Chelonian Conservation And Biology

Vol. 17No.2 (2022) | https://www.acgpublishing.com/ | ISSN - 1071-8443

DOI:doi.org/10.18011/2022.04(1) 1922-1931

# THE ROLE OF NURSES IN PREVENTING HOSPITAL-ACQUIRED INFECTIONS

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## Abstract

The research investigating the connection between nurse staffing and hospital-acquired conditions is diverse due to the utilization of distinct terminology and methodologies. To conduct a comprehensive analysis and synthesis of original research investigating the correlation between nurse staffing levels and the occurrence of hospital-acquired conditions. This research was undertaken by a comprehensive analysis of relevant nursing literature using a systematic review approach. A systematic search was conducted in the CINAHL, Cochrane Library, DBpia, EBSCO, PubMed, PsycINFO, and RISS databases to identify papers published between January 2000 and August 2018 that investigated the relationship between nurse staffing and hospital-acquired conditions. Only articles written in English or Korean were included. Multiple metrics were used to investigate the correlation between nurse staffing and the occurrence of hospital-acquired conditions. Most of the studies that were analyzed showed that there is a negative correlation between the levels of nurse staffing and the occurrence of hospital-acquired conditions. Nevertheless, a considerable proportion of associations did not provide statistically significant results. Future research should focus on investigating the disparities in the correlation between nurse staffing and hospital-acquired conditions. It is crucial to employ accurate data collection methods to determine registered nurses' hours per patient day and total hours per patient day, as obtaining data on these measures is challenging. The results of this research indicate that having an adequate number of nurses on duty is a reliable measure of the delivery of high-quality patient care. Nevertheless, it is advisable to persistently pursue more research in order to establish more certain correlations between nurse staffing and hospital-acquired disorders, as well as to provide precise recommendations pertaining to nurse staffing techniques.

**Keywords:** Nurse, hospital-acquired infection, review, nurse staffing.

## 1. **Introduction**

The presence of an adequate number of nurses is crucial since they directly attend to patients at their bedsides, therefore reducing negative outcomes, encouraging patients' well-being, and enhancing their satisfaction with healthcare services (Aiken et al., 2012; Weissman et al., 2007). The limitation of rising health spending raises worries on the sufficiency of nurse staffing, namely the scarcity of registered nurses (RNs) and the quality of patient care (Aiken et al., 2011). Maintaining a balance between reducing nurse staffing levels and ensuring high-quality patient care is challenging. Indeed, findings from a prior investigation shown that augmenting the quantity of registered nurses (RNs) may result in savings of around $3 billion by mitigating unnecessary poor patient outcomes and readmission rates (American Nurses Association, 2018).

In 1999, California law authorized the establishment of minimum nurse-to-patient ratios in acute care hospitals. Subsequently, in 2005, the ratio was specifically defined at five patients per nurse in general medical-surgical units (Mark, Harless, Spetz, Reiter, & Pink, 2013). Australia, Japan, Taiwan, and Germany have also implemented regulations on the minimum ratio of nurses to patients or the number of nursing hours per patient day (NHPPD) (Simon & Mehmecke, 2017). South Korea implemented a financial incentive system that relies on inpatient fees. This system includes a 5% disincentive on inpatient fees for the lowest nurse staffing level grade in major cities, and a 2% disincentive in other areas based on the occupied-bed-to-nurse ratio (Health Insurance Review & Assessment Service [HIRA], 2018). According to a recent research by Cho, Park, Choi, Lee, and Kim (2018), the average number of surgical patients per nurse at acute hospitals in South Korea was 14.31. Experts in the field of healthcare have suggested that nurse staffing policies should be enhanced in order to ensure the safety of patients.

Multiple research have verified that higher levels of nurse staffing are linked to enhanced patient outcomes (Seago, Williamson, & Atwood, 2006; Zhu et al., 2012). Our recent review research revealed a correlation between nurse staffing and hospital readmission (Park, Bae, & Shin, 2019). Hospital-acquired conditions, which are preventable with evidence-based practice, are a significant cause of death. In 2008, approximately 134,000 older adults, or one in seven Medicare beneficiaries, experienced at least one hospital-acquired condition per hospital stay (Levinson, 2010). Various measures have been put in place to decrease the occurrence of hospital-acquired conditions, such as the nonpayment policy of the Centers for Medicare and Medicaid Services (CMS) (McHugh, Van Dyke, Osei-Anto, & Haque, 2011). The CMS anticipated that hospitals would undertake quality improvement initiatives and adopt care process modifications in order to reduce hospital-acquired diseases (Bae & Yoder, 2015).

Multiple researches have investigated the correlation between nurse staffing and hospital-acquired conditions. These studies have shown that higher levels of nurse staffing are associated

with a reduction in falls and different infections (Blegen, Goode, Spetz, Vaughn, & Park, 2011; Unruh, 2003). A comprehensive analysis of studies found a correlation between higher RN-to-patient ratios and a decrease in nosocomial bloodstream infection, pneumonia, and sepsis from 1990 to 2006 (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007). A recent research conducted by Griffiths et al. (2016) provided a comprehensive analysis of the correlation between nurse staffing levels and patient outcomes. The investigation revealed that the connection between nurse staffing and hospital-acquired conditions, such as falls and pressure ulcers, was not consistently seen. However, this review did not specifically address hospital-acquired illnesses and was unable to offer a comprehensive analysis and synthesis of the available research. In addition, due to the swift transformations in the healthcare landscape and health policy, particularly concerning hospital-acquired conditions, it is imperative that we examine the existing evidence on the correlation between nurse staffing and hospital-acquired conditions by synthesizing and evaluating empirical research on this subject.

## 2. Objectives

The aim of this research is to conduct a comprehensive analysis of primary studies published between 2000 and 2018. The goal is to gather new information and build upon existing results by examining the relationship between nurse staffing and hospital-acquired conditions using data from different nations. The results of this research have significant significance for the monitoring and management of nurse staffing in order to maximize the effect on hospital-acquired conditions.

## 3. Methodology

The studies were found in seven electronic bibliographic databases: CINAHL, Cochrane Library, DBpia, EBSCO, PubMed, PsycINFO, and RISS. We used the search phrases 'nurse staffing' and 'hospitals' as exemplars of independent variables and research contexts. In order to include the majority of relevant research, we refrained from restricting the outcome variables. We conducted searches of the title, keyword, and abstract using these two criteria to locate all relevant publications. For this investigation, we used CMS's definition of hospital-acquired conditions (CMS, 2019) as our operational definition.

## 4. Correlations between nurses on staff and the occurrence of hospital-acquired conditions

Three researches (Frith et al., 2010; Mark & Harless, 2010; Razmus, 2018) investigated the correlation between the number of registered nurse (RN) hours per patient day and three specific hospital-acquired conditions. However, these studies did not find any significant connections between the two variables. Two further studies (Frith et al., 2010; Mark & Harless, 2010) also found that there is no significant correlation between the number of hours worked by licensed practical nurses (LPNs)/licensed vocational nurses (LVNs) per patient day and the occurrence of

hospital-acquired conditions. Eight studies (Blegen et al., 2011; Dunton, Gajewski, Taunton, & Moore, 2004; Everhart et al., 2014; Kouatly, Nassar, Nizam, & Badr, 2018; Patrician et al., 2017; Shuldham, Parkin, Firouzi, Roughton, & Lau-Walker, 2009; Staggs et al., 2012; Van den Heede et al., 2009) investigated the correlation between the number of nursing hours per patient day and the occurrence of seven hospital-acquired conditions.

Significant negative correlations were seen between hospital-acquired pressure injury (HAPI), falls/unassisted falls, injury falls, central line-associated blood stream infection (CLABSI), and catheter-associated urinary tract infection (CAUTI). Conversely, there was no correlation between an escalation in the number of patients per nurse and the occurrence of hospital-acquired diseases (Brooks-Carthon, Kutney-Lee, Sloane, Cimiotti, & Aiken, 2011; Kim & Han, 2018). Unruh (2003) conducted a study examining the correlation between the number of full-time equivalent (FTE) registered nurses (RNs) and licensed practical nurses (LPNs) per 1,000 patient days, and the occurrence of hospital-acquired conditions. The study revealed a negative association between these variables. In their study, Mark et al. (2004) investigated the number of Registered Nurse Full-Time Equivalents (FTEs) per 1,000 inpatient days and Licensed Practical Nurse (LPN) FTEs per 1,000 inpatient days in connection to hospital-acquired infections. The study revealed that there were no significant associations between these variables. Kim and Bae (2018) discovered varied associations with hospital-acquired diseases while using a staffing grade. The ratio of nurses to occupied beds was shown to have a negative correlation with the occurrence of fractures within the hospital setting, as reported by Morita et al. in 2017. Zhu et al. (2012) discovered a correlation between a reduction in personnel numbers and a rise in occurrences of surgical site infections and pressure ulcers.

## 5. Discussion

The nurse staffing metrics consisted of the following: the number of hours worked by registered nurses (RNs) per patient day, the total number of hours of nursing care provided per patient day, the number of patients assigned to each nurse, the number of RN full-time equivalents (FTEs) per 1,000 inpatient days, the total number of nursing staff members per 1,000 inpatient days, the grade given to nurse staffing based on the ratio of RNs to occupied beds, and the ratio of nurses to occupied beds. While a large number of connections between nurse staffing levels and hospital-acquired conditions were found to be significant, there were also a notable number of associations that were not significant.

Specifically, the number of hours worked by registered nurses per patient day did not show any significant correlations with the occurrence of hospital-acquired disorders. However, there was a strong correlation between the total number of hours of nursing care per patient day and the number of full-time equivalent registered nurses (RNs) and licensed practical nurses (LPNs) per 1,000 patient days, and the occurrence of hospital-acquired conditions. Future research should investigate the disparities in the correlation between nurse staffing and hospital-acquired

conditions, using meticulous data collecting methods for RN hours per patient day and total hours per patient day, given the challenges associated with gathering data on these metrics.

Out of the 19 studies we examined, we were unable to perform a meta-analysis on the correlation between nurse staffing levels and hospital-acquired conditions. This is because these conditions are more difficult to quantify compared to other patient outcomes, such as mortality and readmissions. Hospital administrative data alone is insufficient to establish that these hospital-acquired conditions occurred after hospitalization, as it requires additional evidence. The variability in the operational criteria used in the papers under consideration posed challenges in conducting a meta-analysis. Additional administrative data from the NDNQI (Bae, Brewer, Kelly, & Spencer, 2015; Dunton et al., 2004) and Hospital Compare (Bae, 2016; Centers for Medicare & Medicaid Services 2013) might provide more opportunity to investigate the correlation between nurse staffing and hospital-acquired conditions.

Out of the evaluated publications, 7 were longitudinal research studies and 12, which accounted for 63% of the analyzed articles, were cross-sectional studies. The cross-sectional studies used extensive datasets and included other control variables, such as patient characteristics (e.g. age, acuity), and other organizational features, in order to investigate the correlation between nurse staffing and hospital-acquired conditions. Nevertheless, this research design restricts the applicability of the results as the data cannot be utilized to deduce causal correlations, as noted by Aiken et al. (2011). Longitudinal studies often use panel data, which consists of several measures taken over time within the same units or institutions. They overcome a constraint of cross-sectional research and have the potential to establish more definitive causal conclusions, but causation cannot be explicitly inferred from an observational study. To enhance causal inference in the correlation between nurse staffing and hospital-acquired diseases, it is necessary to perform more research utilizing longitudinal studies that focus on individual patients.

Several studies examined hospital-level data by using administrative information. The nurse staffing was determined by splitting the staffing according to the ratio of inpatient-to-outpatient revenues (Mark et al., 2004) or nursing hours per patient day, without taking into account the specific attributes of the nursing unit. This might complicate the analysis of the findings, since they include varying degrees of personnel and the acuity status of patients in each unit. Hence, it is important to support studies that appropriately change the features of unit or patient levels in order to enhance the accuracy of predicting patient outcomes. Furthermore, although our search focused on publications examining the correlations between nurse staffing and hospital-acquired disorders within a hospital environment, it is important to note that the impacts of hospital-acquired conditions might manifest at home or in long-term care facilities after discharge from the hospital. Hence, it may be essential to assess these criteria post-discharge as well in order to enhance our comprehension of the correlation between nurse staffing and hospital-acquired diseases.

## 6. Conclusion

Overall, the examined studies indicate that there is a connection between nurse staffing and hospital-acquired conditions, despite the variations in variables and scales used to measure staffing levels and these disorders. Nevertheless, a substantial proportion of these connections lacked significance. Our research emphasizes that sufficient nurse staffing is a reliable measure of a hospital's ability to provide high-quality nursing care. Hence, it is essential to prioritize the implementation of a robust policy that effectively regulates the minimum levels of nurse staffing in order to safeguard patient safety and ensure the delivery of high-quality treatment. Additional research is advised to establish the ideal ratio of patients to nurses or nursing care hours per patient, in order to provide a framework for nurse staffing methods.

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