersonal and technical care, as well as actions, operations and relationships that produce that care” (Kramer & Schmalenberg, 2005).

hospital, rather than the unit level (Clarke & Donaldson, 2008). This is important to note, given that the relationship between nurse staffing and outcomes has been shown to vary significantly in different units (Hart & Davis, 2011; Sales et al., 2008). In addition, it has been argued that the relationships being measured in staffing-outcomes research are not always linear, which reduces the effectiveness of the traditional statistical methods used in this field (Lankshear, Sheldon & Maynard, 2005; Mark, Harless, McCue & Xu, 2004; Zhang, Unruh, Liu & Wan, 2006). The field of staffing-outcomes research continues to evolve.

6.1 Staffing for Licensed Nurses in Hospitals (RNs and LPNs)

As with the 2004 literature review (CNA, 2004), substantive evidence was found related to staffing in acute care settings. In particular, a recent meta-analysis concluded that there is a strong association between increased nurse staffing (including both RNs and LPNs) in hospitals and improved patient outcomes, particularly in intensive care units (ICUs) and with surgical patients (Kane et al., 2007). As well, a number of reviews have emerged, supporting the association between a richer skill mix — that is, higher levels of RN staff — and better patient outcomes (Lang, Hodge, Olson, Romano & Kravitz, 2004; Lankshear et al., 2005; Unruh, 2008). Although the bulk of evidence hails from the United States (Aiken, Clarke & Sloane, 2002; Blegen, Goode, Spetz, Vaughn & Park, 2011) similar findings have been reported in other countries, including Canada (Estabrooks, Midodzi, Cummings, Ricker & Giovannetti, 2005; McGillis Hall et al., 2003; Tourangeau et al., 2002; Tourangeau, Doran, et al., 2006), England (Rafferty et al., 2007), New Zealand (McCloskey & Diers, 2005) and Belgium (Van den Heede et al., 2008).

Despite these positive findings, conclusions from literature reviews regarding the relationship between staff mix and outcomes sometimes differ, particularly as it relates to *specific* nurse staffing arrangements, such as mandatory patient-to-nurse ratios (Lang et al., 2004) and certain individual patient, nurse and organizational outcomes. For example, the relationship between hospital nurse staffing and patient falls (Bolton, Donaldson, Rutledge, Bennett & Brown, 2007; Donaldson, Burnes Bolton, et al., 2005; Lake & Cheung, 2006;), as well as pressure ulcers (Bolton et al., 2007; Lake & Cheung, 2006) remains conflicted, while Tourangeau, Cranley and Jeffs (2006) noted that evidence regarding nurse staffing and patient mortality is incomplete and inconsistent. As well, a recent Cochrane review regarding hospital staffing models and outcomes found no relationship between the two, stating that the quality of evidence was too limited (Butler et al., 2011).

Discrepancies between reviews are likely due to varying inclusion-exclusion criteria, as well as methodological differences within the research. Mark (2006) highlights the methodological challenges that exist with nurse staffing research including the use of theoretical approaches, inability to demonstrate causal relationships, the need to use good-quality reliable databases that can be risk adjusted, and the tendency toward descriptive rather than more complex research methodologies in study designs. Similarly, others have identified study design, measurement of variables, sampling techniques, level of analysis and consideration of confounding factors analysis as a concern (Clarke &

Donaldson, 2008). For example, some studies include risk adjustment, such as measuring “present on admission”⁶ data, while others do not (Mark & Harless, 2010). Moreover, Jiang, Stocks and Wong (2006) found significant variation among major U.S.-based administrative databases, suggesting the need for greater consistency in variable definitions and data collection methods. Thus, although many reviews may report positive findings, it is important to consider differences in methodology across the studies reviewed.

6.1a Patient-to-Nurse Ratios

The impact of mandated patient-to-nurse ratios as a policy strategy continues to be a contentious topic. In particular, following the first ever legislation of minimum patient-to-nurse staffing requirements in acute care hospitals, the California case study generated a flurry of discussion and research regarding the use of mandated ratios (Aiken et al., 2010; Spetz, 2004). Not surprisingly, research has shown that the California legislation resulted in increased RN hours and percentage of RN care (Bolton et al., 2007); however, its efficacy on nurse, patient and organizational outcomes is mixed (Keepnews, 2007). Some have cited improved rates of nurse satisfaction (Spetz, 2008) and patient mortality (Aiken et al., 2010), while others have found no statistically significant relationship between lower nurse-to-patient ratios and improved nurse (Cox, Anderson, Teasley, Sexton & Carroll, 2005) and patient outcomes (Bolton et al., 2007; Donaldson, Burnes Bolton, et al., 2005; Donaldson & Shapiro, 2010). Moreover, Aiken and colleagues (2010) found that although an increased number of licensed personnel resulted in a subsequent decrease in the use of UCPs, there was also a significant rise in the use of agency nurses.

After the California legislation, other countries have either considered or begun to develop similar mandated ratios. For example, in Victoria, Australia, as an alternative to following California’s legislative route, ratios were implemented as part of the union’s bargaining objective (Buchan, 2005; Gordon, Buchanan & Bretherton, 2008). However, rather than using an individual patient-to-nurse ratio approach, Victoria chose to employ a 5:20 model, with five nurses for every 20 patients. Gerdtz and Nelson (2007) maintain that this approach permits a greater degree of flexibility, where workload can be tailored to a unit based on daily patient acuity and demands.

While researchers continue to question how to define, measure and implement ‘minimum’ nurse staffing levels, preliminary work has shown that higher ratios of patients to nurses have been linked with a higher likelihood of 30-day mortality (Kutney-Lee & Aiken, 2008), increased failure-to-rescue (Kutney-Lee & Aiken, 2008) and greater risk of nosocomial infections (Hugonnet, Villaveces & Pittet, 2007). Moreover, in a study of 168 Pennsylvania hospitals, Aiken, Clarke, Sloane and colleagues (2002) concluded that the risk of death following common surgical procedures was 30 per cent higher in hospitals where nurses’ mean workload was eight patients or more, compared with hospitals where nurses cared for no more than four patients. Also, Cox and colleagues (2005)

⁶ Present on admission is a patient indicator specifying whether a particular diagnosis was present when the patient was originally admitted to the hospital (Mark & Harless, 2010).

report survey findings suggesting that nurse perceptions and job satisfaction are most positive in U.S. states that have adopted minimum staffing regulations and that mandated minimum staffing levels stimulates dialogue between staff nurses and nursing leaders. Despite these encouraging findings, Dubois and Singh (2009) and Newbold (2008) suggest that there continues to be a dearth of good evidence to support specific ratios.

6.1b Total Hours of Nursing Care per Day (HPPD)

Another common measure of staffing levels is HPPD, which can take the form of care delivered by all types of staff (RNs, LPNs and UCPs) or by licensed staff (only RNs and LPNs). Overall, the literature demonstrates that higher hours of care delivered by all types of personnel was associated with lower rates of 30-day mortality (Tourangeau, Doran, et al., 2006), falls (Dunton, Gajewski, Klaus & Pierson, 2007; Dunton, Gajewski, Taunton & Moore, 2004; Patrician et al., 2011), pressure ulcers (Dunton et al., 2007) and failure-to-rescue, as well as decreased LOS (Blegen et al., 2011; Needleman et al., 2002; Rothberg, Abraham, Lindenauer & Rose, 2005; Tschannen & Kalisch, 2008) and improved patient satisfaction (Seago, Williamson & Atwood, 2006). Moreover, total hours of licensed nurse staff has also been associated with improved outcomes, including decreased LOS (Frith et al., 2010) and lower use of restraints (Hart & Davis, 2011). Similarly, McGillis Hall and colleagues (2004) found that units using a lower proportion of licensed nurses experienced higher rates of medication errors and wound infections. However, some studies have not found a relationship between increased total nursing hours and mortality (Hickey, Gauvreau, Connor, Sporing & Jenkins, 2010), or other patient outcomes, such as pressure ulcers, cardiac arrest or hospital-acquired pneumonia (Van den Heede et al., 2009).

6.1c Staff Mix

In nursing, staff mix refers to the combination of RNs, RPNs, LPNs and UCPs, and their corresponding qualifications and experience (Newbold, 2008). Staff mix is frequently used interchangeably with skill mix (O'Brien-Pallas, Duffield, Tomblin Murphy, Birch & Meyer, 2005) and is inherently entwined with the study of staffing levels (Ayre, Gerdtz, Parker & Nelson, 2007). Although staff mix is typically measured in terms of hours and percentages of different types of personnel, it has also been conceptualized in terms of education (e.g., baccalaureate preparation) and years of work experience. However, research measuring nurse experience may track total working years, rather than years employed in the particular environment (Rischbieth, 2006). This is important to note, given that nurses may be viewed as an expert in one setting and a novice in another. Given the many possible combinations of staff mix, it is clear that managing human resources in health care requires careful consideration of multiple factors (Dubois & Singh, 2009).

The largest body of staffing research relates to 'richer' staff mix—in other words, a higher proportion of RN staffing. Increased proportions of RNs at the unit and hospital levels has been associated with a

decrease in mortality (Sales et al., 2008; Tourangeau, Doran, et al., 2006), as well as with lower rates of failure to rescue (Blegen et al., 2011; Lang et al., 2004), falls (Patrician et al., 2011), medical adverse events (Patrician et al., 2011), lower unplanned emergency department visits (Bobay, Yakusheva & Weiss, 2011), and improved patient satisfaction (Seago, Williamson & Atwood, 2006; Tervo-Heikkinen, Kvist, Partanen, Vehviläinen-Julkunen & Aalto, 2008). Moreover, McCloskey and Diers (2005) found a progressive and substantial increase in rates of pressure ulcers, sepsis, UTIs, physiological and metabolic derangement, pulmonary failure, and wound infections, following a decrease in RN hours. Nevertheless, some studies have not found statistically significant relationships between RN staffing and outcomes (Cho, Ketefian, Barkauskas & Smith, 2003; Mark & Harless, 2010).

Evidence regarding LPNs remains limited and mixed (Needleman et al., 2002; Person et al., 2004; Unruh, 2000), given that few analyses have isolated LPNs as an individual group. Rather, LPNs tend to be studied as part of the ‘licensed nurse’ (RNs and LPNs) category (Kane et al., 2007).

Accordingly, there is no specific evidence regarding the relationship between LPN utilization in hospitals and specific outcomes (Clarke & Donaldson, 2008). However, in a discussion regarding the role of LPNs in the future of care delivery, Seago, Spetz, Chapman and Dyer (2006) suggest that hospitals may benefit from employing more LPNs, but that states first need to assess whether easing practice restrictions for LPNs would negatively affect patient care.

Along with staffing proportions of different care personnel, there is a growing body of evidence suggesting that levels of education and experience may have an impact on patient outcomes. For example, higher proportions of baccalaureate-prepared nurses have been linked with lower rates of 30-day mortality (Aiken, Clarke, Cheung, Sloane & Silber, 2003; Estabrooks et al., 2005; Tourangeau, Doran, et al., 2006). As well, a study in home care reported that patients cared for by degree-prepared nurses showed improved knowledge and behaviour scores, as compared with patients cared for by diploma-prepared RNs (O’Brien-Pallas et al., 2002). Aside from education level, higher years of work experience have been linked to improved patient satisfaction indicators (Tervo-Heikkinen et al., 2008), while increased proportions of less-experienced nursing staff was related to a higher incidence of wound infections (McGillis Hall et al., 2004). However, some studies report no relationship between higher educational preparation and patient outcomes (Kutney-Lee & Aiken, 2008; Sales et al., 2008; Van den Heede et al., 2009), while other authors have suggested that the evidence is still too limited to make firm conclusions (Kane et al., 2007; Ridley, 2008).

6.1d Overtime and Contract Hours

Not only can staff levels and staff mix affect outcomes, but select evidence confirms that other attributes of nursing, including use of overtime and contract/agency hours, may impact care. For example, Meyer, Wang, Thomson and O’Brien-Pallas (2009) evaluated a patient care delivery model in two Canadian provinces and found that as nurses worked more overtime hours, patient health was less likely to improve. As well, overtime has also been shown to negatively affect patient mortality (Berney, 2003; Berney & Needleman, 2006; Stratton, 2005), rates of pressure ulcers (Stone et al.,

2007), nosocomial infections (Berney & Needleman, 2006) and medication errors (Rogers, Hwang, Scott, Aiken & Dinges, 2004). Additionally, the use of supplemental staff and nonpermanent staff has been shown to have a significant negative effect on outcomes (Cho, 2002; Cimiotti, 2004; Estabrooks et al., 2005; Hart & Davis, 2011; Newhouse, Johantgen, Pronovost & Johnson, 2005). Conversely, contract staff may, in some cases, have a positive impact on patient outcomes through increasing total nursing staff and nursing hours (Aiken, Xue, Clarke & Sloane, 2007; Newhouse et al., 2005). In addition to overtime and contract hours, a large meta-analysis in Kane and colleagues (2007) suggested that other factors, including shift rotations, full-time versus part-time mix and the utilization of internationally educated nurses also influence outcomes; however, literature is sparse and lacks empirical rigour.

6.2 Staffing Levels in Long-Term Care Settings

Long-term care facilities have received much less attention in staffing-outcomes research, compared with hospitals. Preliminary evidence suggests that there is a relationship between staffing levels in aged care settings and quality of resident care (Castle, 2008; Kotnetzka, Stearns & Park, 2008; Weech-Maldonado, Meret-Hanke, Neff & Mor, 2004; Zhang & Grabowski, 2004). However, a recent Cochrane review regarding the effectiveness of staffing models in long-term care settings concluded that additional methodologically sound studies are necessary before any conclusions can be drawn (Hodgkinson et al., 2011). Moreover, Meyer and Sturdy (2004) recommend caution in the use of traditional approaches to outcomes design, since evaluation of gerontological outcomes is fraught with methodological problems (e.g., risk adjustment).

As with the acute care setting, trials for minimum staffing levels for nursing homes have been done in certain U.S. states (Harrington, 2005). In particular, it has been shown in Florida that total nursing hours per resident increased following the introduction of nurse ratio legislation (Hyer, Temple & Johnson, 2009). Yet, some have shown that these higher total nursing hours were achieved through increases in non-regulated staff and evidence regarding its effect on patient outcomes remains inconclusive (Park & Stearns, 2009).

Regardless, increasing RN levels has been specifically linked with improved quality of care (Castle & Engberg, 2007; Kim, Harrington & Greene, 2009) and better cognitive functioning (Weech-Maldonado et al., 2004), as well as fewer pressure ulcers (Horn, Buerhaus, Bergstrom & Smout, 2005; Kotnetzka et al., 2008; Weech-Maldonado et al., 2004), UTIs (Horn et al., 2005; Konetzka et al., 2008) and reduced hospitalizations (Decker, 2008; Intrator, Zinn & Mor, 2004). As well, long-term care facilities with higher numbers of total nurses are more likely to report higher patient satisfaction (Hurst, 2007), suggesting that richer skill mix is more important than staff size when attempting to improve patient outcomes (Decker, 2008; Intrator & Mor, 2004). Conversely, research regarding the utilization of LPNs and UCPs and associated outcomes in settings that focus on care of the aged remains insufficient to drive policy recommendations (Castle & Engberg, 2007; Horn et al., 2005).

Finally, other nursing characteristics have been associated with improved resident outcomes. For example, lower use of agency nurses (Castle & Engberg, 2007), as well smaller facility size (Rantz et al., 2004) may improve quality of care. Moreover, staffing stability and changes in staffing patterns, such as decreases in staff or change in mix, have been shown to affect patient outcomes (Castle & Engberg, 2007; Duffield, Roche, O'Brien-Pallas & Catling-Paull, 2009; Hickey et al., 2005).

6.3 Staffing Levels in Other Settings

Staffing-outcomes literature in settings other than hospitals and long-term care remains sparse. A very limited number of studies have described staffing characteristics in primary care (Hurst, 2006), home care (O'Brien-Pallas et al., 2001; O'Brien-Pallas et al., 2002), rehabilitation (Nelson et al., 2007) and community mental health (Halsteinli, Karterud & Pedersen, 2008). As a result, there is insufficient evidence for developing a discussion of the impact of nurse staffing on outcomes in these other settings.

6.4 Economic Considerations

Increasingly, health-care systems are focusing on enhanced efficiency and effectiveness to improve quality (Aiken, 2008). In response to this demand, nursing administrators and academics have begun to measure the economic value of staffing levels, while also creating the business case for utilization of nursing resources (Dall, Chen, Furst Seifert, Maddox & Hogan, 2009; Needleman, 2008; Needleman, Buerhaus, Stewart, Zelevinsky & Mattke, 2006). Studies have now emerged demonstrating that higher RN staffing levels have the potential to reduce hospital costs through improved patient outcomes, such as decreased rates of pressure ulcers, UTIs and LOS (Dorr, Horn & Smout, 2005; Thungjaroenkul, Cummings & Embleton, 2007; Titler et al., 2007). This has also been true in earlier literature, where richer staffing was found to be either cost neutral or cost saving (Lang et al., 2004). However, Park and Stearns (2009) argue that Florida's move to mandated patient-to-nurse ratios in long-term care settings was costly, given that legislation resulted in higher demand for workers and thus, increases in staff wages. Although most of these economic evaluations have been conducted in the United States, where nursing education, entry-to-practice requirements and regulatory and health system structures differ from Canadian standards, Aiken (2008) maintained that her findings and limitations are nonetheless useful for consideration in other geographical contexts.

In a recent discussion regarding economic considerations for nurse staffing and outcomes, Needleman (2008) advocated for cost-benefit analyses to be viewed from three angles: the business case (analyzing value from the perspective of the payer); the economic case (considering costs and returns to those involved); and the social case (including consideration of larger social gains/losses). As such, studies examining the fiscal relationship between nursing and outcomes have generated a wide range of conclusions, depending on the paradigms being employed (Unruh, 2008). For example, Shamliyan, Kane, Mueller, Duval and Wilt (2009) re-analyzed data from Kane and colleagues (2007) and

concluded that, although increasing nurse staffing in ICUs and medical-surgical wards could provide public savings from avoided patient deaths and adverse events, that, ultimately, the evidence did not support a business case for hospitals because there was not sufficient monetary gain. Moreover, Needleman (2008) cautioned that although it's possible to determine a cost-effective means for achieving good patient care, increasing nurse staffing to improve outcomes will not necessarily result in a net economic benefit.

Nevertheless, some argue that executives may alter nursing structures and processes to maximize cost-effectiveness, including profit and loss margins (Newbold, 2008). In other words, it is possible to determine upper and lower limits for cost-effective nursing levels (Rothberg et al., 2005). For example, estimates of net annual savings of increased nurse staffing have been calculated, ranging from \$3,191 to over \$300,000 per patient (Dall et al., 2009; Dorr et al., 2005; Horn, 2008). Moreover, Storfjell, Ohlson, Omoike, Fitzpatrick and Wetasin (2009) found that non-value-added costs (in other words, nursing hours that are not impacting patient care) may cost the average medical-surgical unit more than one million dollars annually.

The economic analysis of nursing staffing and outcomes is a relatively small body of research under development (Lamas, Willman, Lindholm & Jacobsson, 2009). Recent studies have plotted the cost of nurse staff and skill mix against potential savings from improved outcomes, such as decreased adverse events (Shamliyan et al., 2009) and shorter LOS (Needleman, 2008). Directions for future work point toward more intricate calculations of cost functions including turnover/retention (Jones & Gates, 2007; O'Brien-Pallas, Tomblin Murphy & Shamian, 2008), as well as job stress and absenteeism (Newbold, 2008).

7.0 Elements that Influence Staff Mix Decision-making

While there has been a great deal of interest in the effect of nurse staffing levels and mix on the quality of care in hospitals, much less attention has been paid to other elements that influence processes of patient care (Blegen, Vaughan & Vojir, 2008). For example, characteristics of individual patients (O'Brien-Pallas, Meyer, Hayes & Wang, 2011) and nurses (White et al., 2008) may influence outcomes. Moreover, hospital work environments have been shown to affect quality of care (Aiken, Clarke, Sloane, Lake & Cheney, 2008; Rafferty et al., 2007). Thus, organizational factors, such as management practices, work design and group culture, are important to bear in mind, given their role in influencing job satisfaction and nurse staffing patterns (Baumann et al., 2001; Page, 2004). As such, staff mix decision-making must also consider patient, provider and organizational factors.

7.1 Patient Factors

Although staffing factors can affect quality of care, patients' outcomes may be affected by their individual characteristics (O'Brien-Pallas et al., 2011). For example, demographic variables including age (Weiss et al., 2007), income (Titler et al., 2006) and gender (Palnum et al., 2009) have been shown to influence outcomes. Furthermore, patient dependency (Hurst, 2005), acuity (Brennan & Daly, 2009), variability (Litvak et al., 2005) and complexity (McGillis Hall & Doran, 2007), can also impact nurse, patient and organizational outcomes. These elements are important to consider when matching human resources to patient needs, since staffing decisions, such as delineating between RN and LPN scope of practice, accountability and autonomy, depend partly on patient status (College of Nurses of Ontario [CNO], 2009).

Not only is it important to identify patient factors that may influence outcomes, but also methods for measuring these characteristics can affect staffing decisions. A recent concept analysis of acuity suggests that patient factors should be classified as patient, provider and organizational-related measures (Brennan & Daly, 2009). Here, patient-related acuity refers to individual attributes including onset and severity of illness, while provider-associated acuity includes tracking nurse staffing needs, workload, and care complexity. Organizational-related acuity involves broader categorizations of resource utilization, including case-mix, patient-classification systems (PCSs) and triage scales (Brennan & Daly, 2009). These data sets are discussed further in section 9.2 — Tools and Processes.

7.2 Provider Factors

Nursing characteristics, such as level of education, training and experience, have already been described; however, other factors — including scope of practice, role clarity, delegation practices and critical thinking processes — have the potential to influence nursing processes and outcomes. In

particular, these elements should be considered as part of a larger goal to optimize nursing workforce utilization (White et al., 2008). Moreover, as leaders begin to argue that LPNs are not being used to their full capacity (Seago, Spetz, et al., 2006), clarity regarding different providers' roles and functions will become increasingly important (Henderson, Curren, Walter, Toffoli & O'Kane, 2011).

In Canada, some maintain that the development of role ambiguity in nursing is not surprising as both RNs and LPNs have overlapping scopes of practice but differ in their educational preparation (Baumann, Blythe, Baxter, Alvarado & Martin, 2009). However, this confusion may have harmful effects on group processes since perceived role overlap can contribute to workplace tension and lack of trust among professionals (Baranek, 2005). This is a concern as improved team functioning, including collaborative nurse-physician relationships, have been linked with improved outcomes for patients (Estabrooks et al., 2005), as well as improved unit productivity and better health for nurses (O'Brien-Pallas et al., 2004). Therefore, researchers caution managers and administrators to carefully consider and understand nurses' roles and scope of practice before integrating new functions into work environments (DeWitt, 2009; Elyn, MacPhee & Pritchard, 2007).

Recent literature supports the belief that nurses' awareness of their roles still varies greatly (Besner et al., 2005). For example, in a study regarding RN, LPN and RPN perceptions of working to "full scope of practice," White and colleagues (2008) found that nurses tended to describe their scope in terms of functional tasks, rather than functional roles. Additionally, White and colleagues (2008) discovered considerable role confusion and blurred boundaries among the three types of regulated nurses, which is similar to earlier findings (Besner et al., 2005). LPNs in the study also reported feelings of frustration, stating that other team members were resistant to them working to their full scope of practice. As such, Oelke and colleagues (2008) identified barriers and facilitators for optimizing roles with this group. Key barriers included workload, patient acuity, lack of time and poor team communication, while important facilitators involved greater collaboration as well as increased support from management and for continuing education.

Since nurses constitute the surveillance system for early detection of patient complications (Aiken et al., 2003) it is important not only to understand what nurses are trained and authorized to do, but also to account for their knowledge base and decision-making processes. For example, a recent study conducted in Alberta evaluated similarities and differences in the knowledge base of RN, LPN and RPN new graduates, concluding that RNs are prepared to care for a range of patient conditions, RPN graduates are best suited for mental health work, and LPNs are well positioned to care for stable, predictable patients (College and Association of Registered Nurses of Alberta [CARNA], College of Licensed Practical Nurses of Alberta & College of Registered Psychiatric Nurses of Alberta, 2009). As well, another Canadian study describing RN and LPN perceptions of their decision-making process found that baccalaureate RNs, when compared with diploma RNs and LPNs, were more forthcoming and articulate when discussing their critical thinking process (Boblin, Baxter, Alvarado, Baumann & Akhtar-Danesh, 2008). Moreover, all RNs in this research project used decision-making process elements more frequently than LPNs. Interestingly, the same study also reports that nurses found "identifying possible outcomes and likelihood of outcomes" to be the most difficult element of

decision-making, suggesting that nurses have not yet been well educated to consider outcomes as part of their work.

Finally, it is increasingly being recognized that licensed nurses (RNs, RPNs and LPNs) work with unregulated personnel in a variety of settings (CNA, 2008b; ICN, 2008). Given that UCPs are not accountable to a regulatory body, nursing organizations have developed guidelines to support delegation of tasks from licensed to unlicensed staff (Association of Registered Nurses of Prince Edward Island, Licensed Practical Nurses Association of Prince Edward Island & PEI Health Sector Council, 2009; CARNA, 2010; CNO, 2009; College of Registered Nurses of Manitoba, 2010; College of Registered Nurses of Nova Scotia, 2004; College of Registered Nurses of British Columbia, 2007; Saskatchewan Registered Nurses' Association, 2004). Although current evidence regarding the impact of delegation on patient and nurse outcomes is inadequate (Dubois & Singh, 2009), recent studies have suggested that ineffective delegation practices between nurses and other health-care staff can contribute to patient care that is missed, delayed or omitted (Bittner & Gravlin, 2009; Kalisch & Aebersold, 2006; Kalisch, Landstrom & Hindshaw, 2009). This is important to consider given that missed or unfinished care has been linked with quality of nursing care (Lucero, Lake & Aiken, 2009; Sochalski, 2004).

7.3 Organizational Factors

There is widespread recognition that organizational factors, including healthy work environments and supportive leadership, can affect patient and nurse outcomes as well as overall systems performance (Baumann et al., 2001; Pearson et al., 2006; Schalk, Bijl, Halfens, Hollands & Cummings, 2010). Moreover, in the United States, Magnet designation has been described as an indicator of positive nursing work environments (Aiken, Buchan, Ball & Rafferty, 2008), with earlier research establishing a link between Magnet hospitals and improved patient outcomes (Aiken et al., 1999; Aiken, Clarke & Sloane, 2002). Therefore, national organizations have called for renewed action to improve the working conditions of Canadian nurses (Canadian Federation of Nurses Unions [CFNU], 2008; CNA & CFNU, 2006). As well, provincial organizations, such as the Registered Nurses Association of Ontario (RNAO), have supported local implementation efforts through the development of best practice guidelines (RNAO, 2007).

Several researchers have determined that associations between nurse staffing and outcomes vary depending on hospital quality; that is, organizations with positive work environments have consistently better nurse and patient outcomes than those in hospitals with poor work environments (Aiken, Clarke, et al., 2008; Rafferty et al., 2007). Moreover, Aiken, Clarke and Sloane (2002) have found that mortality rates remain the same with varying nurse staffing levels, provided the quality of the practice environment is high. Conversely, the same rates vary greatly by staffing ratio in organizations with poor nurse work environments (Aiken, Clarke & Sloane, 2002). As well, hospitals with better work environments and good professional nursing practice (e.g., enhanced nurse autonomy) not only experience improved clinical outcomes, but also better nurse retention (Aiken,

Buchan, et al., 2008) and lower turnover rates (Mark, Sayler & Wan, 2003). Turnover has also been shown to decrease through greater training investments in nursing human capital (Rondeau, Williams & Wagar, 2009). This is important to note, given the significant organizational costs associated with high rates of nurse turnover in Canadian hospitals (O'Brien-Pallas et al., 2008).

Effective leadership as an aspect of the quality of practice environments can affect outcomes, by enhancing nurse performance and subsequently, patient outcomes (Laschinger & Leiter, 2006). For example, in a recent systematic review, Brady Germain and Cummings (2010) found that nursing leadership had a direct influence on factors that motivate nursing performance, such as autonomy and resource accessibility. Nurses' subjective perceptions of greater access to workplace resources have also been associated with improved patient care, less missed care and decreased absenteeism (O'Brien-Pallas et al., 2011). Also, nurse perceptions of managerial and leadership support can have a pronounced effect on nursing outcomes such as burnout (Aiken, Clarke & Sloane, 2002), job satisfaction and role tension (McGillis Hall & Doran, 2007), and patient outcomes, including 30-day mortality (Tourangeau, Doran, et al., 2006) and failure to rescue (Aiken, Clarke, et al., 2008). In the long-term care setting, consistent nursing administrative leadership has been linked with better quality care (Rantz et al., 2004).

Lastly, organizational factors are typified not only by the quality of work environments, but also through specific facility characteristics. For example, a study involving pediatric cardiac surgical patients showed that higher hospital volumes resulted in lower risk-adjusted mortality (Hickey et al., 2010), while Littig and Isken (2007) found that variations in inpatient census can affect patient care quality and nurse satisfaction. As well, hospitals with teaching status (Seago, Spetz & Mitchell, 2004), increased technology scores (Seago et al., 2004), more complex patients (Welton, Unruh & Halloran, 2006), and those located in rural areas (Hodge et al., 2004) tended to have higher levels of unit staffing, thus suggesting a different level of care in academic medical centres versus community hospitals (Welton et al., 2006). In long-term care settings, smaller facilities were more likely to have positive resident outcomes (Rantz et al., 2004). Scott-Cawiezell and colleagues (2005) suggest that these improved outcomes are due to improved leadership, communication and teamwork functions in smaller nursing home centres.

8.0 Tools and Processes that Inform Staff Mix Decision-making

Nurse staffing is a complex and difficult issue and thus it is critical that administrators execute well-informed staff mix decisions, given the deleterious effects that inappropriate staffing can have on nurse, patient and organizational outcomes (Ellis et al., 2006). Over the years, theoretical and conceptual frameworks have been proposed to assess the quality of patient care (Aiken, Sochalski & Lake, 1997; Holzemer & Reilly, 1995; Irvine, Sidani & McGillis Hall, 1998; Mark, Sayler & Smith, 1996; Mitchell, Ferketich, Jennings and American Academy of Nursing Expert Panel on Quality Health Care, 1998). Many of these models represent permutations of Donabedian's (1966) structure-process-outcome theory, each providing a unique perspective on the relationship between nursing variables and health outcomes. Although these models prove valuable in theory, access to, and use of timely, unit-specific data presents challenges to administrators and researchers (McGillis Hall et al., 2006). As such, tools and processes that support staff decision-making continue to be developed.

8.1 Traditional Tools and Processes

Historically, methods to inform staff mix decision-making have involved measurement of nurse staffing levels (e.g., patient-to-nurse ratios and HPPD) and nursing workload — that is, the amount and intensity of work that a nurse performs within a particular length of time (Unruh, 2008). However, because nursing workload measurement is affected by a variety of factors — including skill mix, staffing levels, patient acuity and volume — developing reliable and comprehensive performance measurement tools has proved challenging (Needleman, Kurtzman & Kizer, 2007). For example, the ICN has said that existing tools “are unable to capture more than 40% of the nursing work in some settings” (ICN, 2006b, p. 16).

Nevertheless, workload measurement systems (WMSs) and PCSs have long been used to calculate nursing care needs based on patient acuity (Duffield, Roche & Merrick, 2006). As well, these systems have typically been employed in acute care settings to help track and trend nursing care (McGillis Hall et al., 2006). Despite widespread use of WMSs and PCSs, a recent meta-analysis of staffing-outcomes literature concluded that significant disagreement remains regarding their structure and use (Kane et al., 2007). Moreover, these measurement tools have been criticized for not accurately or effectively reflecting the work that nurses do (McGillis Hall et al., 2006).

Along with nursing acuity and dependency tools, patient-to-nurse ratios have been employed as a standardized approach to determining staffing levels. Although little has been written about the use of specific minimum ratios to improve quality care (Lang et al., 2004), a few jurisdictions have adopted standardized ratios through legislative means (Gerdtz & Nelson, 2007; Spetz, 2004). While some praise ratios for being a simple, sensible and consistent approach to staffing, others argue that mandatory patient-to-nurse ratios are hazardous in environments where patient needs are not stable (McGillis Hall et al., 2006). Moreover, utilization of predetermined staffing ratios does not consider the myriad of nurse,

patient and organizational factors that can influence outcomes (Dubois & Singh, 2009). However, adopting minimum staffing regulations may stimulate dialogue between staff nurses and nurse leaders and offer a level of workload protection for front-line staff (Cox et al., 2005). As such, Canadian perceptions regarding standardized patient-to-nurse ratios remains in flux (McGillis Hall et al., 2006).

8.2 New and Emerging Trends in Tools and Processes

In light of limitations regarding older, unidimensional staff mix decision-making tools, newer measurements are being developed to support a more comprehensive understanding of the relationship between nursing staffing, care processes and patient outcomes. Patient acuity and dependency tools now account for more complex indicators of patient, nurse and organizational elements (Smith, Forde, Goodman, Cannaby & Radford, 2009). Moreover, concepts of nurse competency and skill matching — in other words, linking nurse skill to patient acuity with the objective of decreasing patient risk (Rischbieth, 2006) — are emerging in the literature as a more appropriate approach to determining staffing levels. For example, recent toolkits have been developed in Canada to support the evaluation of patient needs and nurse staffing availability (Beduz, Vincent & Pauzé, 2009; Blastorah et al., 2010). As well, Dubois and Singh (2009) suggest a paradigm shift from staff-mix to skill management, whereby workers are supported to adapt their knowledge, skills, roles and behaviours to changing demands through skill development and role enhancement. The increase in public reporting and use of pay-for-performance schemes has prompted the emergence of tools such as balanced scorecards, nursing report cards, dashboards and the use of benchmarking databases to measure performance and quality (Needleman et al., 2007). Although research is still limited, preliminary studies discuss the critical role that these tools will play in tracking and comparing clinical data for quality improvement (Brown, Donaldson, Burnes Bolton & Aydin, 2010; McGillis Hall et al., 2008). For example, Brown and colleagues (2010) discuss the use of benchmarks to monitor quality through the Collaborative Alliance for Nursing Outcomes — a repository of unit-level, nursing-sensitive quality measures from California hospitals that was established in the mid-1990s by the American Nurses Association (Donaldson, Brown, Aydin, Bolton & Rutledge, 2005). Similarly, another U.S. database, the National Database of Nursing Quality Indicators tracks and allows for analysis of multiple workforce indicators and outcomes (Dunton et al., 2007).

In Canada, nursing-sensitive indicators are being developed and collected through the Ontario-based Health Outcomes for Better Information and Care (HOBIC) program, as well as at a national level through the C-HOBIC project (Doran et al., 2011). Currently, outcomes data have been collected in different sectors — including acute care, complex continuing care, home care and long-term care — and efforts are underway to standardize nursing terminology at a national level for future integration into electronic health records. Ultimately, this work provides the basis for collecting consistent, real-time data regarding nursing-sensitive indicators and will help support future efforts linking nursing structures and processes to various outcomes (Doran et al., 2011).

9.0 Gaps in the Literature

Despite decades of staffing-outcomes research, gaps in the literature persist. Many authors have cited issues regarding level and type of analysis, claiming that previous use of aggregate data does not accurately reflect the realities of daily variability in nursing units (Blegen et al., 2011; Clarke, 2009; Hart & Davis, 2011; McGillis Hall et al., 2003; O'Brien-Pallas, Li, Wang, Meyer & Thomson, 2010; Patrician et al., 2011). Additionally, there continues to be a scarcity of literature related to LPNs, RPNs and UCPs, as well as limited research in settings such as community care, home care and mental health. Other drawbacks of the literature include differing operational definitions of nurse staffing measures (Ayre et al., 2007); lack of methodological rigour (Estabrooks et al., 2009); assumptions regarding causal relationships (Aiken, 2008; Clarke, 2007; Mark 2006); reliance on self-reported data (Aiken et al., 2010); lack of differentiation between nurses who provide direct care and those who work in administration (Blegen et al., 2011); sporadic use of risk adjustment (Clarke, 2007); and variations among current sources of data, such as administrative databases (Spetz et al., 2008) Therefore, future research requires standardized metrics that account for both micro and macro measures, including patient, nurse and system factors that are sensitive to nurse staffing (Ayre et al., 2007).

Regardless of these gaps, there is a growing body of evidence to support relationships between nurse staffing and patient, personnel and organizational outcomes. For example, a comprehensive meta-analysis concluded that increased nurse staffing in hospitals, particularly through increased RN hours, was strongly associated with improved patient outcomes, such as lower hospital-related mortality and decreased rates of failure to rescue (Kane et al., 2007). As well, higher use of overtime hours was linked with an increase in negative patient outcomes, while limited evidence demonstrates a relationship between elevated levels of nurse education (i.e., baccalaureate-prepared RNs) and quality of care. Overall, the authors concluded that, given the quality of the research, causal associations cannot be confirmed and that future work must be done to understand the many other factors that can affect outcomes, such as nursing process characteristics.

10.0 Implications for Nurse Staffing Decisions

As with the 2004 synthesis, the findings of this review demonstrate a strong link between higher nurse staffing levels (in particular, an increased proportion of RNs) and better patient outcomes in acute care settings. However, in light of changing models of care, such as an increased focus on teamwork, inter- and intraprofessional collaboration, and the introduction of new nursing roles in non-acute care settings, more research is needed to understand the changing relationship between staffing and outcomes. Nonetheless, current evidence suggests that staff mix decision-making is optimized when it:

- is based on outcomes, including patient safety and quality of care;
- involves consideration of nursing structures and processes;
- reflects an understanding of nursing work processes while also considering the evolving role of nurses in care delivery models;
- addresses the needs of specific patient populations and promotes quality work environments;
- considers category, education and experience, and supports full scope of practice for each provider;
- leverages technology to support efforts to standardize staffing measurements, and track and trend nursing-sensitive outcomes;
- considers cost effectiveness in the context of optimal outcomes for patients, nurses and the organizations; and
- reflects strong nursing leadership to promote professional nursing autonomy and collaborative relationships.

11.0 Conclusions

This report has documented the findings of a literature review undertaken to inform a review and revisions to the 2005 *Evaluation Framework to Determine the Impact of Nursing Staff Mix Decisions* (CNA et al., 2005). While new evidence related to staff mix and outcomes has been retrieved and reviewed, there is still a paucity of research that evaluates staff mix decision-making. The literature demonstrates the existence of numerous data elements that influence outcomes for patients, nurses and organizations in an ever-evolving health-care system. Moreover, recent efforts to standardize and map nursing-sensitive indicators (Doran et al., 2011) suggest that data-driven frameworks to support nurse staffing will increasingly become the norm.

In light of changes in nursing care delivery (e.g., models of care and shifting scopes of practice), the literature suggests that administrators and researchers must pay close attention not only to tracking staff numbers and skill mix, but also to the processes of interaction between patients, providers and organizations. Accordingly, the literature supports an association between the care delivery model and outcomes for patients, nurses and the organizations. In an era characterized by a focus on patient safety and a patient — and family-centred approach to care, this association reinforces the emerging imperative for outcome measurement highlighted in the literature. Outcome data can inform the determination of the effectiveness of the staff mix complement within the care delivery model based on the degree to which the desired outcomes were achieved. Moreover, giving outcome data to health-care team members to interpret in the context of their patient population and setting enables them to design or provide input into strategies to optimize outcomes for their patients. This practice has the potential to promote quality improvement and safe and appropriate patient care — the end-goals of evidence-informed staff mix decision-making.

References

- Aiken, L. H. (2008). Economics of nursing. *Public, Politics, & Nursing Practice*, 9(2), 73-79.
- Aiken, L. H., Buchan, J., Ball, J., & Rafferty, A. M. (2008). Transformative impact of Magnet designation: England case study. *Journal of Clinical Nursing*, 17(24), 3330-3337.
- Aiken, L. H., Clarke, S. P., Cheung, R. B., Sloane, D. M., & Silber, J. H. (2003). Educational levels of hospital nurses and surgical patient mortality. *Journal of the American Medical Association*, 290(12), 1617-1623.
- Aiken, L. H., Clarke, S. P., & Sloane, D. M. (2002). Hospital staffing, organization, and quality of care: Cross-national findings. *International Journal for Quality in Health Care*, 14(1), 5-13.
- Aiken, L. H., Clarke, S. P., Sloane, D. M., Lake, E. T., & Cheney, T. (2008). Effects of hospital care environment on patient mortality and nurse outcomes. *Journal of Nursing Administration*, 38(5), 223-229.
- Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., & Silber, J. H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *Journal of the American Medical Association*, 288(16), 1987-1993.
- Aiken, L. H., Sloane, D. M., Cimiotti, J. P., Clarke, S. P., Flynn, L., Seago, J. A., ... Smith, H. L. (2010). Implications of the California nurse staffing mandate for other states. *Health Services Research*, 45(4), 904-921.
- Aiken, L. H., Sloane, D. M., Lake, E. T., Sochalski, J., & Weber, A. L. (1999). Organization and outcomes of inpatient AIDS care. *Medical Care*, 37(8), 760-772.
- Aiken, L. H., Sochalski, J., & Lake, E. T. (1997). Studying outcomes of organizational change in health services. *Medical Care*, 35(11, Supplement), NS6-NS18.
- Aiken, L. H., Xue, Y., Clarke, S. P., & Sloane, D. M. (2007). Supplemental nurse staffing in hospitals and quality of care. *Journal of Nursing Administration*, 37(7/8), 335-342.
- Allen, D. E., & Vitale-Nolen, R. A. (2005). Patient care delivery model improves nurse job satisfaction. *Journal of Continuing Education in Nursing*, 36(6), 277-282.
- Association of Registered Nurses of Prince Edward Island, Licensed Practical Nurses Association of Prince Edward Island & Prince Edward Island Health Sector Council. (2009). *Exemplary care: Registered nurses and licensed practical nurses working together*. Charlottetown: Authors. Retrieved from <http://www.arnpei.ca/images/documents/RNsandLPNsWorkingTogether.pdf>
- Ayre, T. C., Gerdtz, M. F., Parker, J., & Nelson, S. (2007). Nursing skill mix and outcomes: A Singapore perspective. *International Nursing Review*, 54(1), 56-62.
- Baker, G. R., Norton, P. G., Flintoft, V., Blais, R., Brown, A., Cox, J., ... Tamblyn, R. (2004). The Canadian adverse events study: The incidence of adverse events among hospital patients in Canada. *Canadian Medical Association Journal*, 170(11), 1678-1686.
- Baranek, P. M. (2005). *A review of scopes of practice of health professions in Canada: A balancing act*. Toronto: Health Council of Canada. Retrieved from http://healthcouncilcanada.ca/docs/papers/2005/Scopes_of_PracticeEN.pdf

-
- Batcheller, J., Burkman, K., Armstrong, D., Chappell, C., & Carelock, J. L. (2004). A practice model for patient safety: The value of the experienced registered nurse. *Journal of Nursing Administration, 34*(4), 200-205.
- Baumann, A., Blythe, J., Baxter, P., Alvarado, K., & Martin, D. (2009). *Registered practical nurses: An overview of education and practice*. Hamilton: Nursing Health Services Research Unit, McMaster University. Retrieved from <http://www.nhsru.com/wp-content/uploads/2010/11/Series-12-Registered-Practical-Nurses-An-Overview-of-Education-and-Practice1.pdf>
- Baumann, A., O'Brien-Pallas, L., Armstrong-Stassen, M., Blythe, J., Bourbonnais, R., Cameron, S., ... Ryan, L. (2001). *Commitment and care: The benefits of a healthy workplace for nurses, their patients and the system — A policy synthesis*. Ottawa: Canadian Health Services Research Foundation. Retrieved from http://www.chsrf.ca/Migrated/PDF/pscomcare_e.pdf
- Beduz, M. A., Vincent, L., & Pauzé, E. (2009). *Building capacity in nursing human resource planning: A best practice resource for nursing managers*. Toronto: Ministry of Health and Long-Term Care. Retrieved from <http://www.mountsinai.on.ca/nursing/building-capacity>
- Berney, B. L. (2003). *Use, trends, and impacts of nurse overtime in New York hospitals, 1995-2000* (Doctoral dissertation). Boston University, Massachusetts.
- Berney, B., & Needleman, J. (2006). Impact of nursing overtime on nurse-sensitive patient outcomes in New York hospitals, 1995-2000. *Policy, Politics, & Nursing Practice, 7*(2), 87-100.
- Berwick, D. M. (2002). A user's manual for the IOM's 'Quality Chasm' report. *Health Affairs, 21*(3), 80-90.
- Besner, J., Doran, D., McGillis Hall, L., Giovanetti, P., Girard, F., Hill, W., ... Watson, L. (2005). *A systematic approach to maximizing nursing scopes of practice*. Ottawa: Canadian Health Services Research Foundation. Retrieved from http://www.chsrf.ca/Migrated/PDF/ResearchReports/OGC/besner_final.pdf
- Bittner, N. P., & Gravlin, G. (2009). Critical thinking, delegation, and missed care in nursing practice. *Journal of Nursing Administration, 39*(3), 142-146.
- Blastorah, M., Alvarado, K., Duhn, L., Flint, F., McGrath, P., & VanDeVelde-Coke, S. (2010). Development and evaluation of an RN/RPN utilization toolkit. *Nursing Leadership, 23* (Special Issue), 33-55.
- Blegen, M. A., Goode, C. J., & Reed, L. (1998). Nurse staffing and patient outcomes. *Nursing Research, 47*(1), 43-50.
- Blegen, M. A., Goode, C. J., Spetz, J., Vaughn, T., & Park, S. H. (2011). Nurse staffing effects on patient outcomes: Safety-net and non-safety-net hospitals. *Medical Care, 49*(4), 406-414.
- Blegen, M. A., Vaughn, T., & Vojir, C. P. (2008). Nurse staffing levels: Impact of organizational characteristics and registered nurse supply. *Health Services Research, 43*(1), 154-173.
- Bobay, K. L., Yakusheva, O., & Weiss, M. E. (2011). Outcomes and cost analysis of the impact of unit-level nurse staffing on post-discharge utilization. *Nursing Economic\$, 29*(2), 69-87.
- Boblin, S., Baxter, P., Alvarado, K., Baumann, A., & Akhtar-Danesh, N. (2008). Registered nurses and registered/licensed practical nurses: A description and comparison of their decision-making process. *Nursing Research, 21*(4), 56-72.

-
- Bolton, L. B., Donaldson, N. E., Rutledge, D. N., Bennett, C., & Brown, D. S. (2007). The impact of nursing interventions: Overview of effective interventions, outcomes, measures, and priorities for future research. *Medical Care Research and Review*, 64(2, Supplement), 123S-143S.
- Brady Germain, P., & Cummings, G. G. (2010). The influence of nursing leadership on nurse performance: A systematic literature review. *Journal of Nursing Management*, 18(4), 425-439.
- Brennan, C. W., & Daly, B. J. (2009). Patient acuity: A concept analysis. *Journal of Advanced Nursing*, 65(5), 1114-1126.
- Brown, D. S., Donaldson, N., Burnes Bolton, L., & Aydin, C. E. (2010). Nursing-sensitive benchmarks for hospitals to gauge high-reliability performance. *Journal for Healthcare Quality*, 32(6), 9-17.
- Buchan, J. (2005). A certain ratio? The policy implications for minimum staffing ratios in nursing. *Journal of Health Services Research and Policy*, 10(4), 239-244.
- Buchan, J. (2009). The nursing workforce and global economic recession. *Collegian*, 16(1), 1-2.
- Burritt, J. E., Wallace, P., Steckel, C., & Hunter, A. (2007). Achieving quality and fiscal outcomes in patient care: The clinical mentor care delivery model. *Journal of Nursing Administration*, 37(12), 558-563.
- Butler, M., Collins, R., Drennan, J., Halligan, P., O'Mathúna, D. P., Schultz, T. J., Sheridan, A., & Vilis, E. (2011). Hospital nurse staffing models and patient and staff-related outcomes (Review). *Cochrane Library*, 7.
- Canadian Federation of Nurses Unions. (2008). *A renewed call for action: A synthesis report on the nursing shortage in Canada*. Ottawa: Author. Retrieved from http://www.nursesunions.ca/sites/default/files/2008.06.15.Call_to_action.Outside.web_.pdf
- Canadian Institute for Health Information. (2008). *The health personnel database technical report*. Ottawa: CIHI. Retrieved from http://secure.cihi.ca/cihiweb/products/HPDB_Tech_report_en.pdf
- Canadian Institute for Health Information. (2010). *Regulated nurses: Canadian trends, 2005 to 2009*. Ottawa: CIHI. Retrieved from http://secure.cihi.ca/cihiweb/products/nursing_report_2005-2009_en.pdf
- Canadian Nurses Association. (2004). *Nursing staff mix: A literature review*. Ottawa: Author. Retrieved from www.cna-aiic.ca
- Canadian Nurses Association. (2008a). *Advanced nursing practice: A national framework*. Ottawa: Author. Retrieved from www.cna-aiic.ca
- Canadian Nurses Association. (2008b). *Unregulated health workers: A Canadian and global perspective. A discussion paper*. Ottawa: Author. Retrieved from www.cna-aiic.ca
- Canadian Nurses Association. (2009a). *Position statement: The nurse practitioner*. Ottawa: Author. Retrieved from www.cna-aiic.ca
- Canadian Nurses Association. (2009b). *Position statement: Clinical nurse specialist*. Ottawa: Author. Retrieved from www.cna-aiic.ca

-
- Canadian Nurses Association, Canadian Council for Practical Nurse Regulators, Registered Psychiatric Nurses of Canada & Canadian Practical Nurses Association. (2005). *Evaluation framework to determine the impact of nursing staff mix decisions*. Ottawa: Author. Retrieved from www.cna-aiic.ca
- Canadian Nurses Association & Canadian Federation of Nurses Unions. (2006). *Joint position statement — Practice environments: Maximizing client, nurse and system outcomes*. Ottawa: Author. Retrieved from www.cna-aiic.ca
- Castle, N. G. (2008). Nursing home caregiver staffing levels and quality of care: A literature review. *Journal of Applied Gerontology*, 27(4), 375-405.
- Castle, N. G., & Engberg, J. (2007). The influence of staffing characteristics on quality of care in nursing homes. *Health Research and Educational Trust*, 42(5), 1822-1847.
- Chiarella, M. E. (2007). Redesigning models of patient care delivery and organisation: building collegial generosity in response to workplace challenges. *Australian Health Review*, 31 (Supp. 1), S109-S115.
- Cho, S. H. (2002). *Nurse staffing and adverse patient outcomes* (Doctoral dissertation). University of Michigan, Ann Arbor.
- Cho, S. H., Ketefian, S., Barkauskas, V. H., & Smith, D. G. (2003). The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. *Nursing Research*, 52(2), 71-79.
- Cimiotti, J. P. (2004). *Nurse staffing and healthcare-associated infections in the neonatal ICU* (Doctoral dissertation). Columbia University, New York.
- Clarke, S. P., (2007, November). Nurse staffing in acute care settings: research perspectives and practice implications. *The Joint Commission Journal on Quality and Patient Safety*, 33(11, Supplement), 30-44.
- Clarke, S. P., (2009). Three metaphors and a (mis)quote: thinking about staffing-outcomes research, health policy and the future of nursing. *Journal of Nursing Management*, 17, 151-154.
- Clarke, S. P., & Donaldson, N. E. (2008). Nurse staffing and patient care quality and safety. In R. Hughes (Ed.), *Patient safety and quality: An evidence-based handbook for nurses* (Chap. 25). (AHRQ Publication No. 08-0043). Rockville, MD: Agency for Healthcare Research and Quality. Retrieved from <http://www.ahrq.gov/qual/nursesfdbk>
- College and Association of Registered Nurses of Alberta. (2010). *Decision-making standards for nurses in the supervision of health care aides: Restricted activities and activities of daily living*. Edmonton: Author. Retrieved from <http://www.nurses.ab.ca/pdf/Joint%20Nrsrg%20Decision%20Making%20Document.pdf>
- College and Association of Registered Nurses of Alberta, College of Licensed Practical Nurses of Alberta & College of Registered Psychiatric Nurses of Alberta. (2009). *Knowledge and education at entry to nursing practice in Alberta*. Edmonton: Author. Retrieved from http://www.clpna.com/Portals/0/Files/pub_KEP_Executive_Summary_Feb_2010.pdf
- College of Nurses of Ontario. (2009). *Working with unregulated care providers*. Practice Guideline. Toronto: Author. Retrieved from http://www.cno.org/Global/docs/prac/41014_workingucp.pdf

-
- College of Registered Nurses of British Columbia. (2007). *Assigning and delegating to unregulated care providers*. Vancouver: Author. Retrieved from <https://www.crnbc.ca/downloads/98.pdf?q=unregulated>
- College of Registered Nurses of Manitoba. (2010). *Practice direction — Delegation to unregulated care providers*. Winnipeg: Author. Retrieved from http://cms.tng-secure.com/file_download.php?fFile_id=13506
- College of Registered Nurses of Nova Scotia. (2004). *Delegation guidelines for registered nurses*. Halifax: Author. Retrieved from <http://www.crnns.ca/documents/Delegation%20Guidelines%202004.pdf>
- Commission on the Future of Health Care in Canada. (2002). *Building on values: The future of health care in Canada*. Ottawa: Author. Retrieved from <http://dsp-psd.pwgsc.gc.ca/Collection/CP32-85-2002E.pdf>
- Cox, K. S., Anderson, S. C., Teasley, S. L., Sexton, K. A., & Carroll, C. A. (2005). Nurses' work environment perceptions when employed in states with and without mandatory staffing ratios and/or mandatory staffing plans. *Policy, Politics, & Nursing Practice*, 6(3), 191-197.
- Dall, T. M., Chen, Y. J., Furst Seifert, R., Maddox, P. J., & Hogan, P. J. (2009). The economic value of professional nursing. *Medical Care*, 47(1), 97-104.
- Dechant, G. M. (2006). Human resource allocation: Staffing and scheduling. In J. M. Hibberd and D. L. Smith (Eds.), *Nursing leadership and management in Canada* (3rd ed., pp. 625-647). Toronto: Elsevier Mosby.
- Decker, F. H. (2008). The relationship of nursing staff to the hospitalization of nursing home residents. *Research in Nursing & Health*, 31(3), 238-251.
- DeWitt, L. (2009, December). Licensed practical nurses in the PACU. *Journal of PeriAnesthesia Nursing*, 24(6), 356-361.
- Donabedian, A. (1966). Evaluating the quality of medical care. *Millbank Memorial Fund Quarterly*, 44(3), 166-203.
- Donaldson, N., Brown, D. S., Aydin, C. E., Bolton, M. L., & Rutledge, D. N. (2005). Leveraging nurse-related dashboard benchmarks to expedite performance improvement and document excellence. *Journal of Nursing Administration*, 35(4), 163-72.
- Donaldson, N., Burnes Bolton, L., Aydin, C., Brown, D., Elashoff, J. D., & Sandhu, M. (2005). Impact of California's licensed nurse-patient ratios on unit-level nurse staffing and patient outcomes. *Policy, Politics, & Nursing Practice*, 6(3), 198-210.
- Donaldson, N., & Shapiro, S. (2010). Impact of California mandated acute care hospital nurse staffing ratios: A literature synthesis. *Policy, Politics & Nursing Practice*, 11(3), 184-201.
- Doran, D. M. (2003). "Preface". In D. M. Doran (Ed.), *Nursing-sensitive outcomes: State of the science* (pp. vii-ix). Sudbury, MA: Jones and Bartlett.
- Doran, D., Mildon, B., & Clarke, S. (2011). Towards a national report card in nursing: A knowledge synthesis. *Nursing Leadership*, 24(2), 38-57.
- Dorr, D. A., Horn, S. D., & Smout, R. J. (2005). Cost analysis of nursing home registered nurse staffing times. *Journal of the American Geriatrics Society*, 53(5), 840-845.

-
- Dubois, C-A., & Singh, D. (2009). From staff-mix to skill-mix and beyond: Towards a systematic approach to health workforce management. *Human Resources for Health*, 7(87), 1-19.
- Duffield, C., Roche, M., Diers, D., Catling-Paull, C. & Blay, N. (2010). Staffing, skill mix and the model of care. *Journal of Clinical Nursing*, 19, 2242-2251.
- Duffield, C., Roche, M., & Merrick, E. T. (2006). Methods of measuring nursing workload in Australia. *Collegian*, 13(1), 16-22.
- Duffield, C., Roche, M., O'Brien-Pallas, L., & Catling-Paull, C. (2009). The implications of staff 'churn' for nurse managers, staff, and patients. *Nursing Economic\$,* 27(2), 103-110.
- Dunton, N., Gajewski, B., Klaus, S. & Pierson, B. (2007). The relationship of nursing workforce characteristics to patient outcomes. *The Online Journal of Issues in Nursing*, 12(3). Retrieved from www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume122007/No3Sept07/NursingWorkforceCharacteristics.aspx
- Dunton, N., Gajewski, B., Taunton, R. L., & Moore, J. (2004). Nurse staffing and patient falls on acute care hospital units. *Nursing Outlook*, 52(1), 53-59.
- Ellis, J., Priest, A., MacPhee, M., & Sanchez McCutcheon, A., on behalf of the Canadian Health Services Research Foundation (CHRSF) and partners. (2006). *Staffing for safety: A synthesis of the evidence on nurse staffing and patient safety*. Ottawa: CHRSF. Retrieved from http://www.chrsf.ca/Migrated/PDF/ResearchReports/CommissionedResearch/staffing_for_safety_policy_synth_e.pdf
- Elyn, F., MacPhee, S., & Pritchard, L. (2007). Introduction of registered practical nurses (RPNs)/licensed practical nurses (LPNs) into hemodialysis units: Experiences in three units across Canada. *The CANNT Journal*, 17(3), 87-88.
- Estabrooks, C. A., Cummings, G. G., Olivo, S. A., Squires, J. E., Giblin, C., & Simpson, N. (2009). Effects of shift length on quality of patient care and health provider outcomes: systematic review. *Quality and Safety in Health Care*, 18(3), 181-188.
- Estabrooks, C. A., Midodzi, W. K., Cummings, G. G., Ricker, K. L., & Giovannetti, P. (2005). The impact of hospital nursing characteristics on 30-day mortality. *Nursing Research*, 54(2), 74-84.
- Fairbrother, G., Jones, A., & Rivas, K. (2010). Changing model of nursing care from individual patient allocation to team nursing in the acute inpatient environment. *Contemporary Nurse*, 35(2), 202-220.
- Fowler, J., Hardy, J., & Howarth, T. (2006). Trialing collaborative nursing models of care: The impact of change. *Australian Journal of Advanced Nursing*, 23(4), 40-46.
- Frith, K. H., Anderson, F., Caspers, B., Tseng, F., Sanford, K., Hoyt, N. G., & Moore, K. (2010). Effects of nurse staffing on hospital-acquired conditions and length of stay in community hospitals. *Quality Management in Health Care*, 19(2), 147-155.
- Gerdtz, M. F., & Nelson, S. (2007). 5-20: A model of minimum nurse-to-patient ratios in Victoria, Australia. *Journal of Nursing Management*, 15(1), 64-71.
- Gordon, S., Buchanan, J., & Bretherton, T. (2008). *Safety in numbers: Nurse-to-patient ratios and the future of health care*. Ithaca, NY: Cornell University Press.

-
- Halsteinli, V., Karterud, S. & Pedersen, G. (2008). When costs count: The impact of staff size, skill mix and treatment intensity on patient outcome for psychotherapeutic day treatment programmes. *Health Policy*, 86(2-3), 255-265.
- Harrington, C. (2005). Nurse staffing in nursing homes in the United States. *Journal of Gerontological Nursing*, 31(2), 18-23.
- Hart, P., & Davis, N. (2011). Effects of nursing care and staff skill mix on patient outcomes within acute care nursing units. *Journal of Nursing Care Quality*, 26(2), 161-168.
- Henderson, J., Curren, D., Walter, B., Toffoli, L., & O’Kane, D. (2011). Relocating care: Negotiating nursing skillmix in a mental health unit for older adults. *Nursing Inquiry*, 18(1), 55-65.
- Hickam, D. H., Severance, S., Feldstein, A., Ray, L., Gorman, P., Schuldheis, S., ... Helfand, M. (2003). *The effect of health care working conditions on patient safety*. Summary, Evidence Report/Technology Assessment: Number 74 (AHRQ Pub. no. 03-E0204). Rockville, MD: Agency for Healthcare Research and Quality. Retrieved from <http://www.ahrq.gov/clinic/epcsums/worksum.htm>
- Hickey, E. C., Young, G. J., Parker, V. A., Czarnowski, E. J., Saliba, D., & Berlowitz, D. R., (2005). The effects of changes in nursing home staffing on pressure ulcer rates. *Journal of the American Medical Directors Association*, 6(1), 50-53.
- Hickey, P., Gauvreau, K., Connor, J., Sporing, E., & Jenkins, K. (2010). The relationship of nurse staffing, skill mix, and Magnet recognition to institutional volume and mortality for congenital heart surgery. *Journal of Nursing Administration*, 40(5), 226-232.
- Hodge, M. B., Romano, P. S., Harvey, D., Samuels, S. J., Olson, V. A., Sauve, M. J., & Kravitz, R. L. (2004). Licensed caregiver characteristics and staffing in California acute care hospital units. *Journal of Nursing Administration*, 34(3), 125-33.
- Hodgkinson, B., Haesler, E. J., Nay, R., O’Donnell, M., & McAuliffe, L. P. (2011). Effectiveness of staffing models in residential, subacute, extended aged care settings on patient and staff outcomes (review). *Cochrane Library*, 6.
- Holzemer W. L., & Reilly C. A. (1995) Variables, variability, and variations research: Implications for medical informatics. *Journal of the American Medical Informatics Association*, 2(3), 183-190.
- Horn, S. D. (2008). The business case for nursing in long-term care. *Policy, Politics, & Nursing Practice*, 9(2), 88-93.
- Horn, S. D., Buerhaus, P., Bergstrom, N., & Smout, R. J. (2005). RN staffing time and outcomes of long-stay nursing home residents. *American Journal of Nursing*, 105(11), 58-70.
- Hugonnet, S., Villaveces, A., & Pittet, D. (2007). Nurse staffing level and nosocomial infections: Empirical evaluation of the case-crossover and case-time-control designs. *American Journal of Epidemiology*, 165(11), 1321-1327.
- Hurst, K. (2005). Relationships between patient dependency, nursing workload and quality. *International Journal of Nursing Studies*, 42(1), 75-84.
- Hurst, K. (2006). Primary and community care workforce planning and development. *Journal of Advanced Nursing*, 55(6), 757-769.
- Hurst, K. (2007). Does workforce size and mix influence patient satisfaction? *Nursing Standard*, 21(46), 15.

-
- Hyer, K., Temple, A., & Johnson, C. E. (2009). Florida's efforts to improve quality of nursing home care through nurse staffing standards, regulation, and Medicaid reimbursement. *Journal of Aging & Social Policy*, 21(4), 318-337.
- International Council of Nurses. (2006a). *The global nursing shortage: Priority areas for intervention*. Geneva: Author. Retrieved from http://www.icn.ch/images/stories/documents/publications/GNRI/The_Global_Nursing_Shortage-Priority_Areas_for_Intervention.pdf
- International Council of Nurses. (2006b). Safe staffing saves lives: information and action tool kit. Geneva: Author. Retrieved from <http://www.icn.ch/images/stories/documents/publications/ind/indkit2006.pdf>
- International Council of Nurses. (2008). Position statement: Assistive nursing personnel. Geneva: Author. Retrieved from http://www.icn.ch/images/stories/documents/publications/position_statements/B01_Assistive_Support_Nsg_Personnel.pdf
- Intrator, O. & Mor, V. (2004). Effect of state Medicaid reimbursement rates on hospitalizations from nursing homes. *Journal of the American Geriatrics Society*, 52(3), 393-398.
- Intrator, O., Zinn, J., & Mor, V. (2004). Nursing home characteristics and potentially preventable hospitalizations of long-stay residents. *Journal of the American Geriatrics Society*, 52(10), 1730-1736.
- Irvine, D., Sidani, S., & McGillis Hall, L. M. (1998). Finding value in nursing care: A framework for quality improvement and clinical evaluation. *Nursing Economic\$, 16(3)*, 110-116.
- Jiang, H. J., Stocks, C., & Wong, C. J. (2006). Disparities between two common data sources on hospital nurse staffing. *Journal of Nursing Scholarship*, 38(2), 187-193.
- Jones, C., & Gates, M. (2007). The costs and benefits of nurse turnover: A business case for nurse retention. *The Online Journal of Issues in Nursing*, 12(3). Retrieved from <http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TablofContents/Volume122007/No3Sept07/NurseRetention.aspx>
- Jost, S. G., Bonnell, M., Chacko, S. U., & Parkinson, D. L. (2010). Integrated primary nursing: A care delivery model for the 21st-century knowledge worker. *Nursing Administration Quarterly*, 34(3), 208-216.
- Kalisch, B. J., & Aebersold, M. (2006). Overcoming barriers to patient safety. *Nursing Economic\$, 24(3)*, 143-148.
- Kalisch, B. J., Landstrom, G. L., & Hinshaw, A. S. (2009). Missed nursing care: A concept analysis. *Journal of Advanced Nursing*, 65(7), 1509-1517.
- Kane, R. L., Shamliyan, T. A., Mueller, C., Duval, S., & Wilt, T. J. (2007). The association of registered nurse staffing levels and patient outcomes: Systematic review and meta-analysis. *Medical Care*, 45(12), 1195-1204.
- Keepnews, D. M. (2007). Evaluating nurse staffing regulation. *Policy, Politics, & Nursing Practice*, 8(4), 236-237.
- Kim, H., Harrington, C., & Greene, W. H. (2009). Registered nurse staffing mix and quality of care in nursing homes: A longitudinal analysis. *The Gerontologist*, 49(1), 81-90.
- Kimball, B., Joynt, J., Cherner, D., & O'Neil, E. (2007). The quest for new innovative care delivery models. *Journal of Nursing Administration*, 37(9), 392-398.

-
- Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). *To err is human: Building a safer health system*. Washington, D.C.: National Academy of Sciences. Retrieved from <http://www.csen.com/err.pdf>
- Kotnetzka, R. T., Stearns, S. C., & Park, J. (2008). The staffing-outcomes relationship in nursing homes. *Health Services Research*, 43(3), 1025-1042.
- Kramer, M., & Schmalenberg, C. (2005). Revising the Essentials of Magnetism tool: There is more to adequate staffing than numbers. *Journal of Nursing Administration*, 35(4), 188-198.
- Kutney-Lee, A., & Aiken, L. H. (2008). Effect of nurse staffing and education on the outcomes of surgical patients with comorbid serious mental illness. *Psychiatric Services*, 59(12), 1466-1469.
- Lake, E. T., & Cheung, R. B. (2006). Are patient falls and pressure ulcers sensitive to nurse staffing? *Western Journal of Nursing research*, 28(6), 654-677.
- Lamas, K., Willman, A., Lindholm, L., & Jacobsson, C. (2009). Economic evaluation of nursing practices: a review of literature. *International Nursing Review*, 56(1), 13-20.
- Lang, T. A., Hodge, M., Olson, V., Romano, P. S., & Kravitz, R. L. (2004). Nurse-patient ratios: A systematic review on the effects of nurse staffing on patient, nurse employee, and hospital outcomes. *Journal of Nursing Administration*, 34(7/8), 326-337
- Lankshear, A. J., Sheldon, T. A., & Maynard, A. (2005). Nurse staffing and healthcare outcomes — A systematic review of the international research evidence. *Advances in Nursing Science*, 28(2) 163-174.
- Laschinger, H. K., & Leiter, M. P. (2006). The impact of nursing work environments on patient safety outcomes: The mediating role of burnout/engagement. *Journal of Nursing Administration*, 36(5), 259-267.
- LeClerc, C. M., Doyon, J., Gravelle, D., Hall, B., & Roussel, J. (2008). The autonomous-collaborative care model: Meeting the future head on. *Nursing Leadership*, 21(2), 63-75.
- Lichtig, L. K., Knauf, R. A., & Milholland, D. K. (1999). Some impacts of nursing on acute care hospital outcomes. *Journal of Nursing Administration*, 29(2), 25-33.
- Littig, S. J., & Isken, M. W. (2007). Short term hospital occupancy prediction. *Health Care Management Science*, 10(1), 47-66.
- Litvak, E., Buerhaus, P. I., Davidoff, F., Long, M. C., McManus, M. L., & Berwick, D. M. (2005). Managing unnecessary variability in patient demand to reduce nursing stress and improve patient safety. *Joint Commission Journal on Quality and Patient Safety*, 31(6), 330-338.
- Lookinland, S., Tiedeman, M. E., & Crosson A. E. T. (2005). Nontraditional models of care delivery. *Journal of Nursing Administration*, 35(2), 74-80.
- Lucero, R. J. (2008). *Linking outcomes to the quality of the process of nursing care*. (Doctoral dissertation). University of Pennsylvania, Philadelphia.
- Lucero, R. J., Lake, E. T., & Aiken, L. H. (2009). Variations in nursing care quality across hospitals. *Journal of Advanced Nursing*, 65(11), 2299-2310.
- Lyon, J. (1993). Models of nursing care delivery and case management: Clarification of terms. *Nursing Economic\$, 11(3)*, 163-169.

-
- Mark, B. A. (2002). What explains nurses' perceptions of staffing adequacy? *Journal of Nursing Administration*, 32(5), 234-242.
- Mark, B. A. (2006). Methodological issues in nurse staffing research. *Western Journal of Nursing Research*, 28(6), 694-709.
- Mark, B. A., & Harless, D. W. (2010). Nurse staffing and post-surgical complications using the present on admission indicator. *Research in Nursing & Health*, 33(1), 35-47.
- Mark, B. A., Harless, W., McCue, M., & Xu, Y. (2004). A longitudinal examination of hospital registered nurse staffing and quality of care. *Health Services Research*, 39(2), 279-300.
- Mark, B. A., Sayler, J., & Smith, C. S. (1996). A theoretical model for nursing systems outcomes research. *Nursing Administration Quarterly*, 20(4), 12-27.
- Mark, B. A., Sayler, J., & Wan, T. T. (2003). Professional nursing practice: impact on organizational and patient outcomes. *Journal of Nursing Administration*, 33(4), 224-234.
- McCloskey, B. A., & Diers, D. K. (2005). Effects of New Zealand's health reengineering on nursing and patient outcomes. *Medical Care*, 43(11), 1140-1146.
- McGillis Hall, L. (1997). Staff mix models: complementary or substitution roles for nurses. *Nursing Administration Quarterly*, 21(2), 31-39.
- McGillis Hall, L. (2005). Nurse staffing. In L. McGillis Hall (Ed.), *Quality Work Environments for Nurse and Patient Safety* (pp. 9-37). Sudbury, MA: Jones and Bartlett.
- McGillis Hall, L., & Doran, D. (2004). Nurse staffing, care delivery model, and patient care quality. *Journal of Nursing Care Quality*, 19(1), 27-33.
- McGillis Hall, L., & Doran, D. (2007). Nurses' perceptions of hospital work environments. *Journal of Nursing Management*, 15(3), 264-273.
- McGillis Hall, L., Doran, D. I., Baker, G. R., Pink, G., Sidani, S., O'Brien-Pallas, L., & Donner, G. J. (2001). *The impact of nursing staff mix models and organizational change strategies on patient, system and nurse outcomes — A summary report of the nursing staff mix outcomes study*. Toronto: Faculty of Nursing, University of Toronto. Retrieved from http://74.81.206.232/migrated/pdf/researchreports/ogc/mcgillis_report.pdf
- McGillis Hall, L., Doran, D., Baker, G. R., Pink, G., Sidani, S., O'Brien-Pallas, L., & Donner, G. H. (2003). Nurse staffing models as predictors of patient outcomes. *Medical Care*, 41(9), 1096-1109.
- McGillis Hall, L., Doran, D., & Pink, G. H. (2004). Nursing staffing mix models, nursing hours and patient safety outcomes. *Journal of Nursing Administration*, 34(1), 41-45.
- McGillis Hall, L., Peterson, J., Baker, R., Brown, A. D., Pink, G. H., McKillop, I., ... Pederson, C. (2008). Nurse staffing and system integration and change indicators in acute care hospitals: Evidence from a balanced scorecard. *Journal of Nursing Care Quality*, 23(3), 242-250.
- McGillis Hall, L., Pink, L., Lalonde, M., Tomblin Murphy, G., O'Brien-Pallas, L., Laschinger, H., ... Akeroyd, J. (2006). Decision making for nurse staffing: Canadian perspectives. *Policy, Politics, & Nursing Practice*, 7(4), 261-270.
- Meehan, T. C. (2003). Careful nursing: A model for contemporary nursing practice. *Journal of Advanced Nursing*, 44(1), 99-107.

-
- Meyer, J. & Sturdy, D. (2004). Exploring the future of gerontological nursing outcomes. *International Journal of Older People Nursing*, 13(6b), 128-134.
- Meyer, R. M., Wang, S., Li, X., Thomson, D., & O'Brien-Pallas, L. (2009). Evaluation of a patient care delivery model: Patient outcomes in acute cardiac care. *Journal of Nursing Scholarship*, 41(4), 399-410.
- Mitchell, P. (2009). *Nurse staffing — A summary of current research, opinion and policy. A report of the Ruckelshaus Center Nurse Staffing Steering Committee*. Pullman, WA: The William D. Ruckelshaus Center. Retrieved from <http://www.ruckelshauscenter.wsu.edu/projects/documents/NurseStaffingfinal.pdf>
- Mitchell, P. H., Ferketich, S., Jennings, B. M., & American Academy of Nursing Expert Panel on Quality Health Care. (1998). Quality health outcomes model. *Journal of Nursing Scholarship*, 30(1), 43-46.
- Needleman, J. (2008). Is what's good for the patient good for the hospital? Aligning incentives and the business case for nursing. *Policy, Politics, & Nursing Practice*, 9(2), 80-87.
- Needleman, J., Buerhaus, P. L., Mattke, S., Stewart, M., & Zelevinsky, K. (2002). Nurse staffing levels and the quality of care in hospitals. *New England Journal of Medicine*, 346(22), 1715-1722.
- Needleman, J., Buerhaus, P. I., Stewart, M., Zelevinsky, K., & Mattke, S. (2006). Nurse staffing in hospitals: Is there a business case for quality? *Health Affairs*, 25(1), 204-211.
- Needleman, J., Kurtzman, E. T., & Kizer, K. W. (2007). Performance measurement of nursing care: State of the science and the current consensus. *Medical Care Research and Review*, 64(2), 10S-43S.
- Neisner, J., & Raymond, B. (2002). *Nurse staffing and care delivery models: A review of the evidence*. Oakland, CA: Kaiser Permanente Institute for Health Policy. Retrieved from http://xnet.kp.org/ihp/publications/docs/nurse_staffing.pdf
- Nelson, A., Powell-Cope, G., Palacios, P., Luther, S. L., Black, T., Hillman, T., ... Gross, J. C. (2007). Nurse staffing and patient outcomes in inpatient rehabilitation settings. *Rehabilitation Nursing*, 32(5), 179-202.
- Newbold, D. (2008). The production economics of nursing: A discussion paper. *International Journal of Nursing Studies*, 45(1), 120-128.
- Newhouse, R. P., Johantgen, M., Pronovost, P. J., & Johnson, E. (2005). Perioperative nurses and patient outcomes — Mortality, complications and length of stay. *AORN*, 81(3), 508-528.
- O'Brien-Pallas, L., Doran, D. I., Murray, M., Cockerill, R., Sidani, S., Laurie-Shaw, B., & Lochhaas-Gerlach, J. (2001). Evaluation of a client care delivery model, part 1: Variability in nursing utilization in community home nursing. *Nursing Economic\$, 19(6)*, 267-276.
- O'Brien-Pallas, L., Doran, D. I., Murray, M., Cockerill, R., Sidani, S., Laurie-Shaw, B., & Lochhaas-Gerlach, J. (2002). Evaluation of a client care delivery model, part 2: Variability in client outcomes in community home nursing. *Nursing Economic\$, 20(1)*, 13-21, 36.
- O'Brien-Pallas, L., Duffield, C., Tomblin Murphy, G., Birch, S., & Meyer, R. (2005). *Nursing workforce planning: Mapping the policy trail*. Geneva, Switzerland: International Council of Nurses. Retrieved from <http://www.hrhresourcecenter.org/node/621>

-
- O'Brien-Pallas, L., Li, M., Wang, S., Meyer, R. M., & Thomson, D. (2010). Evaluation of a patient care delivery model: System outcomes in acute cardiac care. *Canadian Journal of Nursing Research*, 42(4), 98-120.
- O'Brien-Pallas, L., Meyer, R. M., Hayes, L. J., & Wang, S. (2011). The patient care delivery model — an open system framework: Conceptualisation, literature review and analytical strategy. *Journal of Clinical Nursing*, 20(11), 1640-1650.
- O'Brien-Pallas, L., Thomson, D., McGillis Hall, L., Pink, G., Kerr, M., Wang, S., ... Meyer, R. (2004). *Evidence-based standards for measuring nurse staffing and performance*. Toronto: Canadian Health Services Research Foundation. Retrieved from http://28784.vws.magma.ca/final_research/ogc/pdf/obrien_final.pdf
- O'Brien-Pallas, L., Tomblin Murphy, G., & Shamian, J. (2008). *Final report: Understanding the costs and outcomes of nurses' turnover in Canadian hospitals*. Toronto: Nursing Health Services Research Unit, University of Toronto.
- Oelke, N. D., White, D., Besner, J., Doran, D., McGillis Hall, L., & Giovannetti, P. (2008). Nursing workforce utilization: An examination of facilitators and barriers on scope of practice. *Nursing Leadership*, 21(1), 58-71.
- Page, A. (Ed.). (2004). *Keeping patients safe: Transforming the work environment of nurses*. Washington, DC: National Academy of Sciences. Retrieved from <http://www.iom.edu/Reports/2003/Keeping-Patients-Safe-Transforming-the-Work-Environment-of-Nurses.aspx>
- Palnum, K. D., Andersen, G., Ingeman, A., Krog, B. R., Bartels, P., & Johnsen, S. P. (2009). Sex-related differences in quality of care and short-term mortality among patients with acute stroke in Denmark: A nationwide follow-up study. *Stroke*, 40(4), 1134-1139.
- Park, J., & Stearns, S. C. (2009). Effects of state minimum staffing standards on nursing home staffing and quality of care. *Health Services Research*, 44(1), 56-78.
- Patrician, P. A., Loan, L., McCarthy, M., Fridman, M., Donaldson, N., Bingham, M., & Brosch, L. (2011). The association of shift-level nurse staffing with adverse patient events. *Journal of Nursing Administration*, 41(2), 64-70.
- Pearson, A., O'Brien Pallas, L., Thomson, D., Doucette, E., Tucker, D., Wiechula, R., ... Jordan, Z. (2006). Systematic review of evidence on the impact of nursing workload and staffing on establishing healthy work environments. *International Journal of Evidence Based Healthcare*, 4(4), 337-384.
- Person, S. D., Allison, J. J., Kiefe, C. I., Weaver, M. T., Williams, O. D., Centor, R. M., & Weissman, N. (2004). Nurse staffing and mortality for Medicare patients with acute myocardial infarction. *Medical Care*, 42(1), 4-12.
- Preston, B. (2009). The Australian nurse and midwifery workforce: issues, developments and the future. *Collegian*, 16(1), 25-34.
- Rafferty, A. M., Clarke, S. P., Coles, J., Ball, J., James, P., McKee, M., & Aiken, L. (2007). Outcomes of variation in hospital nurse staffing in English hospitals: Cross-sectional analysis of survey data and discharge records. *International Journal of Nursing Studies*, 44(2), 175-182.
- Rahman, A., Straker, J., & Manning, L. (2009). Staff assignment practices in nursing homes: Review of the literature. *Journal of the American Medical Directors Association*, 10(1), 4-10.

-
- Rantz, M. J., Hicks, L., Grando, V., Petroski, G. F., Madsen, R. W., Mehr, D. R., ... Maas, M. (2004). Nursing home quality, cost, staffing and staff mix. *The Gerontologist*, 44(1), 24-38.
- Registered Nurses' Association of Ontario. (2007). *Developing and sustaining effective staffing and workload practices*. Toronto: Author. Retrieved from http://www.rnao.org/Storage/35/2935_BPG_Staffing_Workload.pdf
- Ridley, R. T. (2008). The relationship between nurse education level and patient safety: An integrative review. *Journal of Nursing Education*, 47(4), 149-156.
- Rischbieth, A. (2006). Matching nurse skill with patient acuity in the intensive care units: A risk management mandate. *Journal of Nursing Management*, 14(5), 397-404.
- Rogers, A. E., Hwang, W., Scott, L. D., Aiken, L. H., & Dinges, D. F. (2004). The working hours of hospital staff nurses and patient safety. *Health Affairs*, 23(4), 202-212.
- Rondeau, K. V., Williams, E. S., & Wagar, T. H. (2009). Developing human capital: What is the impact on nurse turnover? *Journal of Nursing Management*, 17(6), 739-748.
- Rothberg, M. B., Abraham, I., Lindenauer, P. K., & Rose, D. N. (2005). Improving nurse-to-patient staffing ratios as a cost effective safety intervention. *Medical Care*, 43(8), 785-791.
- Sales, A., Sharp, N., Li, Y. F., Lowy, E., Greiner, G., Liu, C. F., ... Needleman, J. (2008). The association between nursing factors and patient mortality in the veterans health administration: The view from the nursing unit level. *Medical Care*, 46(9), 938-945.
- Saskatchewan Registered Nurses' Association. (2004). *Practice of nursing: RN assignment and delegation*. Regina: Author. Retrieved from http://www.srna.org/images/stories/pdfs/nurse_resources/2004_RN_assignment_delegation.pdf
- Schalk, D. M. J., Bijl, M. L. P., Halfens, R. J. G., Hollands, L., & Cummings, G. G. (2010). Interventions aimed at improving the nursing work environment: A systematic review. *Implementation Science*, 5, 34.
- Scott-Cawiezell, J., Main, D. S., Vojir, C. P., Jones, K., Moore, L., Nutting, P. A., ... Pennington, K. (2005). Linking nursing home working conditions to organizational performance. *Health Care Management Review*, 30(4), 372-380.
- Seago, J. A., Spetz, J., Chapman, S. & Dyer, W (2006). Can the use of LPNs alleviate the nursing shortage? *American Journal of Nursing*, 106(7), 40-49.
- Seago, J. A., Spetz, J., & Mitchell, S. (2004). Nurse staffing and hospital ownership in California. *Journal of Nursing Administration*, 34(5), 228-237.
- Seago, J. A., Williamson, A., & Atwood, C. (2006). Longitudinal analyses of nurse staffing and patient outcomes: More about failure to rescue. *Journal of Nursing Administration*, 36(1), 13-21.
- Sexton, J. B., Hozmueller, C., Pronovost, P. J., Thomas, E. J., McFerran, S., Nunes, J., ... Fox, H. E. (2006). Variations in caregiver perceptions of teamwork climate in labor and delivery units. *Journal of Perinatology*, 26(8), 463-470.
- Shamliyan, T. A., Kane, R. L., Mueller, C., Duval, S., & Wilt, T. J. (2009). Cost savings associated with increased RN staffing in acute care hospitals: Simulation exercise. *Nursing Economic\$,* 27(5), 302-331.

-
- Sibbald, B., Shen, J., & McBride, A. (2004). Changing the skill-mix of the health care workforce. *Journal of Health Services Research Policy*, 9(Supplement 1), 28-38.
- Sidani, S., Doran, D. M., & Mitchell, P. H. (2004). A theory-driven approach to evaluating quality of nursing care. *Journal of Nursing Scholarship*, 36(1), 60-65.
- Skillings, L. N., & MacLeod, D. (2009). The patient care coordinator role: An innovative delivery model for transforming acute care and improving patient outcomes. *Nursing Administration Quarterly*, 33(4), 296-300.
- Smith, D. S., & Dabbs, M. T. (2007). Transforming the care delivery model in preparation for the clinical nurse leader. *Journal of Nursing Administration*, 37(4), 157-160.
- Smith, J., Forde, V., Goodman, M., Cannaby, A. M., & Radford, M. (2009). How to keep score of acuity and dependency. *Nursing Management*, 16(8), 14-19.
- Smith, S., Manfredi, T., Hagos, O., Drummond-Huth, B., & Moore, P. D. (2006). Application of the clinical nurse leader role in an acute care delivery model. *Journal of Nursing Administration*, 36(1), 29-33.
- Sochalski, J. (2004). Is more better? The relationship between nurse staffing and quality of nursing care in hospitals. *Medical Care*, 42(2, Supplement), II-67-II-73.
- Sochalski, J., Aiken, L. H., & Fagin, C. M. (1997). Hospital restructuring in the United States, Canada, and Western Europe: An outcomes research agenda. *Medical Care*, 35(10, Supplement), OS13-OS25.
- Spetz, J. (2004). California's minimum nurse-to-patient ratios: The first few months. *Journal of Nursing Administration*, 34(12), 571-578.
- Spetz, J. (2008). Nurse satisfaction and the implementation of minimum nurse staffing regulations. *Policy, Politics, & Nursing Practice*, 9(1), 15-21.
- Spetz, J., Donaldson, N., Aydin, C., & Brown D. S. (2008). How many nurses per patient? Measurements of nurse staffing in health services research. *Health Research and Educational Trust*, 43(5) (Part 1), 1674-1692.
- Stone, P. W., Mooney-Kane, C., Larson, E. L., Horan, T., Glance, L., Zwanziger, J., & Dick, A. (2007). Nurse working conditions and patient safety outcomes. *Medical Care*, 45(6), 571-578.
- Storfjell, J. L., Ohlson, S., Omoike, O., Fitzpatrick, T., & Wetasin, K. (2009). Non-value-added time: The million dollar nursing opportunity. *Journal of Nursing Administration*, 39(1), 38-45.
- Stratton, K. M. (2005). *The relationship between pediatric nurse staffing and quality of care in the hospital setting* (Doctoral dissertation). University of Colorado, Denver.
- Tervo-Heikkinen, T., Kvist, T., Partanen, P., Vehviläinen-Julkunen, K., & Aalto, P. (2008). Patient satisfaction as a positive nursing outcome. *Journal of Nursing Care Quality*, 23(1), 58-65.
- Thungjaroenkul, P., Cummings, G. G., & Embleton, A. (2007). The impact of nurse staffing on hospital costs and patient length of stay: A systematic review. *Nursing Economic*, 25(5), 255-265.
- Tiedeman, M. E., & Lookinland, S. (2004). Traditional models of care delivery: What have we learned? *Journal of Nursing Administration*, 34(6), 291-297.

-
- Titler, M., Dochterman, J., Kim, T., Kanak, M., Shever, L., Picone, D. M., ... Budreau, G. (2007). Cost of care for seniors hospitalized for hip fracture and related procedures. *Nursing Outlook*, 55(1), 5-14.
- Titler, M., Dochterman, J., Xie, X., Kanak, M., Fei, Q., Picone, D. M., & Shever, L. (2006). Nursing interventions and other factors associated with discharge disposition in older patients after hip fractures. *Nursing Research*, 55(4), 231-242.
- Tomblin Murphy, G., Alder, R., MacKenzie, A., & Rigby, J. (2010). *Model of care initiative in Nova Scotia (MOCINS): Final evaluation report*. Nova Scotia Department of Health & Wellness. Retrieved from <http://www.gov.ns.ca/health/MOCINS/docs/MOCINS-evaluation-report.pdf>
- Tourangeau, A. E., Cranley, L. A., & Jeffs, L. (2006). Impact of nursing on hospital patient mortality: A focused review and related policy implications. *British Medical Journal: Quality & Safety in Health Care*, 15(1), 4-8.
- Tourangeau, A. E., Doran, D. M., McGillis Hall, L., O'Brien Pallas, L., Pringle, D., Tu, J. V., & Cranley, L. A. (2006). Impact of hospital nursing care on 30-day mortality for acute medical patients. *Journal of Advanced Nursing*, 57(1), 32-44.
- Tourangeau, A. E., Giovannetti, P., Tu, J. V., & Wood, M. (2002). Nursing-related determinants of 30-day mortality for hospitalized patients. *Canadian Journal of Nursing Research*, 33(4), 71-88.
- Tran, D. T., Johnson, M., Fernandez, R., & Jones, S. (2010). A shared care model vs. a patient allocation model of nursing care delivery: Comparing nursing staff satisfaction and stress outcomes. *International Journal of Nursing Practice*, 16(2), 148-158.
- Tschannen, D., & Kalisch, B. J. (2008). The effect of variation in nurse staffing on patient length of stay in the acute care setting. *Western Journal of Nursing Research*, 31(2), 153-170.
- Unruh, L. Y. (2000). *The impact of hospital nurse staffing on the quality of patient care* (Doctoral dissertation). University of Notre Dame, Notre Dame, IN.
- Unruh, L. (2008). Nurse staffing and patient, nurse, and financial outcomes. *American Journal of Nursing*, 108 (1), 62-71.
- Van den Heede, K., Clarke, S. P., Sermeus, W., Vleugels, A., & Aiken, L. H. (2007). International experts' perspectives on the state of the nurse staffing and patient outcomes literature. *Journal of Nursing Scholarship*, 39(4), 290-297.
- Van den Heede, K., Lesaffre, E., Diya, L., Vleugels, A., Clarke, S. P., Aiken, L. H., & Sermeus, W. (2008). The relationship between inpatient cardiac surgery mortality and nurse numbers and educational level: Analysis of administrative data. *International Journal of Nursing Studies*, 46(6), 796-803.
- Van den Heede, K., Sermeus, W., Diya, L., Clarke, S. P., Lesaffre, E., Vleugels, A., & Aiken, L. H. (2009). Nurse staffing and patient outcomes in Belgian acute hospitals: Cross-sectional analysis of administrative data. *International Journal of Nursing Studies*, 46(7), 928-939.
- Venturato, L., & Drew, L. (2010). Beyond 'doing': Supporting clinical leadership and nursing practice in aged care through innovative models of care. *Contemporary Nurse*, 35(2), 157-170.
- Vlasses, F. R., & Smeltzer, C. H. (2007). Toward a new future for healthcare and nursing practice. *Journal of Nursing Administration*, 37(9), 375-380.

-
- Wagner, D., & Bear, M. (2009) Patient satisfaction with nursing care: A concept analysis within a nursing framework. *Journal of Advanced Nursing*, 65(3), 692-701.
- Weech-Maldonado, R. Meret-Hanke, L., Neff, M. C., & Mor, V. (2004) Nurse staffing patterns and quality of care in nursing homes. *Health Care Management Review*, 29(2), 107-116.
- Weiss, M. E., Piacentine, L. B., Lokken, L., Ancona, J., Archer, J., Gresser, S., ... Vega-Stromberg, T. (2007). Perceived readiness for hospital discharge in adult medical-surgical patients. *Clinical Nurse Specialist*, 21(1), 31-42.
- Welton, J. M, Unruh, L., & Halloran, E. J. (2006). Nurse staffing, nursing intensity, staff mix, and direct nursing care costs across Massachusetts hospitals. *Journal of Nursing Administration*, 36(9), 416-425.
- White, D., Jackson, K., Besner, J., Suter, E., Doran, D., McGillis Hall, L., & Parent, K. (2009). *Enhancing nursing role effectiveness through job redesign: Final Report*. Calgary: Alberta Health Services. Retrieved from <http://www.calgaryhealthregion.ca/hswru/documents/reports/JobRedesignReportFeb2009.pdf>
- White, D., Oelke, N. D., Besner, J., Doran, D., McGillis Hall, L., & Giovannetti, P. (2008). Nursing scope of practice: Descriptions and challenges. *Nursing Leadership*, 21(1), 44-57.
- Wiggins, M. S. (2008). The partnership care delivery model: An examination of the core concept and the need for a new model of care. *Journal of Nursing Management*, 16(5), 629-638.
- World Health Organization. (2006). *The world health report 2006 – Working together for health*. Geneva: Author. Retrieved from http://www.who.int/whr/2006/whr06_en.pdf.
- World Health Organization. (2008). *Task shifting: Global recommendations and guidelines*. Geneva: Author. Retrieved from <http://www.who.int/healthsystems/TTR-TaskShifting.pdf>.
- Wunderlich, G. S., Sloan, F. A., & Davis, C. K. (Eds.). (1996). *Nursing staff in hospitals and nursing homes: Is it adequate?* Washington, D.C.: National Academies Press.
- Zhang, N. J., Unruh, L., Liu, R., & Wan, T. (2006). Minimum nurse staffing ratios for nursing homes. *Nursing Economic\$,* 24(2), 78-93.
- Zhang, X., & Grabowski, D. C. (2004). Nursing home staffing and quality under the nursing home reform act. *The Gerontologist*, 44(1), 13-23.
- Zimmerman, B. I. (2007). *Comparing functional and team nursing models of care delivery on patient outcomes* (Master's thesis). Mountain State University, Beckley, West Virginia.



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