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REVIEW ARTICLE

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Nursing-sensitive indicators for nursing care: A systematic review (1997–2017)

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Abstract

Aim: To provide a systematic review of the literature from 1997 to 2017 on nursing-sensitive indicators.

Design: A qualitative design with a deductive approach was used.

Data sources: Original and Grey Literature references from Cochrane Library, Medline/PubMed, Embase, and CINAHL, Google Scholar Original and Grey Literature.

Review methods: Quality assessment was performed using the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.

Results: A total of 3,633 articles were identified, and thirty-nine studies met the inclusion criteria. The quantitative assessment of investigated relationships in these studies suggests that nursing staffing, mortality, and nosocomial infections were the most frequently reported nursing-sensitive indicators.

Conclusion: This review provides a comprehensive list of nursing-sensitive indicators, their frequency of use, and the associations between these indicators and various outcome variables. Stakeholders of nursing research may use the findings to streamline the indicator development efforts and standardization of nursing-sensitive indicators.

Impact: This review provides evidence-based results that health organizations can benefit from nursing care quality.

KEYWORDS

care, indicator, nursing, nursing outcomes, nursing-sensitive indicator

1 | INTRODUCTION

There has been growing interest in the implications of evidence-based nursing care on patient outcomes, which are essential in highlighting the value of nursing care (Blegen et al., 2011; Dubois et al., 2013; Needleman et al., 2007; Patrician et al., 2010). The demand for efficiency in health care has led to significant and frequent changes, such as the restructuring of hospital care through staffing strategies (Duffield et al., 2007; Kane et al., 2007; Montalvo, 2007).

Considering that a large part of the health expenditure is attributed to staffing costs and nurses constitute the majority of healthcare workers, it is imperative to understand the relationship between cost and quality. While policymakers plan more investment in qualified nurses in some areas of the world as part of the strategy to improve quality of care, in other parts, they chose to replace a skilled nursing workforce with less paid staff assistants (Lankshear et al., 2005). For this reason, the evidence of quality care is increasingly being questioned, and the nurses, like all

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health professionals, thrust to demonstrate the value of their care (Haberfelde et al., 2005). In this respect, nursing research has led to the question of whether nurses make a difference in patient care, what these differences are, and how to ameliorate these differences based on evidence (Alexander, 2007; Patrician et al., 2010).

Examining the care indicators is an important pre-condition before evaluating the quality of nursing care (Burston et al., 2013). In the international literature, it is seen that academics examine this subject in various parts of the world, such as Australia, Canada, China, UK and USA (Driscoll et al., 2018; Dubois et al., 2013; Kane et al., 2007; Lang et al., 2004; Lankshear et al., 2005; Liao et al., 2016; Myers et al., 2018). In this context, one of the most comprehensive two reviews that aimed to generate a pool of nursing-sensitive indicators included studies through 2008 (Dubois et al., 2013). The other comprehensive review, however, focused on nursing-sensitive indicators only in stand-alone high acuity areas (Myers et al., 2018). All of the other systematic reviews had a specific focus, such as nurse staffing (Kane et al., 2007; Lang et al., 2004; Lankshear et al., 2005), nurse education (Liao et al., 2016) or nurse-to-patient ratios (Driscoll et al., 2018). Therefore, there is a need for an updated, comprehensive systematic review that provides encompassing evidence on the implications of nursing-sensitive indicators. This systematic review addresses the niche by reviewing 20 years of literature and summarizing the findings.

What problem did the study address?

- Monitoring patient outcomes associated with the quality of nursing care in both general and acute areas is essential; however, there is a need for a comprehensive review of nursing-sensitive indicators.
- This systematic review addresses this need by encompassing studies investigating nursing-sensitive indicators in both general and acute care hospitals within the last twenty years (1997–2017).

What were the main findings?

- The most frequently used terms were patient outcomes, nursing staffing, mortality, adverse event, medication error, pneumonia, failure to rescue and pressure ulcer in the summaries of the studies of nursing-sensitive indicators in the last twenty years.
- The independent variables that exhibited the most consistent results were the ratio of patients to Register Nurses' (RNs), Register Nurse (RN) proportion and nurse education within all the nursing-sensitive indicators. The dependent variables that exhibited the most consistent results were mortality and nosocomial infections within all the nursing-sensitive indicators.
- The high numbers and similarity of nursing-sensitive indicators call for better standardization efforts of nursing-sensitive indicators

Where and on whom will the research have an impact?

- This review provides evidence-based results that health organizations can benefit in their nursing care-focused quality improvement efforts.
- This review demonstrates that the areas open to further research related to the implications of nursing-sensitive indicators on quality.

1.1 | Background

Nursing-sensitive indicators are the criteria for changes in health status that nursing care can directly affect (Joint Commission International, 2014; Nakrem et al., 2009). Nursing-sensitive indicators have been increasingly adopted as valid and reliable tools due to their features such as objective assessment, improvement of clinical practice, evaluation of nursing care quality and performance, and informed decision-making capability for patients in selecting a hospital to receive care (Bazzoli et al., 2003; Doran et al., 2011; Heslop & Lu, 2014; Patrician et al., 2010).

The use of nursing-sensitive indicators affects the outcomes of nursing care by defining the structure and processes of nursing care (Furukawa et al., 2011; Garcia & Fugulin, 2012). These indicators are specific to nursing and have become an area of intense interest since the middle of the 1990s (Montalvo, 2007). Although considerable research has been devoted to the evaluation of nursing care, the literature generally consists of empirical studies focusing on one or a few criteria (Aiken et al., 2002; Dunton et al., 2004, 2007; Needleman et al., 2011; Park et al., 2014; Sujijantararat et al., 2005). For this reason, systematic literature reviews on the most popular nursing-sensitive indicators such as hospital-acquired infections, mortality, failure to rescue, patient, falls, pressure ulcer, medication administration errors, length of stay, patient satisfaction, nurse satisfaction are needed to view the implications of nursing care from a complete perspective (Lankshear et al., 2005). Even though there are several systematic reviews on nursing-sensitive indicators (Audet et al., 2018; Driscoll et al., 2018; Dubois et al., 2013; Kane et al., 2007; Lang et al., 2004; Lankshear et al., 2005; Liao et al., 2016; Myers et al., 2018), the majority of these reviews had focused on specific indicators instead of generating a more comprehensive view. Therefore, there is a need for a comprehensive systematic review that focuses on nursing-sensitive indicators in both general and acute areas.

This systematic review uses the conceptual framework developed by combining based on the Donabedian model, The National Quality Forum (NQF), and American Nurses Association's (ANA) frameworks (ANA, 1995; Donabedian, 1980; NQF, 2004). In the conceptual framework (Figure 1), indicators of acute care nursing quality were

combined into four main categories: Organizational-focused structural indicators; nursing-focused process/intervention indicators; nurse-focused outcome indicators; patient-focused outcome indicators (ANA, 1995; Donabedian, 1980; NQF, 2004). In health services, the Donabedian Model is often used to conceptualize and evaluate quality. Donabedian (1980) describes the measures of quality as structure, process and outcomes (Donabedian, 1980). Donabedian's point of view is substantially linear, and it has a dynamic loop, which assumes that the structure influences the processes and thus affects the outcomes (Donabedian, 1988; Mitchell et al., 1998). Structure refers to how the delivery of health services is organized, including distribution, and qualification of professional personnel, number of staff and resources. Process refers to the interactions between the patients and providers about how things work in an organization (Sidani et al., 2004). Outcomes are the effects of health care on the health status of patients (Donabedian, 1988). ANA has launched some initiatives to reveal the contributions of nursing to patient outcomes based on Donabedian's model. In 1994, ANA initiated the Safety and Quality Initiative to identify the impact of Register Nurses' (RNs) care on patient outcomes (ANA, 1995). To this end, the NQF, a non-profit and voluntary consensus standard-setting organization, has been formed by federal and state governments, and private sector organizations, including the ANA. The NQF serves as an essential driving force to provide the primary standards to measure and report the quality and efficiency of healthcare in the United States. With the support of ANA, a framework to measure nursing care performance was established, and nursing-sensitive indicators were endorsed by the NQF to assess the quality of nursing in acute care hospitals (NQF, 2004). In summary, the conceptual framework of this review, which is exhibited in Figure 1, combines the nursing-sensitive quality indicators from ANA and NQF into the Donabedian framework (the most commonly utilized dependent-independent variables and their frequencies based on the number of articles are provided in Appendix A and B).

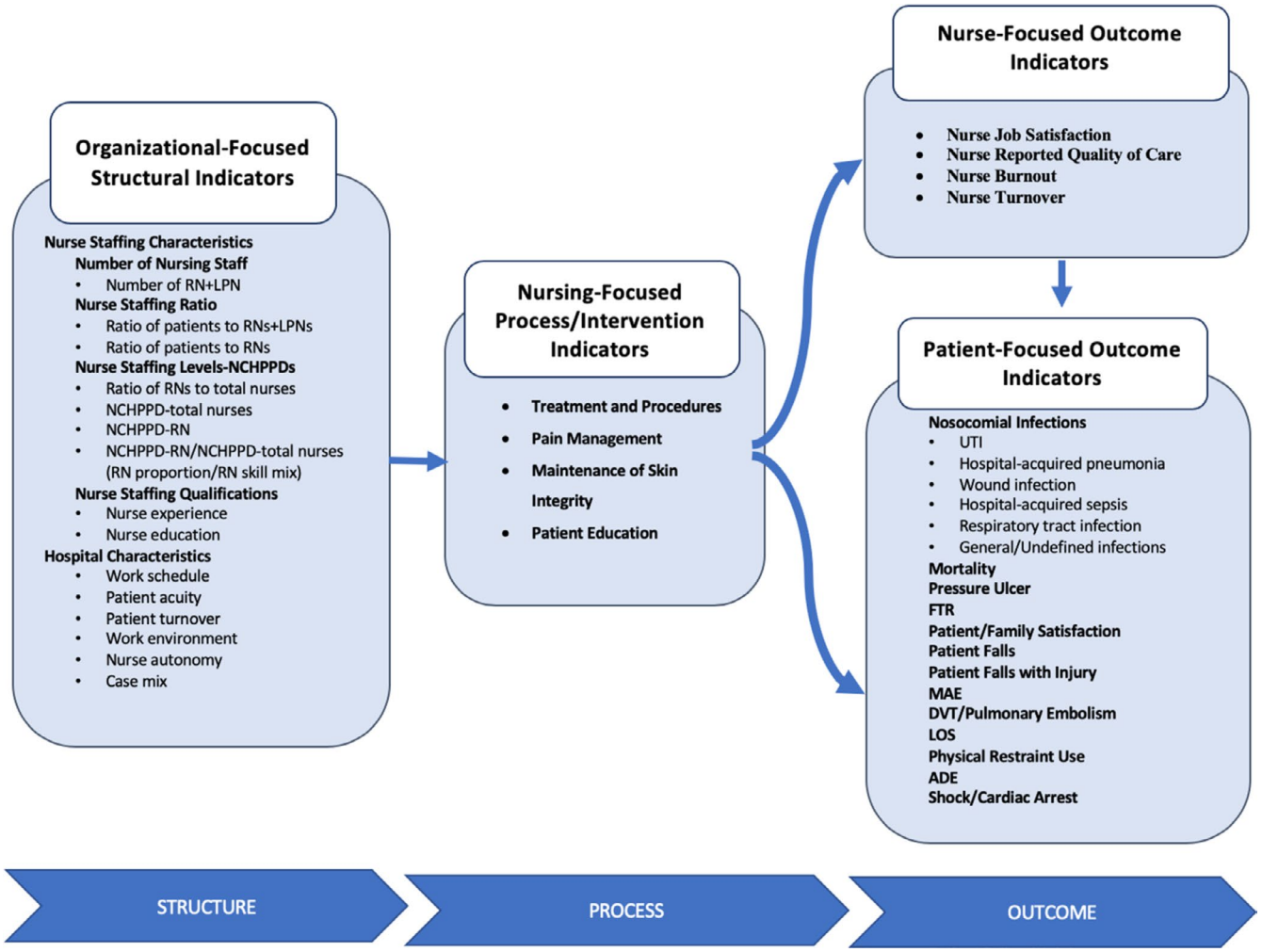


FIGURE 1 Conceptual framework. Developed by combining Donabedian's model, The National Quality Forum, and American Nurses Association frameworks (ANA, 1995; Donabedian, 1980; NQF, 2004). ADE, Adverse Drug Events; DVT, Deep Venous Thrombosis; FTR, Failure to Rescue; LOS, Length of Stay; MAE, Medication Administration Error; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; LPN/LVN, Licensed Practical/Vocational Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel; UTI, Urinary Tract Infection. Work schedule refers to the night shift, missed work hours

2 | THE REVIEW

2.1 | Aims

This review aims to provide a systematic review of the literature from 1997 to 2017 on nursing-sensitive indicators. This study aims to present a comprehensive perspective over the last two decades, mapping the relationships among all dependent and independent variables in the reviewed studies.

The following research questions guide this review:

1. What are the nursing-sensitive indicators that are used as the determinants of assessment of nursing care in the reviewed studies?
2. What are the significant findings regarding the relationship between nursing-sensitive indicators?
3. What are the implications of nursing-sensitive indicators on quality?

2.2 | Design

This systematic review used a qualitative design with a deductive approach (Elo & Kyngäs, 2008) and articles published in scientific journals as data.

2.3 | Search methods

As a methodological approach for this systematic review, we utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). The publications to be included in the study were determined using the PRISMA guidelines. According to the PRISMA guidelines, four sections were used, including identification, screening, eligibility and included.

2.3.1 | Identification section

The literature search involved three stages. First, we determined the keywords by using the systematic reviews (Dubois et al., 2013; Kane et al., 2007; Lang et al., 2004; Lankshear et al., 2005), and second, two nursing researchers' expertise (26-year career with the US Army Nurse Corps and 12-year academic career; a 12-year career with the university hospital and 8-year academic career) in nursing and nursing-sensitive indicators. To confirm the comprehensive of our keyword list, we compared our list to the ones used in some recent reviews such as Liao et al. (2016), Audet et al. (2018), Driscoll et al. (2018), and Myers et al., (2018). We concluded that the list of keywords was comprehensive to identify the literature on nursing-sensitive indicators. The final keyword combinations consisted the following: (a) nursing care/quality indicator/criteria/standard, (b) nursing-sensitive patient outcome/output, (c) nursing care performance measurement/evaluation/assessment/measure, and (d) nursing-sensitive care. Second, multiple searches were performed by using Boolean operators (OR, AND) in several search engines, including Cochrane Library, Medline/PubMed, Embase and CINAHL. Also, Google Scholar Original and Grey Literature databases were scanned to not to miss any existing literature. Third, publications were filtered to those that were published between January 1997 and December 2017 written in the English language, in a peer-reviewed journal and having the predetermined keywords in the abstract or title. A total of 3,633 articles were identified from these searches, including (Figure 2). All titles and abstracts (n = 3,633) were downloaded to Thomson Reuters' EndNote Reference Management Tool. After the exclusion of 1,197 duplicates, 2,436 articles remained for further review.

2.3.2 | Screening section

Firstly, the criteria for exclusion/inclusion were used by reviewing titles and then reviewing the abstracts: (a) exclusions of studies that were not published in English/the studies that the full-text/abstracts were not available; (b) removal of publications that were not relevant to nursing-sensitive indicators (i.e. related to general medicine, diseases, treatments/drugs, medical diagnosis/devices); (c) exclusion of publications addressing a specific nursing field/a disease (i.e. related to maternal/child health, psychiatric/mental health, dental health, oncology, geriatric health, infection control, home care); (d) exclusion of publications that were related to specific medical/nursing intervention/medication (e.g. utilization of different medications/therapeutic ultrasound to treat the pressure ulcer, use of hyperbaric therapy for tissue injury), nursing management/quality, nursing education; (e) elimination of studies that were not published in a peer-reviewed journals (e.g. congress/symposium papers)/were not empirical such as letters, cases, reports, editorials, anecdotal. Another author repeated all these steps were repeated in a different EndNote file, and differences were compared and resolved. Ultimately, the use of a priori criteria resulted in 144 full-text publications to be examined.

2.3.3 | Eligibility section

The full-text review of publications resulted in the further exclusion of manuscripts that were literature reviews, systematic reviews, descriptive studies, non-empirical reports, method papers, and studies that are identifying quality indicators.

2.3.4 | Included section

39 empirical publications, to be examined in detailed full text, have been identified.

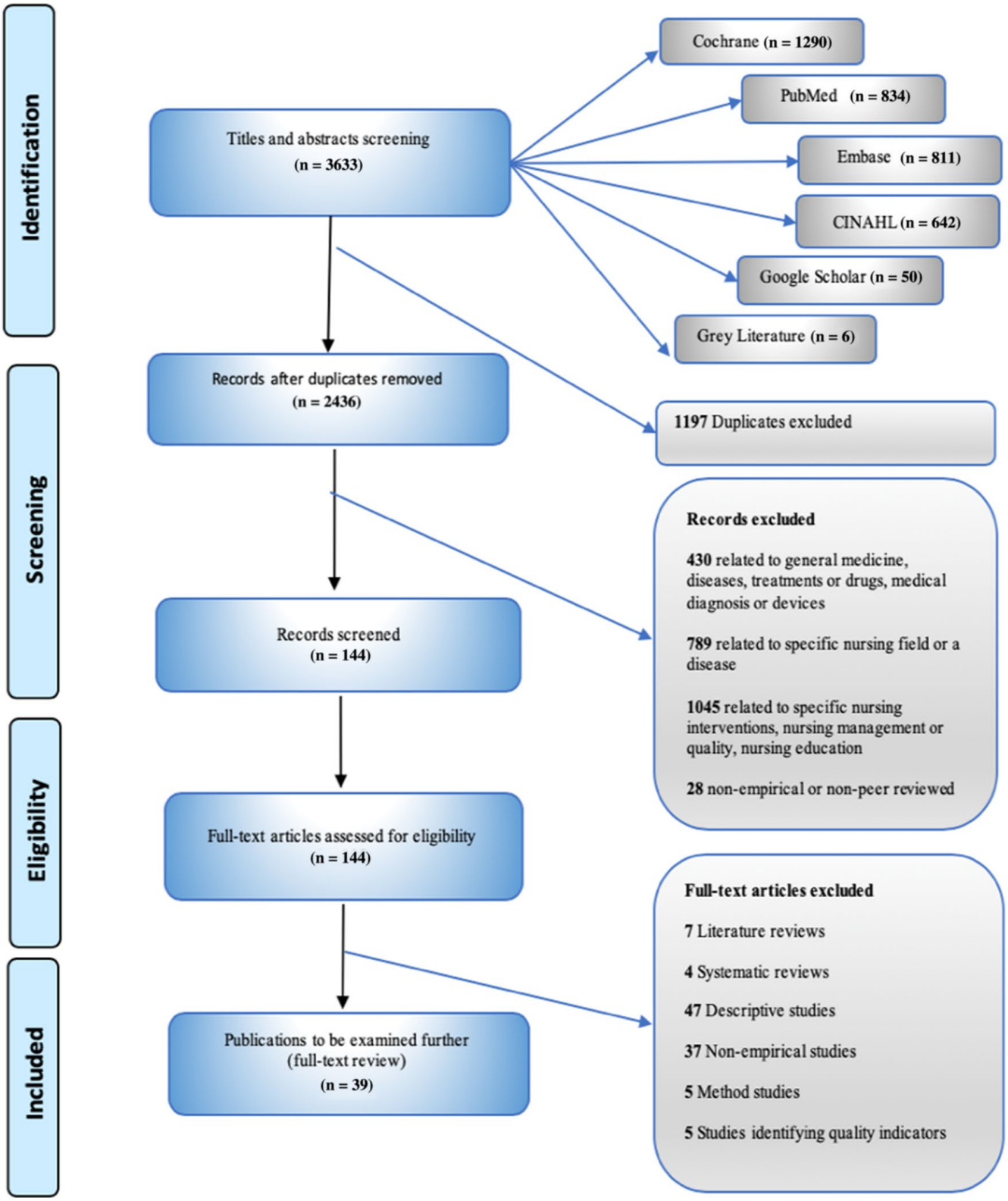


FIGURE 2 Flow diagram of included studies. Composed using the PRISMA Flow Diagram (Moher et al., 2009)

2.4 | Search outcome

The yield of the combined database searches identified 3,633 articles. After deliberation by two review authors, 39 studies met the inclusion criteria for the review (Figure 2).

2.5 | Quality appraisal

In order to evaluate the methodological strength and risk of bias in 39 studies included in the review, the National Institutes of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Heart, Lung, & Blood Institute, 2014) was used. The National Institutes of Health (NIH) Quality Assessment Tool consists of a checklist of 14 questions designed to assess the internal validity (potential risk of selection, information, or measurement bias, or confounding) of cross-sectional and cohort studies. All criteria were answered as "yes," "no," "not applicable" or "not reported." Each included study was rated as good, fair or poor quality based on the quality rating guidance document provided along with the assessment tool (Appendix C). The final studies (39 articles) that met the inclusion criteria to be considered in this review were independently assessed for quality using both tools by two authors (NO and BO). All of the included 39 studies met the inclusion standard of the appraisal tools. If there were any disagreements, it was resolved through discussions until a consensus was reached.

2.6 | Data abstraction

The content analysis was applied for the remaining 39 publications, and coding worksheets with drop-down menus were created in Microsoft Excel 2016. These coding sheets captured general information as well as the information on the relationships between each independent and dependent nursing measures in all of the 39 studies. The significance level was accepted as ($p \leq .05$), and dependent and independent variables having p-value determined above this value were not included in this review. Term lists for coding files were created using each statistically significant dependent and independent variables separately. In this review, we also used JMP 13.1 and the Tableau program for content analysis, coding and analysis, such as cross-tabulations, descriptive statistics, frequencies, summary tables and charts. The coding was performed by the first and third authors, and the second author audited the coded information (Elo & Kyngäs, 2008).

Even though there were only 39 studies in this systematic review, we recorded a total of 624 relationships in the coding sheet given that each study used a multitude of independent variables and some of the studies used more than one dependent variables, analytical approaches and facility type or hospital unit type (Appendix D). For example, Patrician et al. (2011) explored the implications of nine different independent variables on injury falls within 13 different hospitals, which led to a total of 27 explored relationships. Providing information on all these 624 relationships would make this review very lengthy and challenging to interpret. Therefore, we first decided to focus on the most frequently used dependent variables under the sub-category of organizational-focused structure indicators, nursing-focused process/intervention indicators, nurse-focused outcome indicators and patient-focused outcome indicators (Appendix A). This approach allowed us to reduce the numbers of relationships to more manageable levels. However, due to the large numbers of independent variables in these 39 studies, we also had to make some selection among the independent variables. For the independent variables, again, we investigated the frequency of use of these independent variables under sub-categories of organizational-focused structure indicators, nursing-focused process/intervention indicators, nurse-focused outcome indicators and patient-focused outcome indicators. If a particular frequency of an independent variable was larger than 10 per cent, we included them in the Tableau program and reported the results in Figures 5–11.

2.7 | Synthesis

The information in the coding sheet was used to generate the qualitative summary table and quantitative descriptive table. These coding sheets included the following column titles: author, year published, data beginning year, data ending year, study objective, sample size, design (cross-sectional, longitudinal), sample location (rural, urban, or not limited to a subgroup), sample level (national, multiple states, single state), the independent variables, nursing indicators (dependent variables), analysis type and key findings related to nursing indicators (Oner et al., 2016).

3 | RESULTS

Table 1 presents the descriptive statistics for 39 included studies related to nursing-sensitive indicators. Approximately 72% of the publications appeared in nursing journals. It is seen that 74% of the articles are made in the USA, 74% of them have a cross-sectional design, and 69% of them are applied in general hospitals.

3.1 | Frequency of explored relationships

Figure 3 shows the frequency distribution of nursing-sensitive indicators in the studies examined by showing the relationships between the dependent and independent variables. A higher frequency of explored relationships is indicated with darker colours. Figure 3 clearly shows that nurse staffing levels were the most frequently explored independent variables, whereas mortality was the most frequently explored dependent variable. In most of the studies, the relationship between nosocomial infections, mortality, and pressure ulcer and nurse staffing levels was examined.

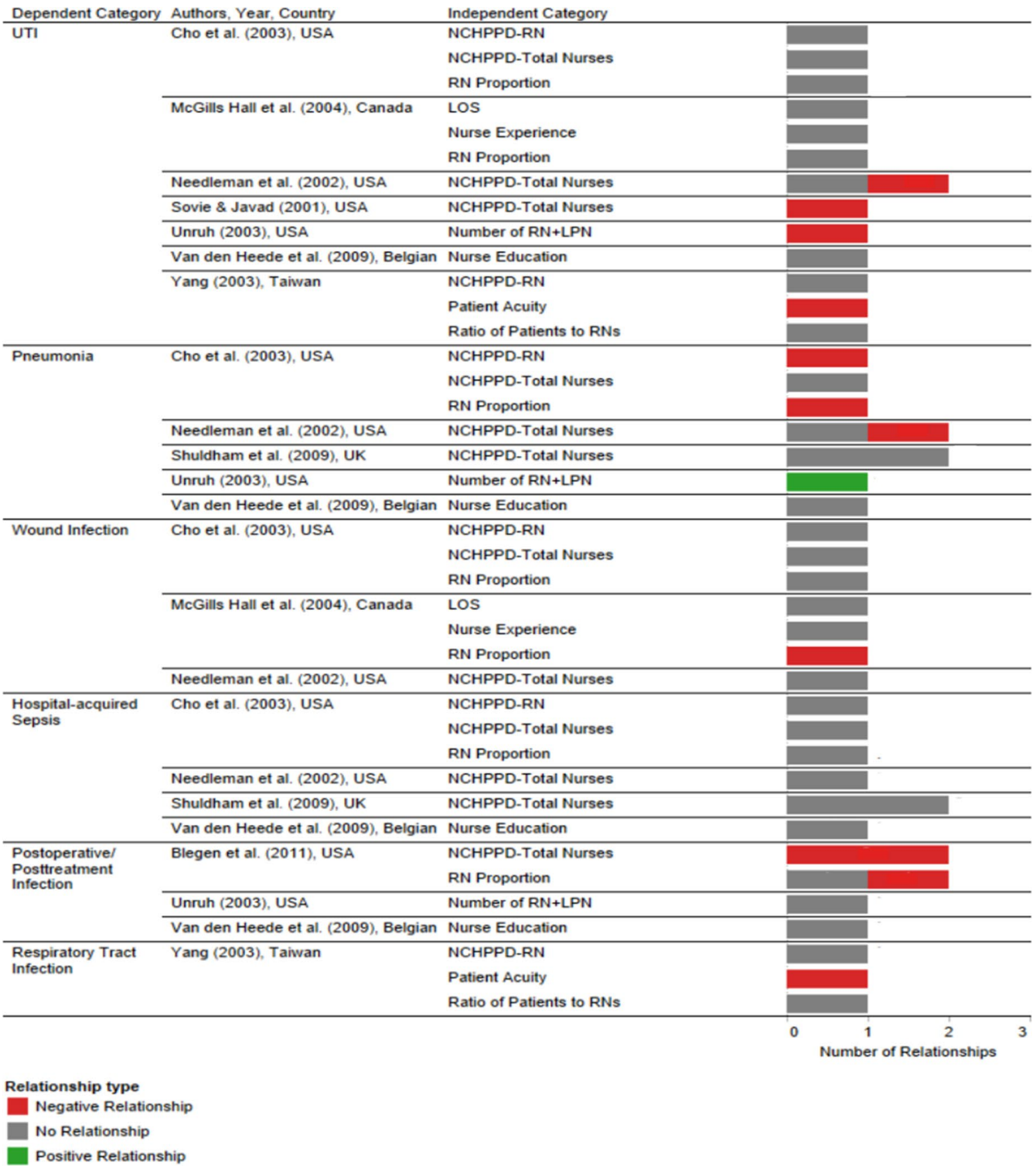


FIGURE 5 Patient-focused outcome indicators—urinary tract infection (UTI), pneumonia, wound infection, hospital-acquired sepsis, postoperative/posttreatment infection, respiratory tract infection. LOS, Length of Stay; LPN, Licensed Practical Nurse; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel; UTI, Urinary Tract Infection

Figure 4 word cloud exhibits the content analysis results of the 39 abstracts that were included in this systematic review. Given that these abstracts were selected through a systematic process, the content, particularly the terms that are used in these abstracts, would provide further insights about the 39 reviewed articles. The larger size of a term indicates the higher frequency of use of the term. The term list in the word cloud was generated by using stemmization/lemmatization, which considers the semantic root of a particular



FIGURE 6 Patient-focused outcome indicators—mortality, failure to rescue (FTR), shock or cardiac arrest. FTR, Failure to Rescue; LPN, Licensed Practical Nurse; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel

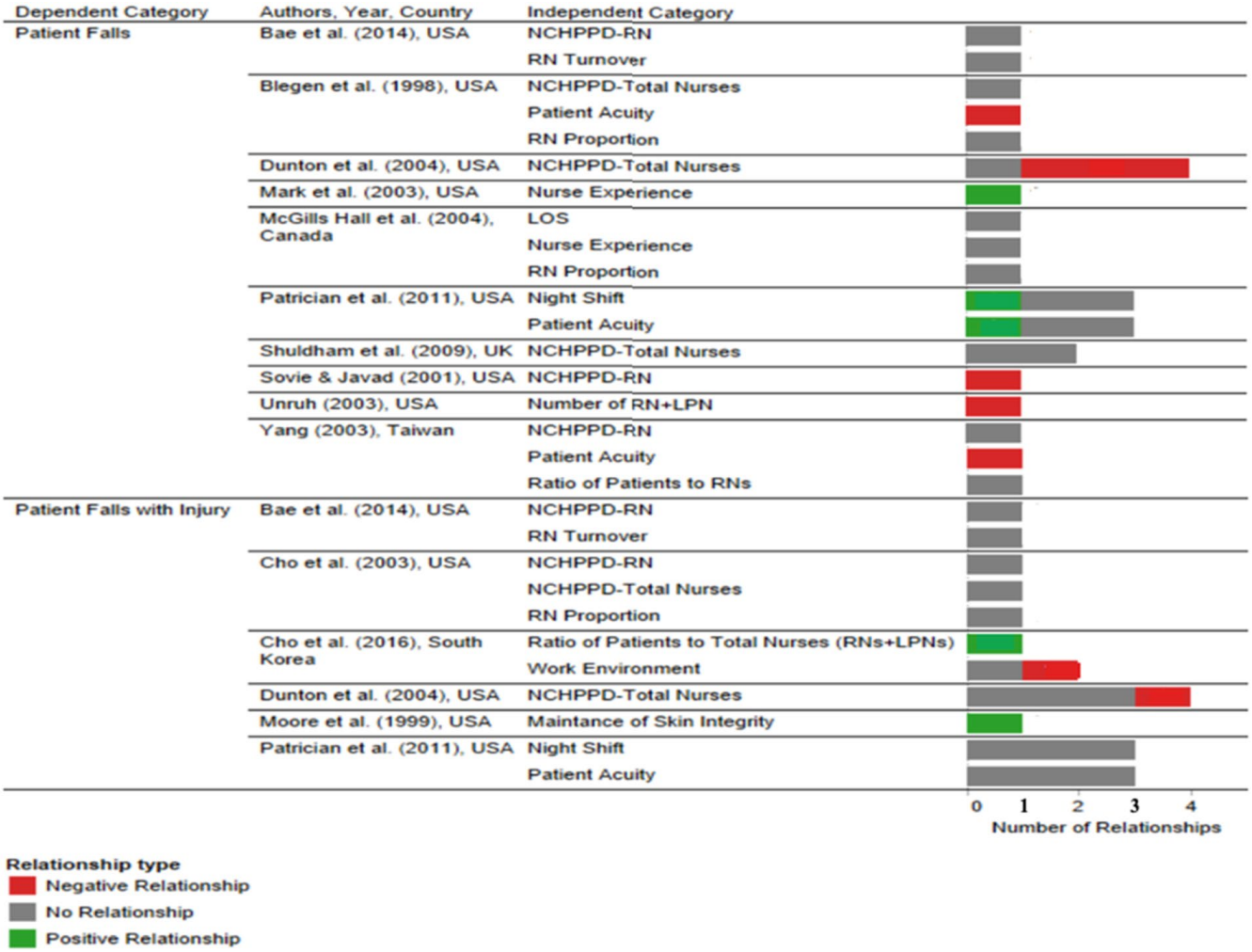


FIGURE 7 Patient-focused outcome indicators—patient falls and patient falls with injury. LOS, Length of Stay; LPN, Licensed Practical Nurse; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel

word and combines the words with the same root into a single term (Ozaydin et al., 2017). For example, the term "hospit." includes words such as hospital, hospitalization. The content analysis revealed the most frequently used terms as hospital, patient outcomes, staffing, nursing staffing and mortality.

3.2 | The most consistent findings across 39 reviewed studies

Figure 5 summarizes the results from 39 abstracted studies on patient-focused outcome indicators for urinary tract infection, pneumonia, wound infection, hospital-acquired sepsis, post-operative/treatment infection and respiratory tract infection. Among these results, we would like to draw attention to the mixed findings. For example, there were two studies with non-significant results (Cho et al., 2003; Needleman et al., 2002) and two studies with significant and inverse findings (Cho et al., 2003; Needleman et al., 2002) regarding the relationship between total nursing care hours per patient day (NCHPPD-total nurses) and urinary tract infection (UTI). In the case of Needleman et al. (2002), the non-significant results were found for surgical patients, whereas the significant and inverse relationships were observed among medical patients. Given that model 2 of Needleman et al. (2002) included unlicensed aid personnel hours per patient day and licensed-practical-nurse hours a patient day, we recorded the findings under NCHPPD-total nurses instead of NCHPPD-RN. There are significant inverse relationships between UTI and number of RN + LPN and NCHPPD-total nurses; between pneumonia and NCHPPD-RN, NCHPPD-total nurses and RN proportion (RN skill mix/the proportion of nursing staff who are RNs); between wound infection and RN proportion; between post-operative/post-treatment infection and NCHPPD-total nurses, and RN proportion.

Figure 6 summarizes the results from 39 abstracted studies on patient-focused outcome indicators in mortality, failure to rescue (FTR) and shock or cardiac arrest by exhibiting the significance of the relationships and their directions between dependent and independent variables. Again, we would like to draw attention to some

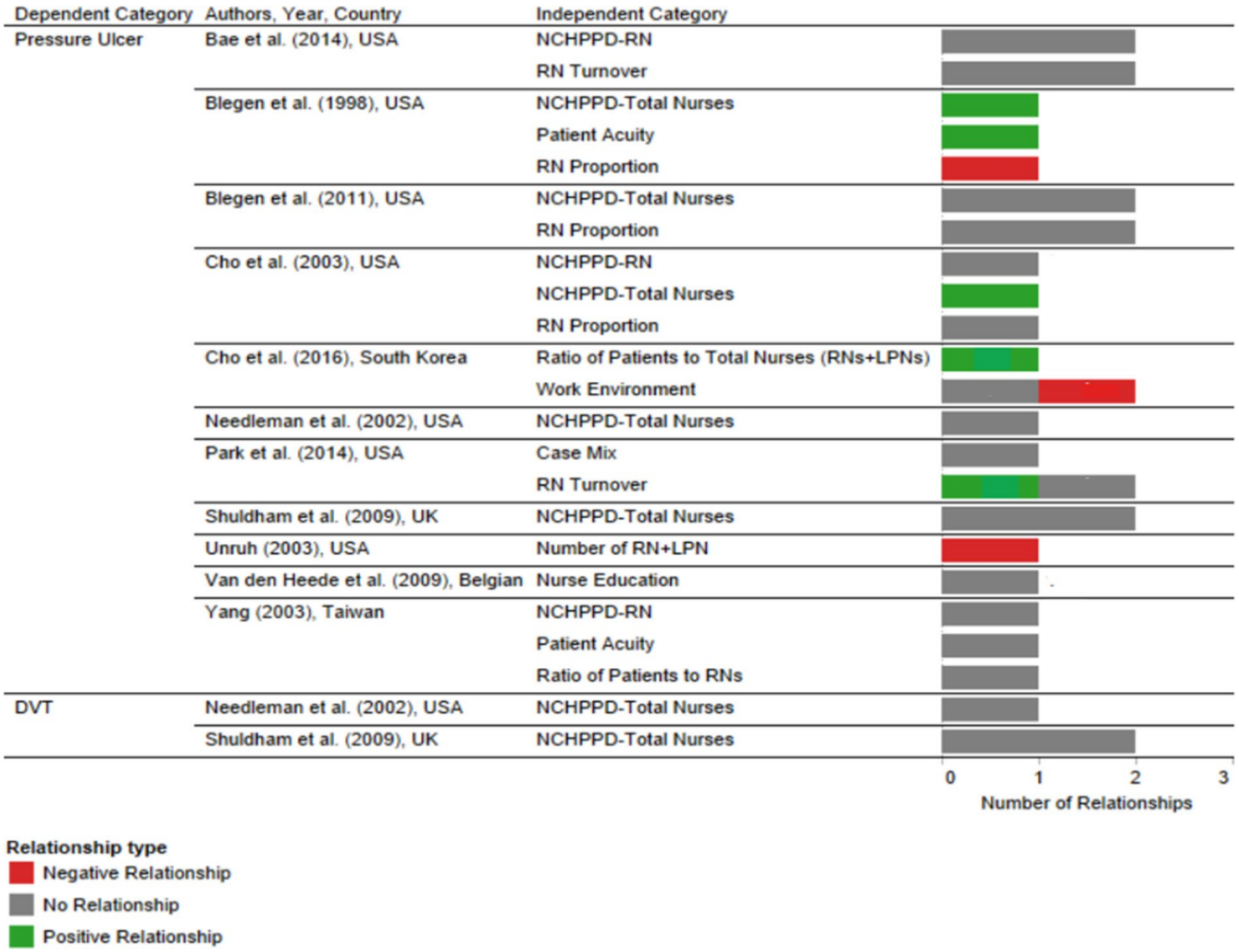


FIGURE 8 Patient-focused outcome indicators—pressure ulcer and deep vein thrombosis (DVT). DVT, Deep Venous Thrombosis; LPN, Licensed Practical Nurse; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel

of those relationships that exhibit mixed findings. First, the relationship between nurse experience and mortality was either non-significant (Aiken et al., 2003; Sasichay-Akkadechanunt et al., 2003) or inverse (Tourangeau et al., 2002). Second, the relationship between nurse education and mortality exhibited similarly mixed results with non-significant (Van den Heede et al., 2009) and inverse (Aiken et al., 2003, 2011; Tourangeau et al., 2006) findings. Besides the mixed findings, there were also some consistent results, such as the significant and positive relationship between the ratio of patients to RNs and mortality and FTR (Aiken et al., 2002, 2003, and 2011). Moreover, a similar positive relationship between the ratio of patients to RNs + LPNs and mortality in Thailand (Sasichay-Akkadechanunt et al., 2003) further strengthens this highlighted a positive relationship.

Figure 7 summarizes the findings from 39 abstracted studies for patient-focused outcome indicators focusing on patient falls and the patient falls with injury. There are inverse relationships between patient falls and NCHPPD-RN, NCHPPD-total nurses and the number of RN + LPN. There are positive relationships between patient falls and night shift and nurse experience. Additionally, patient acuity exhibits some mixed findings such as positive (Patrician et al., 2011) and inverse (Blegen et al., 1998; Yang, 2003) relationships. There was a significant and positive relationship between patient falls with injury and the ratio of patients to RNs + LPNs (Cho et al., 2003). There was a significant and inverse relationship between NCHPPD-total nurses, and the patient falls up to a specific point-15 hr per patient day (Dunton et al., 2004).

Figure 8 summarizes the results from 39 studies for patient-focused outcome indicators focusing on pressure ulcers and deep vein thrombosis (DVT). In these studies, there were inverse and significant relationships between pressure ulcer and RN proportion, number of RN + LPN, and work environment. There were also positive relationships between pressure ulcers and the ratio of patients to RNs + LPNs, NCHPPD-total nurses, RN turnover and patient acuity. There was no significant relationship between DVT and NCHPPD-total nurses. In Figure 8, we would like to draw attention to several findings. First, the positive relationship between NCHPPD-total nurses and pressure ulcers (Blegen

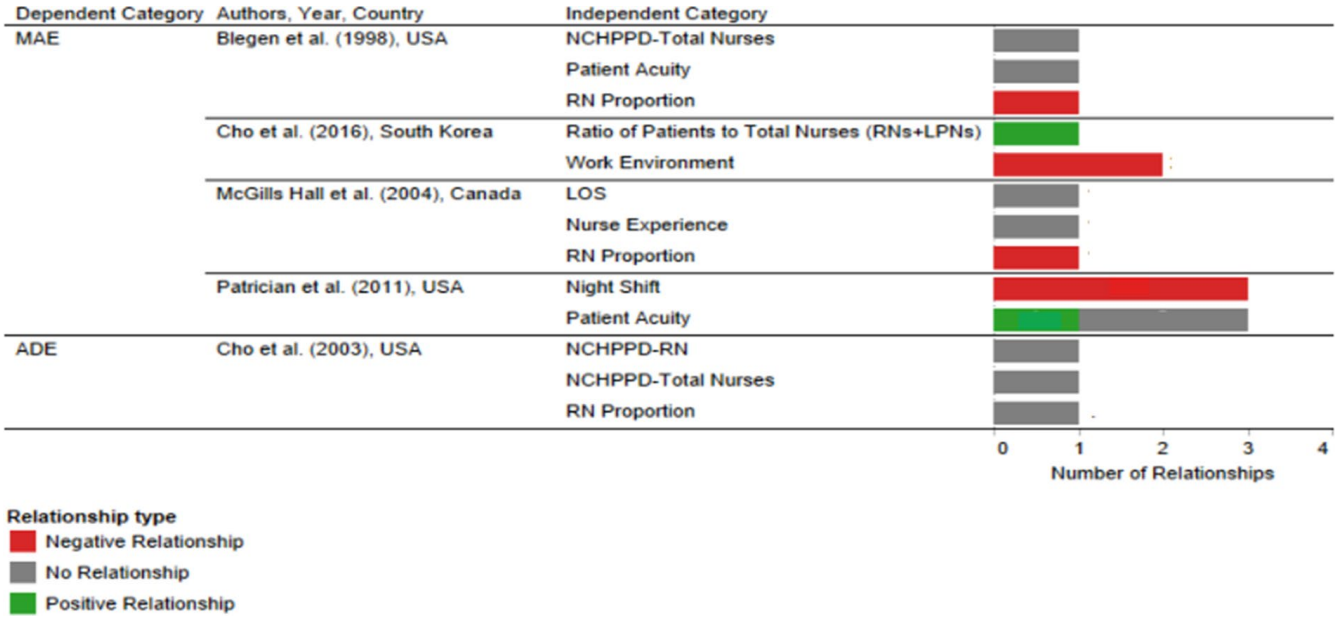


FIGURE 9 Patient-focused outcome indicators—medication administration error (MAE) and adverse drug event (ADE). ADE, Adverse Drug Events; LOS, Length of Stay; LPN, Licensed Practical Nurse; MAE, Medication Administration Error; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel

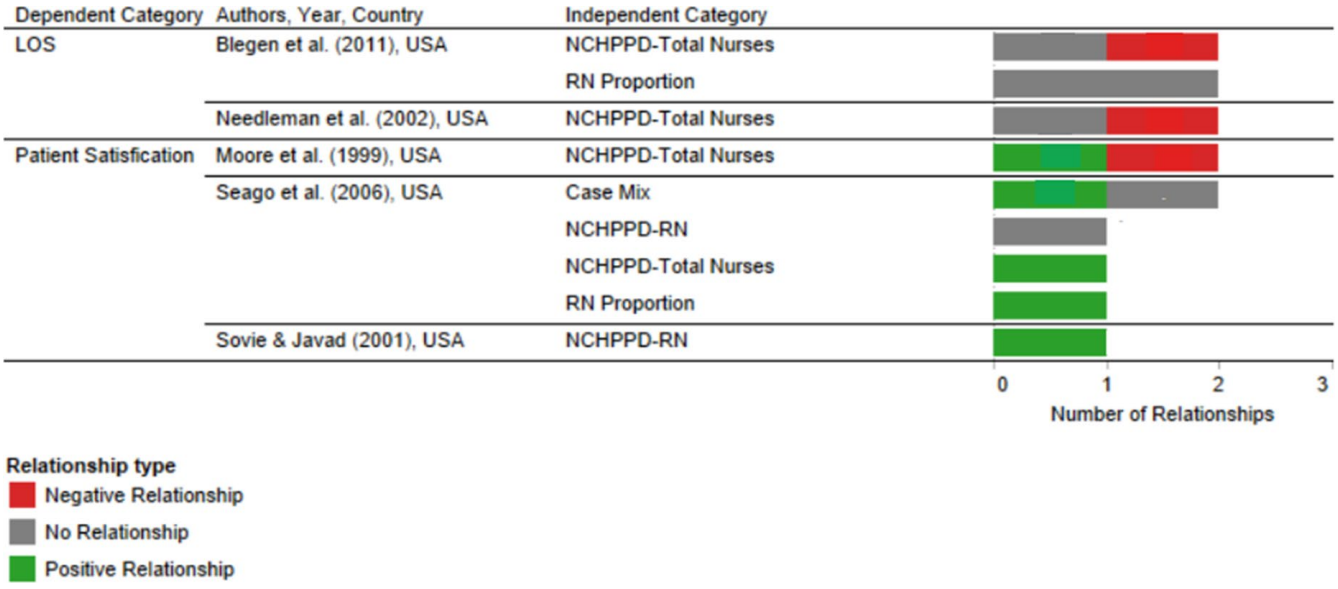


FIGURE 10 Patient-focused outcome indicators—length of stay (LOS) and patient satisfaction. LOS, Length of Stay; LPN, Licensed Practical Nurse; NCHPPD, Nursing Care Hours per Patient Day; RN, Registered Nurse; Total Nurses, RN + LPN+UAP; UAP, Unlicensed Assistive Personnel

et al., 1998; Cho et al., 2003) seems to be counterintuitive at face value. However, while interpreting these results, we suggest the readers pay attention to the positive relationship with patient acuity and inverse relationship with RN proportion in Blegen et al., (1998) study.

Figure 9 summarizes the results from 39 abstracted studies for patient-focused outcome indicators concentrating on medication administration error (MAE) and adverse drug events (ADE). There are inverse relationships between MAE and RN proportion (Blegen et al., 1998), work environment (Cho et al., 2016) and night shift (Patrician et al., 2011). Significant and positive relationships were observed between MAE and ratio of patients to RNs + LPNs (Cho et al., 2016), and the patient acuity (Patrician et al., 2011). Among the 39 abstracted studies, there was no significant relationship between ADE and any independent variables reported.

Figure 10 exhibits the results from 39 abstracted studies on patient-focused outcome indicators for the length of stay (LOS) and patient satisfaction. NCHPPD-total nurses exhibited significant and inverse relationships with LOS (Blegen et al., 2011; Needleman et al., 2002) and patient satisfaction (Moore et al., 1999). However,

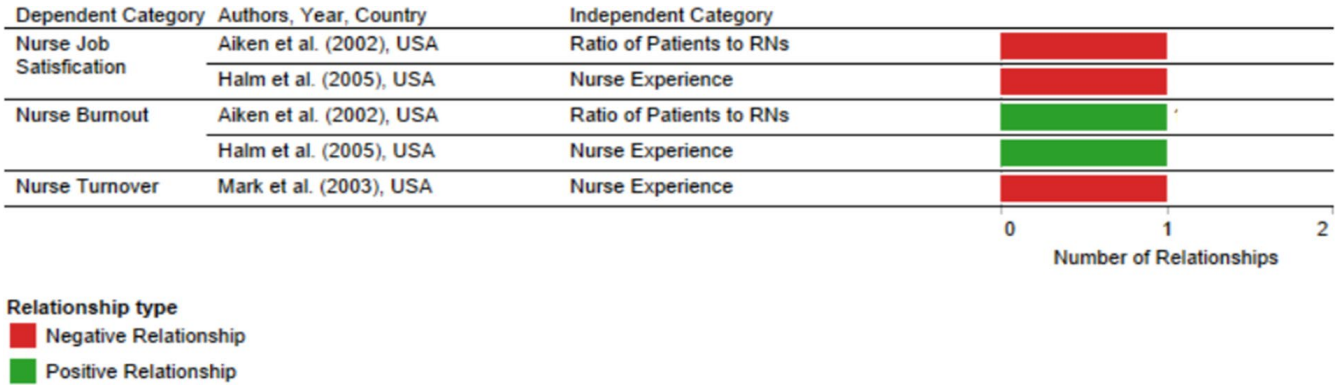


FIGURE 11 Nurse-focused outcome indicators. RN, Registered Nurse

NCHPPD-RN had a significant positive relationship with patient satisfaction (Sovie & Jawad, 2001).

Figure 11 summarizes the results from 39 abstracted studies for nurse-focused outcome indicators. Regarding the nursing staff satisfaction as the dependent variable, two studies highlighted significant and inverse associations. First, Aiken et al. (2002) found that an increase in patient to RN ratio decreased the odds of job satisfaction among nurses. Second, Halm et al. (2005) also found that the increase in experience (i.e. the number of years a nurse work at an institution) of nurses was significantly and inversely associated with job satisfaction. Regarding nurse burnout as the dependent variable, Halm et al. (2005) found that the additional number of years in the nursing profession leads to a higher incidence of emotional exhaustion (i.e., burnout) among nurses. Regarding the nurse turnover as the dependent variable, Mark et al. (2003) found that in units with more experienced nurses, the turnover was lower.

When the overall results of this systematic review considered, among all nursing-sensitive indicators, the independent variables that exhibited the most consistent results were as follows: the ratio of patients to RNs, RN proportion and nurse education. The ratio of patients to RNs exhibited significant and positive relationships with mortality, FTR, nurse job satisfaction and nurse burnout. Similarly, RN proportion exhibited significant and inverse associations with nosocomial infections (pneumonia, wound infection, post-operative/post-treatment infection), mortality, pressure ulcer and MAE. Nurse education also exhibited significant and inverse relationships with mortality and FTR.

4 | DISCUSSION

This systematic review summarizes the results of nursing-sensitive indicators from 39 studies for the last 20 years (1997–2017). We aimed to develop a comprehensive list of nursing-sensitive indicators and their implications on various healthcare outcomes. Based on our results, there are several conclusions and recommendations for future research in the following five areas: 1) frequency of explored relationships, 2) implications of nursing-sensitive indicators on quality, 3) the most consistent findings across 39 reviewed studies, 4) high numbers and variety of nurse staffing variables and lack of standardization, 5) dominance of the USA and certain indicators. We also summarized some of the critical information from these studies qualitatively in Appendix E (available from the Authors).

4.1 | Frequency of explored relationships

The first set of discussions focuses on the frequency of explored relationships. We observed the most frequently used terms as patient outcomes, nursing staffing, mortality, adverse event, medication error, pneumonia, failure to rescue and pressure ulcer in the abstracts of reviewed studies of nursing-sensitive indicators in the last 20 years (1997–2017) (Figure 4). The most frequently used patient-focused outcome indicator dimensions were nosocomial infections and mortality. The remaining patient-focused outcome indicators that followed these were pressure ulcer, patient falls, FTR, patient falls with injury, MAE, LOS, patient satisfaction, other outcomes, ADE and DVT-pulmonary embolism (Figures 5–11). Our review findings are in harmony with the findings of Myers et al. (2018) and Audet et al. (2018) since both reviews also found the mortality as the most frequently explored patient-focused indicators. In addition, in accordance with our study, Myers et al. (2018) found nosocomial infections as the most consistently investigated patient-focused indicator. In their review, Myers et al. (2018) identified the most important indicators for quality of nursing care as mortality, length of stay, central-line-associated bloodstream infection, ventilator-associated pneumonia, sepsis, falls with injury, re-intubation and medication errors. Similarly, Audet et al. (2018) identified mortality and FTR as the most frequently explored indicators.

The most frequently explored nurse-focused outcome indicators included nurse job satisfaction, nurse burnout and nurse turnover. The most frequently used organizational-focused structure indicator dimension was NCHPPD-total nurses in nurse staffing levels dimensions. This finding confirms the conclusion of

TABLE 1 Descriptive statistics for the abstracted 39 nursing-sensitive indicators studies

Descriptive ($N = 39$)		Frequency	Percentage (%)
Journal type	Nursing journal	28	71.8
	Medical journal	11	28.2
Study design	Cross-sectional	29	74.4
	Longitudinal	10	25.6
Institution type	General hospital	27	69.2
	Military hospital	1	2.6
	Teaching hospital	11	28.2
Sample area	Rural-urban	26	66.7
	Urban	3	7.7
	N/A[a]	10	25.6
Sample level	Multiple hospitals in multiple states	1	2.6
	Multiple hospitals in a single state	1	2.6
	Multiple units in multiple hospitals	29	74.4
	Multiple units in a single hospital	8	20.5
Study location	Belgium	1	2.6
	Canada	3	7.7
	China	1	2.6
	South Korea	1	2.6
	Thailand	1	2.6
	Taiwan	1	2.6
	United Kingdom	2	5.1
	USA	29	74.4
Resource type	Administrative and research data	18	46.2
	Administrative data	11	28.2
	Research data	10	25.6

[a]Not enough information was available in the study.

an earlier review in which Myers et al. (2018) highlighted nurse staffing measures as more frequently explored ones compared to the nurse staffing mix measures. The most frequently explored nurse staffing measures included NCHPPD-RN and RN proportion. Regarding the nurse staffing ratio measures, there were two that received higher levels of attention from researchers; 1) ratio of patients to RNs and 2) ratio of patients to RNs + LPNs. Nurse staffing qualifications dimensions included the following frequently explored measures; nurse experience and education. The most frequently explored hospital characteristic measures were work schedule, patient acuity, work environment, nurse autonomy and case mix.

4.2 | Implications of nursing-sensitive indicators on quality

For this sub-section, we highlight the significant findings in regard to the implications of nursing-sensitive indicators on quality outcomes. The most frequently examined patient-focused outcome indicators were nosocomial infections and mortality. As independent variables, NCHPPD-total nurses, NCHPPD-RN, RN proportion, number of RN + LPN and patient acuity were found to be significantly and inversely associated with UTI, pneumonia, wound infection and post-operative/post-treatment infection. These independent variables can be considered to be the most potent determinants of nosocomial infections. Specific findings from the reviewed studies would be valuable in developing strategies to reduce infection rates. For example, the UTI rate declines as the number of registered nurse hours worked per patient day increases (Sovie & Javad, 2001). Hospitals with more licensed nurses had significantly lower incidences of urinary tract infections (Unruh, 2003). There were also some mixed findings. For example, the relationship between NCHPPD-total nurses and UTI Needleman et al. (2002) found some non-significant results for surgical patients. In contrast, significant and inverse relationships were observed among medical patients. The authors explained their findings by emphasizing the small sample size and the potential for surgical patients being healthier than medical patients.

Consistent with our findings, in their systematic review and meta-analysis, Kane et al. (2007) also found a significant and positive relationship between the ratio of patients to RN and pneumonia and significant and inverse relationship between NHPPD-RN and pneumonia. Myers et al. (2018) did not have a significant association post-operative infection and urinary tract infection with nurse staffing variables. According to our review, either there was no significant relationship (Aiken et al., 2003; Sasichay-Akkadechanunt et al., 2003) or a significant inverse relationship between the number of years of work experience and mortality (Tourangeau et al., 2002). According to Audet et al. (2018), RN experience does not appear to have a significant or consistent association with the occurrence of mortality and other adverse events. Although the relationship between nurse education and mortality displayed similarly mixed results with non-significant (Van den Heede et al., 2009) and inverse (Aiken et al., 2003, 2011; Tourangeau et al., 2006) findings, in particular, the significant inverse relationships seem more remarkable. In the literature, there was evidence that higher proportions of RNs with baccalaureate degrees were associated with lower mortality rates (Audet et al., 2018; Kane et al., 2007; Liao et al., 2016; Yakusheva et al., 2014).

In addition to the mixed findings, there were some consistent results, including a significant and positive relationship between mortality and ratio of patients to RNs (Aiken et al., 2002, 2003, and 2011). Furthermore, a similar positive relationship between the ratio of patients to RNs + LPNs and mortality in Thailand further strengthens this emphasized positive relationship (Sacichay-Akkadechanunt et al., 2003). The literature suggests that as the level of nursing staff increases, the hospital mortality decreases (Driscoll et al., 2018; Kane et al., 2007). Although there are many studies about mortality as a nursing-sensitive indicator



FIGURE 3 The frequency distribution of the dependent and independent category of nursing-sensitive indicators in the included studies ($n = 39$). DE, Adverse Drug Events; DVT, Deep Venous Thrombosis; FTR, Failure to Rescue; LOS, Length of Stay; MAE, Medication Administration Error

(Aiken et al., 2002, 2003, and 2011; Needleman et al., 2002; Tourangeau et al., 2002; Tourangeau et al., 2006; Sasichay-Akkadechanunt et al., 2003; Halm et al., 2005; Van den Heede et al., 2009; McHugh & Stimpfel, 2012; Rao et al., 2017), there are also criticisms about the sensitivity of mortality to nursing care (Audet et al., 2018; Blegen, 2006; Kane et al., 2007; Numata et al., 2006). Therefore, further research is needed to support this sensitivity assumption.

4.3 | High numbers and variety of nurse staffing variables and lack of standardization

Among the included 39 studies in this review, we detected a large number of nurse staffing variables and lack of standardization, which makes very difficult to make comparison across studies. Studies included a large number of nurse staffing measures along with different variations of them such as NCHPPD-RN, NCHPPD-LPN, NCHPPD-UAP, NCHPPD-Non-RN (Bae et al., 2014; Park et al., 2012; Patrician et al., 2011; Shuldham et al., 2009; Heede et al., 2009). These large numbers and variety of nurse staffing variables indicate the importance of generating a common language through the standardization of these nurse staffing measures. Along with the much-needed standardization, there is also a need to generate staffing measures that would support evidence-based strategic human resource allocation decisions (Audet et al., 2018; Burston et al., 2013).

4.4 | The areas open to research for nursing-sensitive indicators

Among the 39 studies, the majority (74%) originated in the USA and focused on relationships between patient-focused outcomes and



FIGURE 4 Distribution of terms based on the content analysis of 39 abstracts (the larger letter size indicates a higher frequency of the term)

nurse staffing levels, nurse staffing ratio, hospital/unit characteristics and nurse staffing qualifications. There were a very limited number of studies within nurse-focused outcome indicators dimension focusing on nurse burnout, nurse job satisfaction and nurse turnover. The majority of the studies in the nurse-focused outcome indicator dimension explored relationships with nurse staffing ratio and exhibited inconsistent results (Aiken et al., 2002; Halm et al., 2005; Mark et al., 2003; Raffertya et al., 2007). Therefore, this area seems to open for further research, particularly in regard to nurse staffing levels, staffing qualifications and hospital/unit characteristics. Moreover, there were limited numbers of explored relationships focusing on nursing-focused process/intervention (Potter et al., 2003; Zhu et al., 2012). This lack of attention on these indicators maybe because of the nature of these indicators being more relevant to process management and the difficulty of analysing processes. Therefore, there is a need for future studies focusing on this dimension.

4.5 | Limitations

This systematic review was limited to English language studies were published between 1997 and 2017; therefore, it potentially excluded some relevant studies. Thus, it does not account for earlier research. Due to the overall broad focus of this review, publications addressing a specific nursing field or a disease process were excluded. Moreover, this study was limited to empirical studies that included relationships between independent and dependent variables. Due to very high numbers of potential relationships, the study had to utilize elimination based on the frequency of a particular relationship in all of the 39 studies. Therefore, the results from some relationships, there were not frequently explored were not included in the final document, and their interpretation was not provided. Future studies may focus on these less frequently explored relationships to inform the nursing scholars.

5 | CONCLUSIONS

This review provides a comprehensive systematic review of existing research on the nursing-sensitive indicators and trends for the last 20 years. It accounts for the details of the relationships between types of nursing-sensitive indicators. The most frequently utilized nursing-sensitive indicators are mortality and nosocomial infections. Evidence for the sensitivity of some nursing care indicators is inconsistent, depending on high numbers and variety of nurse staffing variables and lack of standardization in the definition. As highlighted in this review, the inconsistent and sometimes contradictory associations in previous studies indicate the need to establish a common language through standardization of high numbers and a variety of nurse staffing variables. Also, by exhibiting the less frequently explored associations, this review draws attention to areas that are more prone to the development of research regarding the effects of nursing-sensitive indicators on quality. Stakeholders of nursing research may use the findings of this study to develop the future research agenda with a particular focus on nursing-sensitive indicators.

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CONFLICT OF INTEREST

The authors report no conflict of interest.

AUTHOR CONTRIBUTIONS

Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data (BO, FZ, NO, NI, AK, PP). Involved in drafting the manuscript or revising it critically for important intellectual content (BO, FZ, NO, NI, AK, PP). Given final approval of the version to be published. Each author should

have participated sufficiently in the work to take public responsibility for appropriate portions of the content (BO, FZ, NO, NI, AK, PP). Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (BO, FZ, NO, NI, AK, PP).

DATA AVAILABILITY STATEMENT

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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REFERENCES

Aiken, L. H., Cimiotti, J. P., Sloane, D. M., Smith, H. L., Flynn, L., & Neff, D. F. (2011). The effects of nurse staffing and nurse education on patient deaths in hospitals with different nurse work environments. *Medical Care*, *49*(12), 1047–1053. https://doi.org/10.1097/MLR.0b013e3182330b6e

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. *The Journal of the American Medical Association*, *90*(12), 1617–1623. https://doi.org/10.1001/jama.290.12.1617

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. https://doi.org/10.1001/jama.288.16.1987

Alexander, G. R. (2007). Nursing sensitive databases: Their existence, challenges, and importance. *Medical Care Research and Review*, *64*(2 SUPPL), 44S–63S. https://doi.org/10.1177/1077558707299244

American Nurses Association (ANA). (1995). *Nursing care report card for acute care* (pp. 1–17). American Nurses Publishing.

Audet, L.-A., Bourgault, P., & Rochefort, C. M. (2018). Associations between nurse education and experience and the risk of mortality and adverse events in acute care hospitals: A systematic review of observational studies. *International Journal of Nursing Studies*, *80*, 128–146. https://doi.org/10.1016/j.ijnurstu.2018.01.007

Bae, S.-H., Kelly, M., Brewer, C. S., & Spencer, A. (2014). Analysis of nurse staffing and patient outcomes using comprehensive nurse staffing characteristics in acute care nursing units. *Journal of Nursing Care Quality*, *29*(4), 38–326. https://doi.org/10.1097/NCQ.0000000000000057

Bazzoli, G. J., Manheim, L. M., & Waters, T. M. (2003). U.S. hospital industry restructuring and the hospital safety Net. *INQUIRY: the Journal of Health Care Organization, Provision, and Financing*, *40*, 6–24. https://doi.org/10.5034/inquiryjrnl_40.1.6

Blegen, M. A. (2006). Patient safety in hospital acute care units. *Annual Review of Nursing Research*, *24*, 103–125. https://doi.org/10.1891/0739-6686.24.1

Blegen, M. A., Goode, C. J., & Reed, L. (1998). Nurse staffing and patient outcomes. *Nursing Research*, *47*(1), 43–50. https://doi.org/10.1097/00006199-199801000-00008

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. https://doi.org/10.1097/MLR.0b013e318202e129

Burston, S., Chaboyer, W., & Gillespie, B. (2013). Nurse-sensitive indicators suitable to reflect nursing care quality: A review and discussion of issues. *Journal of Clinical Nursing*, *23*, 1785–1795.

Cho, E., Chin, D. L., Kim, S., & Hong, O. (2016). The relationships of nurse staffing level and work environment with patient adverse events. *Journal of Nursing Scholarship*, *48*(1), 74–82. https://doi.org/10.1111/jnu.12183

Cho, H. Y., 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. https://doi.org/10.1097/00006199-200303000-00003

Donabedian, A. (1980). *Explorations in quality assessment and monitoring: The definition of quality and approaches to its assessment* (Vol. *I*, pp. 8–16, 79–128). Health Administration Press.

Donabedian, A. (1988). The quality of care: How can it be assessed? *Journal of the American Medical Association*, *260*(12), 1743–1748. https://doi.org/10.1001/jama.260.12.1743

Doran, D., Mildon, B., & Clarke, S. (2011). *Toward a national report card in nursing: A knowledge synthesis* (pp. 6–22). Nursing Health Services Research Unit and University of Toronto.

Driscoll, A., Grant, M. J., Carroll, D., Dalton, S., Deaton, C., Jones, I., Lehwaldt, D., McKee, G., Munyombwe, T., & Astin, F. (2018). The effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units: A systematic review and meta-analysis. *European Journal of Cardiovascular Nursing*, *17*(1), 6–22. https://doi.org/10.1177/1474515117721561

Dubois, C. A., D'Amour, D., Pomey, M. P., Girard, F., & Brault, I. (2013). Conceptualizing performance of nursing care as a prerequisite for better measurement: A systematic and interpretive review. *BioMed Central Nursing*, *12*(7), 1–20. https://doi.org/10.1186/1472-6955-12-7

Duffield, C., Kearin, M., Johnston, J., & L'eonard, J.(2007). The impact of hospital structure and restructuring on the nursing workforce. *Australian Joumal of Advanced Nursing*, *24*(4), 42-6.

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), 1–11.

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. https://doi.org/10.1016/j.outlook.2003.11.006

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Furukawa, M. F., Raghu, T. S., & Shao, B. B. M. (2011). Electronic medical records, nurse staffing, and nurse-sensitive patient outcomes: Evidence from the national database of nursing quality indicators. *Medical Care Research and Review*, *68*(3), 311–331. https://doi.org/10.1177/1077558710384877

Garcia, P. C., & Fugulin, F. M. T. (2012). Nursing care time and quality indicators for adult intensive care: Correlation analysis. *Revista Latino-Americana De Enfermagem*, *20*(4), 651–658. https://doi.org/10.1590/S0104-11692012000400004

Haberfelde, M., Bedecarré, D., & Buffum, M. (2005). Nurse-sensitive patient outcomes: An annotated bibliography. *Journal of Nursing Administration*, *35*(6), 293–299. https://doi.org/10.1097/00005110-200506000-00005

Halm, M., Peterson, M., Kandels, M., Sabo, J., Blalock, M., Braden, R., Gryczman, A., Krisko-hagel, K., Larson, D., Lemay, D., Sisler, B., Strom, L., & Topham, D. (2005). Hospital nurse staffing and patient mortality, emotional exhaustion, and job dissatisfaction. *Clinical Nurse Specialist*, *19*(5), 241–251. https://doi.org/10.1097/00002800-200509000-00007

Heslop, L., & Lu, S. (2014). Nursing-sensitive indicators: A concept analysis. *Journal of Advanced Nursing*, *70*(11), 2469–2482. https://doi.org/10.1111/jan.12503

Joint Commission International (JCI). (2014). *Joint Commission International Accreditation Standarts for hospitals* (5th ed., pp. 9–72). JCI Press.

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. https://doi.org/10.1097/MLR.0b013e3181468ca3

Lang, T. A., Romano, P. S., Hodge, M., Kravitz, R. L., & Olson, V. (2004). Nurse–patient ratios a systematic review on the effects of nurse staffing on patient, nurse employee, and hospital outcomes. *JONA: the Journal of Nursing Administration*, *7*(8), 326–337. https://doi.org/10.1097/00005110-200407000-00005

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. https://doi.org/10.1097/00012272-200504000-00008

Liao, L.-M., Sun, X.-Y., Yu, H., & Li, J.-W. (2016). The association of nurse educational preparation and patient outcomes: Systematic review and meta-analysis. *Nurse Education Today*, *42*, 9–16. https://doi.org/10.1016/j.nedt.2016.03.029

Mark, B. A., Salyer, J., & Wan, T. T. H. (2003). Professional nursing practice impact on organizational and patient outcomes. *The Journal of Nursing Administration*, *33*(4), 224–234. https://doi.org/10.1097/00005110-200304000-00008

McHugh, M. D., & Stimpfel, A. W. (2012). Nurse reported quality of care: A measure of hospital quality. *Research in Nursing & Health*, *35*, 566–575. https://doi.org/10.1002/nur.21503

Mitchell, P. H., Ferketich, S., & Jennings, B. M. (1998). Quality health outcomes model: American academy of nursing expert panel on quality health care. *Journal of Nursing Scholarship*, *30*(1), 43–46. https://doi.org/10.1111/j.1547-5069.1998.tb01234.x

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G.; The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journalpmed1000097

Montalvo, I. (2007). The National Database of Nursing Quality Indicators (NDNQI). *Online Journal of Issues in Nursing*, *12*(3), 13.

Moore, K., Lynn, M. R., McMillen, B. J., & Evans, S. (1999). Implementation of the ANA report card. *JONA: the Journal of Nursing Administration*, *29*(6), 48–54. https://doi.org/10.1097/00005110-199906000-00009

Myers, H., Pugh, J. D., & Twigg, D. E. (2018). Identifying nurse-sensitive indicators for stand-alone high acuity areas: A systematic review. *Collegian*, *25*, 447–456. https://doi.org/10.1016/j.colegn.2017.10.004

Nakrem, S., Vinsnes, A. G., Harkless, G. E., Paulsen, B., & Seim, A. (2009). Nursing sensitive quality indicators for nursing home care: International review of literature, policy and practice. *International Journal of Nursing Studies*, *46*, 848–857. https://doi.org/10.1016/j.ijnurstu.2008.11.005

National Heart, Lung and Blood Institute. (2014). *Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies*. - NHLBI, NIH. National Institutes of Health. 2014. Available from: https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools. [last accessed 15 June 2020]

National Quality Forum (NQF). (2004). *National voluntary consensus standards for nursing-sensitive care: An initial performance measure set* (pp. 1–14). National Quality Forum.

Needleman, J., Buerhaus, P., Mattke, S., Stewart, M., & Zelevinsky, K. (2002). Nurse-staffing levels and the quality of care in hospitals. *The New England Journal of Medicine*, *346*(22), 1715–1722. https://doi.org/10.1056/NEJMsa012247

Needleman, J., Buerhaus, P., Pankratz, S., Leibson, C. L., Stevens, S. R., & Harris, M. (2011). Nurse staffing and inpatient hospital mortality. *The New England Journal of Medicine*, *364*, 1037–1045. https://doi.org/10.1056/NEJMsa1001025

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*, 10S–43S. https://doi.org/10.1177/1077558707299260

Numata, Y., Schulzer, M., van der Wal, R., Globerman, J., Semeniuk, P., Balka, E., & FitzGerald, J. M. (2006). Nurse staffing levels and hospital mortality in critical care settings: Literature review and meta-analysis. *Journal of Advanced Nursing*, *55*(4), 435–438. https://doi.org/10.1111/j.1365-2648.2006.03941.x

Oner, N., Zengul, F. D., Ozaydin, B., Pallotta, R. A., & Weech-Maldonado, R. (2016). Organizational and environmental factors associated with hospital financial performance: A systematic review. *Journal of Health Care Finance*, *43*(2), 13–37.

Ozaydin, B., Zengul, F., Oner, N., & Delen, D. (2017). Text-mining analysis of mHealth research. *mHealth*, *3*, 53. https://doi.org/10.21037/mhealth.2017.12.02

Park, S. H., Blegen, M. A., Spetz, J., Chapman, S. A., & De Groot, H. (2012). Patient turnover and the relationship between nurse staffing and patient outcomes. *Research in Nursing & Health*, *35*, 277–288. https://doi.org/10.1002/nur.21474

Park, S. H., Boyle, D. K., Bergquist-Beringer, S., Staggs, V. S., & Dunton, N. E. (2014). Concurrent and lagged effects of registered nurse turnover and staffing on unit-acquired pressure ulcers. *Health Services Research*, *49*(4), 1205–1225. https://doi.org/10.1111/1475-6773.12158

Patrician, P., Loan, L., McCarthy, M., Brosch, L. R., & Davey, K. S. (2010). Towards evidence-based management: Creating an informative database of nursing-sensitive indicators. *Journal of Nursing Scholarship*, *42*(4), 358–366. https://doi.org/10.1111/j.1547-5069.2010.01364.x

Patrician, P. A., Loan, L., McCarthy, M., Fridman, M., Donaldson, N., Bingham, M., & Brosch, L. R. (2011). The Association of shift-level nurse staffing with adverse patient events. *JONA: the Journal of Nursing Administration*, *41*(2), 64–70. https://doi.org/10.1097/NNA.0b013e31820594bf

Potter, P., Barr, N., McSweeney, M., & Sledge, J. (2003). Identifying nurse staffing and patient outcome relationships: A guide for change in care delivery. *Nursing Economics*, *21*(4), 158–166.

Raffertya, A. M., Clarkeb, S. P., Colesc, J., Balld, J., Jamese, P., McKeef, M., & Aiken, L. H. (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. https://doi.org/10.1016/j.ijnurstu.2006.08.003

Rao, A. D., Kumar, A., & McHugh, M. (2017). Better nurse autonomy decreases the odds of 30-day mortality and failure to rescue. *Journal of Nursing Scholarship*, *49*(1), 73–79. https://doi.org/10.1111/jnu.12267

Sasichay-Akkadechanunt, T., Scalzi, C. C., & Jawad, A. F. (2003). The relationship between nurse staffing and patient outcomes. *The Journal of Nursing Administration*, *33*(9), 478–485. https://doi.org/10.1097/00005110-200309000-00008

Shuldham, C., Parkin, C., Firouzi, A., Roughton, M., & Lau-Walker, M. (2009). The relationship between nurse staffing and patient outcomes: A case study. *International Journal of Nursing Studies*, *46*, 986–992. https://doi.org/10.1016/j.ijnurstu.2008.06.004

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. https://doi.org/10.1111/j.1547-5069.2004.04014.x

Sovie, M. D., & Jawad, A. F. (2001). Hospital restructuring and its impact on outcomes nursing staff regulations are premature. *The Journal of Nursing Administration*, *31*(12), 588–600. https://doi.org/10.1097/00005110-200112000-00010

Sujijantararat, R., Booth, R. Z., & Davis, L. L. (2005). Nosocomial urinary tract infection: Nursing-sensitive quality indicator in a Thai hospital. *Journal of Nursing Care Quality*, *20*(2), 134–139. https://doi.org/10.1097/00001786-200504000-00008

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*, *5*(1), 32–44. https://doi.org/10.1111/j.1365-2648.2006.04084.x

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.

Unruh, L. (2003). Licensed nurse staffing and adverse events in hospitals. *Medical Care*, *41*(1), 142–152. https://doi.org/10.1097/00005650-200301000-00016

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*, 928–999. https://doi.org/10.1016/j.ijnurstu.2008.05.007

Yakusheva, O., Lindrooth, R., & Weiss, M. (2014). Economic evaluation of the 80% baccalaureate nurse workforce recommendation, a patient-level analysis. *Medical Care*, *52*(10), 864–869. https://doi.org/10.1097/MLR.0000000000000189

Yang, K. (2003). Relationships between nurse staffing and patient outcomes. *Journal of Nursing Research*, *11*(3), 150–158. https://doi.org/10.1097/01.JNR.0000347631.87723.de

Zhu, X.-W., You, L.-M., Zheng, J., Liu, K., Fang, J.-B., Hou, S.-X., Lu, M.-M., Lv, A.-L., Ma, W.-G., Wang, H.-H., Wu, Z.-J., & Zhang, L.-F. (2012). Nurse staffing levels make a difference on patient outcomes: A multisite study in Chinese hospitals. *Journal of Nursing Scholarship*, *44*(3), 266–273. https://doi.org/10.1111/j.1547-5069.2012.01454.x

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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