

# How a Reduction in Nursing Impacts Hospital Centers; A Scoping Review

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## ABSTRACT

This article explores the relationship between the reduction in nurse staffing levels and the quality of patient care and hospital financial performance. The online database PubMed was searched by employing the MeSH terms “Nurse Staffing AND Hospitals AND (Patient Care OR Financial Performance)” and incorporating a set of inclusion (e.g., tracks trends in nurse staffing numbers and are conducted in adult medical units) and exclusion criteria (e.g., out-patient medical centers that aren’t affiliated with an academic institution). Through integrating a systematic search methodology into the format of a scoping literature review, this paper identifies that reducing nurse staffing correlates with higher rates of patient mortality and patient complications. Lower RN levels also correlated with higher costs in hospitals, thus a reduction in profit; though, this finding was inconsistent across included articles. The findings from this review contribute to the rising debate over the vitality of nurses in the healthcare industry. Along with the quantity of staffing, the quality of employment provided to nurses will help hospitals efficiently use their resources in providing patients with high value care—the best care possible.

## Introduction

The Covid-19 pandemic has ravaged the United States, resulting in the death of over one million people and hospitalizing nearly 4.9 million.<sup>1</sup> As a result, hospitals have faced a surplus of patients, placing a strain on financial capital and medical resources. Hospital staff have undergone significant pay cuts while working for far longer hours.<sup>2</sup> Concurrently, fewer elective surgeries have undermined hospital profits, causing many institutions to reduce staff numbers.<sup>3</sup> Registered Nurses account for 30% of the United States healthcare workforce, making it the largest medical profession.<sup>4</sup> Thus, nurses are facing the brunt of the issues spurred on by the pandemic, leading to high burnout rates, along with voluntary and involuntary termination.<sup>5</sup>

In this study, a scoping review was performed to assess how nurse staffing numbers at in-patient academic medical centers in the United States affect hospital financial performance and patient safety outcomes. One reviewer independently reviewed all the relevant articles which populated the PubMed database using the following MeSH terms: “Nurse Staffing,” “Hospitals,” “Patient Care,” and “Financial Performance.” Following an abstract screening, appropriate studies were selected for full-text review, with studies meeting inclusion criteria being synthesized in this analysis. Through reviewing the selected literature, data was consolidated and analyzed for correlational patterns to determine the significance of the topic. As healthcare systems grow, more nurses than ever will be needed to staff them and take care of patients. However, recent modifications to the work environment are causing nurses to leave the field and retire at an unprecedented rate, underscoring how the nursing industry will need to grow in order to avoid a shortage. Achieving a greater understanding of how nurses both impact safety and financial performance will aid healthcare systems everywhere in improving the quality and efficiency of high value care.

## Methods

This study was conducted in the format of a scoping review to address how nurse staffing numbers at in-patient academic medical centers in the United States affect hospital financial performance and patient safety outcomes. An advanced keyword search on the electronic database PubMed with the following MeSH term combination: “Nurse Staffing AND Hospitals AND (Patient Care OR Financial Performance).” The reviewer screened articles published between January 1975 and May 2022, resulting in 563 results. Out of the 563 articles, 512 articles were deemed to be outside of the scope of the review after screening the abstracts through the lens of the inclusion and exclusion criteria (Table 1). Each article’s abstract was reviewed to provide a more thorough approach for excluding inappropriate literature and leaving less room for error. A full-text review was performed on 51 articles, with 20 articles meeting the criteria for the review. Included studies were published between August 2004 and July 2021 and were all written in English. A data table was created to organize all the articles that fit the inclusion criteria and provided relevant information. Data analysis included stratifying articles based on their focal findings; articles were grouped into focusing on patient safety outcomes, hospital financial performance, or both. The design of each article was also monitored, along with a summary of its quality appraisal through the Joanna Briggs Institute assessment tool for systematic reviews.

**Table 1.** Inclusion and Exclusion Criteria for Literature Search Algorithm

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>• Trends in nurse staffing numbers</li> <li>• In-patient academic medical centers</li> <li>• Within the United States</li> <li>• Adult medicine units (18 or Above)</li> <li>• Analyzes impact on patient care</li> <li>• Analyzes impact on hospital financial performance</li> </ul>	<ul style="list-style-type: none"> <li>• Trends in non-nurse staffing numbers</li> <li>• Pediatric units (Below 18)</li> <li>• Medical centers not affiliated with an academic institution</li> <li>• Out-patient medical centers</li> <li>• Non-United States hospitals</li> </ul>

## Results

Studies analyzed the impact of nurse staffing levels on the quality of patient care in two separate domains: patient mortality and complications. Seven out of the twenty studies discussed the relationship between nurse staffing numbers and patient mortality rates,<sup>6-12</sup> with mortality rates decreasing between 1.2% to 16% through the addition of one Registered Nurse.<sup>6,10</sup> All seven studies approached a unison understanding that a reduction in nurse staffing numbers was correlated with higher mortality, suggesting an inverse relationship between the number of nurses employed and patient mortality rates. Tourangeau et al.(2006), in particular, identified that medical centers who employed more registered nurses per shift saw lower patient mortality over the span of 30 days.<sup>9</sup> Thirteen out of the twenty studies explored how an increase or decrease in nurse staffing numbers affected the rate of patient complications.<sup>6,8,13-23</sup> Complications included a variety of problems such as missed patient care<sup>13,23</sup> and hospital acquired infections<sup>6,14,15,18,19,22</sup> such as pneumonia, UTIs, pressure ulcers, and more.<sup>6,13,14,15,18,19,22,23</sup> Additionally, the review identified nurses were less safe as a result of low staffing. Wyenendaele et al. (2019) reported that nurses are more susceptible to needlestick injuries as a result of understaffed hospital units, thus affecting their ability to care for patients.<sup>17</sup> Results from a study conducted by Penoyer et al. (2010) estimated a potential 26.7% decrease in infection rates if ICUs increased nurse staffing.<sup>19</sup> Overall, all thirteen studies which analyzed complications concluded that units with lower nurse staffing were more prone to complications and an overall compromise in the quality of care.

There was a lack of uniformity amongst the seven articles that investigated the relationship between a change in nurse staffing levels and hospital financial performance.<sup>7,10,11,16,20,24,25</sup> Two articles found that a reduction in staffing raised expenses as the additional costs from patient complications and nurse burnout were greater than the savings

that resulted from cutting labor.<sup>11,25</sup> Three studies concluded that an increase in nursing numbers lowered hospital costs,<sup>7,16,20</sup> with Timothy et al. (2009) quantifying \$60,000 in savings per RN.<sup>16</sup> Two articles saw a direct, positive relationship between nurse staffing and hospital costs.<sup>20,25</sup> Twigg et al. (2015) found that the increase in operating costs secondary to hiring more nurses outweighed the costs of the negative externalities associated with less nurses.<sup>25</sup> Unruh (2008) saw that increasing RN staffing raised operating costs, but had an insignificant impact on profits.<sup>20</sup> Finally, Treacy et al. (2019) claimed an inconsistent impact on hospital costs as a result of altering staffing levels.<sup>23</sup>

Because most of the articles were systematic reviews, the JBI quality appraisal tool was used to assess each article's quality. Thirteen out of the twenty articles were assigned a relatively high score of at least an 8 out of 11 on the test, with some outliers due to a lack of transparency in the methodology. The high JBI quality appraisals of the included articles speaks to the strength of this review, suggesting minimal bias in the data.

**Table 2.** Data Synthesis of Each Selected Article

Source	Setting of the Study	Design of the Study	Main Finding	Bias Assessment (Joanna Briggs Institute Checklist for Systematic Reviews and Research Syntheses)
Kane et al. (March 2007)	-In-patient medical centers	-Systematic literature review supported by the American Organization of Nurse Executives -Used a variety of databases to find studies that matched the eligibility criteria	-An additional RN per patient day correlated with a 1.24% reduction in death rate in ICUs and surgical units	JBI 11/11
Saville et al.(2019)	-Nursing staff working in general inpatient units	- Inputted search terms into three databases and excluded articles that included <i>problem</i> search terms -Screened abstracts and reviewed full text of articles that fit the criteria	-Adequate staffing levels correlated with a decrease in mortality rates when compared to insufficient staffing levels -An increase in permanent nurses decreased costs for hospitals according to an optimization model made by Harper et al. (2010)	JBI 9/11
Aiken (2008)	-Unspecified	-Unspecified	-Recalled observations made in Kane et al.(2007) that indicated "that an additional RN per patient day would	Not enough information on protocol to provide a score

			avoid 7 cases of infected wounds and 4 cases of nosocomial sepsis per 1,000 hospitalized surgical patient”	
Rae et al. (2021)	- Critical care units - Registered nurses	-Systematic Review -Three reviewers who accessed data from open access databases like CINAHL Plus, MEDLINE, SCOPUS, etc.	-10 of 15 studies reported a statistically significant correlation between higher staffing numbers and lower death rates -5 studies reported a statistically significant correlation between higher staffing numbers and lower infection rates -4 studies on patient outcomes reported a statistically significant correlation between increased staffing and lower rates of adverse events	JBI 10/11
Tourangeau et al. (2006) 7	-Nurses and patients in acute care hospitals	-Searched MEDLINE and CINAHL from 1986 to 2004 for potentially relevant research literature -Out of 444 publications that resulted from MeSH terms, 15 were deemed relevant by using inclusion criteria	-7 studies reported that reduced mortality rates were associated with higher RN staffing -Manheim et al. (1992) reported a lower 30 day mortality number in hospitals that employed more RNs -Blegen et al. (1998) also reported a correlation between higher nursing staff and lower patient mortality	JBI 10/11
Kane et al. (Dec 2007) 6	-RN and Patients in acute care hospitals	-Systematic review that follows protocol dictated by Meta-Analysis of Observational Studies in Epidemiology -Several reviewers found studies from databases such as Medline, CINAHL, Cochrane, etc...	- Correlation between greater RN staffing and lower adjusted odds ratio of mortality related to hospitals -“An increase by 1 RN FTE per patient day was associated with a 9% reduction in odds of death in ICUs,16% in surgical , and 6% in medical patients.” -Non-linear decrease in hospital-related mortality	JBI 11/11

		<p>-Meta-analysis used to quantify the findings of the association between RN staffing and patient outcomes</p>	<p>when nurse staffing was increased          -'The observed death rate was 9 –10% lower when there was 1 more RN FTE per 1000 patient days"          -When hospitals increased RN staffing, varied results occurred between the cost of increased staffing and a decrease in adverse patient events</p>	
Penoyer et al. (2010)	-Nurses and patients in ICUs and CCUs	<p>-Annotated review of nursing and medical literature from 1998 to 2008 through databases like PubMed, Medline, CINAHL          -All abstracts reviewed using inclusion criteria</p>	<p>-Increased nurse staffing is associated with around a 33% decrease in infection risk and 26.7% decrease in infection risk in ICUs          -Lower nurse staffing associated with higher risk for postoperative patient complications</p>	<p>JBI          8/11</p>
Robnett (2006)	-Nurses and patients in Critical care units	<p>-Review of past and current literature within the U.S. and internationally          -Articles found in Medline and CINAHL databases</p>	<p>-The Joint Commission on Accreditation of Healthcare Organizations examined 1,609 hospital reports of patient deaths and injuries since 1996 and found that low nursing staff levels were a contributing factor in 24% of the cases.          -Inadequate nurse staffing may cost more money due to the costs of nurse burnouts and poor patient outcomes that occur as a result</p>	<p>JBI          6/11</p>
Engineer et al.(2016)	-Rural and urban hospitals	<p>-Systematically reviewed studies in PubMed and gray literature that pertained to the 14 hospital characteristics and 17 Inpatient</p>	<p>-Six out of ten studies found a correlation between higher nurse staffing and lower mortality</p>	<p>JBI          10/11</p>

		Quality Indicators selected by authors		
Griffiths et al.(2018)	-General medical/surgical wards in acute hospitals	-Systematic Review on databases such as CINAHL, CENTRAL, Econlit, etc.. -Two reviewers and National Institute for Health and Care Excellence quality appraisal checklist was used	-Fourteen studies found that a reduction in nurse staffing equated to more missed care	JBI 8/11
Mitchell et al. (2017)	-Hospital settings -Majority of studies chosen conducted in ICU setting	-Systematic Review using PRISMA guidelines -Used databases like MEDLINE, PubMed, CINAHL -PROSPERO protocol -Narrowed down studies through eligibility criteria -Timeline ranges from 200 to 2015	- Increased staffing is associated with a lower risk for contracting hospital-acquired infections in patients	JBI 9/11
Timothy et al. (2009)	-Acute care hospitals	-Reviewed research literature on relationship between RN staffing level and patient risk for complications -Combined findings to quantify the elasticity or percent change in patient risk for complication for each 1% increase in nurse hours per patient day -Hospital discharge data from NIS 2005	-Interpreted NIS hospital discharge data for 2005 to reveal that approx. 87% of lives saved by better staffing protocols was achievable by stopping nosocomial complications -Each new RN staffed results annually in \$60,000 in reduced medical costs	JBI 6/11
Wynendaele et al. (2019)	-RNs or LPNs working in an acute hospital setting	-Systematic literature review on studies from databases such as	-Patients in hospital units with lower nurse staffing had a greater to chance to be victim of needle stick injuries	JBI 11/11

		<p>PubMed, CINAHL, Cochrane, etc...</p> <p>-Two independent reviewers screened titles and abstracts</p> <p>-MMAT 2011 used for quality appraisal</p>		
Garrett et al. (2009)	-Unspecified	-Unspecified	-The conclusion from Whitman et al. (2002) suggests that hospital units with lower nurse staffing are more susceptible to negative patient outcomes	<p>JBI</p> <p>4/11</p>
Unruh (2008)	-Nurses and patients in hospitals	<p>-Comprehensive literature review on articles published from 1980 to 2006</p> <p>-Gathered articles from databases such as CINAHL, Medline, EconLit, etc...</p> <p>-Chose U.S. or international studies</p>	<p>-Kovner et al. (2002) showed lower rates of pneumonia in hospitals with higher RN staffing</p> <p>- Unruh (2003) proved that less patients faced complications in hospitals with higher licensed nurse staffing</p> <p>-Four studies illustrated lower mortality rates in hospitals with higher nurse staffing</p> <p>-Titler et al. (2007) showed that higher nurse staffing decreased hospital costs while the opposite occurred with lower nurse staffing</p> <p>-McCue et al. (2003) found that increasing full-time RNs raised operating costs while not significantly increasing profits</p>	<p>JBI</p> <p>8/11</p>
Shin et al. (2019)	-Nurses in hospital settings	<p>-Systematic literature review following PRISMA guidelines</p> <p>-Systematic five-step approach used to evaluate published studies: problem formulation, literature search, data</p>	<p>-Majority of studies identify a negative correlation between nurse staffing levels and hospital-acquired conditions</p> <p>-Considerable amount of these relationships are not significant, however</p>	<p>JBI</p> <p>11/11</p>

		<p>evaluation, data analysis, and presentation</p> <p>-Found journal articles from databases such as CINAHL, PubMed, Cochrane, etc...</p>		
Hugonnet et al.(2004)	-Unspecified	-Unspecified	-Results from Vicca (1999) showed a weak, but significant association between MRSA contraction rate and nurse staffing levels	<p>JBI</p> <p>5/11</p>
Treacy et al. (2019)	- Patients and nurses in acute care hospitals	<p>-Two literature search strategies</p> <p>1. Inputting MeSH terms into electronic databases like CINAHL, Medline, and Web of Science and cross-referencing results with inclusion criteria</p> <p>2.screening backward and forward citations of chosen studies</p> <p>-CASP quality appraisal tool used to validify evidence</p>	-Six studies identified reduced nurse staffing levels associated with patient deterioration	<p>JBI</p> <p>9/11</p>
Thungjaroenkul et al.(2007)	-ICUs and operating rooms	<p>-Systematic Review including five databases</p> <p>-Timeline from 1990 to 2006</p> <p>Two reviewers independently screened articles that came under the search terms</p> <p>A quality assessment tool evaluated the final 17 papers that met inclusion criteria</p>	<p>-Mixed results when analyzing association between nurse staffing levels and its impact on hospital costs</p> <p>-Ten studies reported a correlation between nurse staffing and costs</p>	<p>JBI</p> <p>10/11</p>



<p>Twigg et al. (2015 May)</p>	<p>-Nurses and patients in medical and/or surgical acute care wards</p>	<p>-Systematic review of literature using the Cochrane Collaboration systematic review method          -Sources derived from MEDLINE, CINAHL, SPORTDiscus, and PsychINFO in 2013          -Inclusion and Exclusion criteria determined the relevance of studies</p>	<p>-Behner et al. (1990) revealed that when nurse staffing was 20% below the mandated number, costs from patient complications outweighed the savings from cutting labor          -Shamliyan et al. (2009) saw that the cost of elevating nurse staffing levels outweighed the benefits</p>	<p>JB1          11/11</p>
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## Discussion

This review identified literature which explored the financial, patient complications, and mortality rates associated with a reduction in nurse staffing numbers at in-patient medical centers. Of the articles included, an inverse relationship was unanimously identified between staffing levels and the quality of patient care, specifically through patient mortality and complications. Furthermore, five of the seven articles that discussed the relationship between nurse staffing numbers and hospital financial performance argued that a reduction in staffing would increase costs,<sup>7,11,16,20,25</sup> mainly through a higher risk of patient complications.<sup>11,25</sup> These results suggest that a decrease in nurse staffing may be a harm to both the hospital and its patients.

Many nursing organizations have warned of the risks of reducing nurse staffing, and this literature review may corroborate their claims. The American Association of Critical-Care Nurses argues that because hospitals simply view nurses as a percentage of their operating costs—40% according to the American Nurses Association—, these corporations slash costs by minimizing staffing and ignoring any adverse effect this change may have on both patients and nurses.<sup>26-27</sup> Complications arise, ranging from compromises in the well-being of nurses and patient safety. The American Nurses Association cites findings from Avalere when proposing that nurse staffing levels should always be changing depending on various factors, including the number of admissions, nurse skill mix, patient complexity, and more.<sup>27</sup> Dr. Linda Aiken reports in *The Journal of the American Medical Association* that the addition of a patient onto a nurse’s workload can equate to a 7% increase in the probability of 30-day mortality and failure-to-rescue, along with a 23% increase in the odds of nurse fatigue and job dissatisfaction.<sup>28</sup>

The American College of Healthcare Executives (ACHE) conducted a survey in which hospital CEOs were asked about the top concern to their organizations. Their largest issue was reported to be personnel shortages, with 94% specifically mentioning scarcity of RNs.<sup>29</sup> ACHE CEO Deborah Bowen finds that for the first time since 2004, “staffing challenges have surpassed financial challenges.”<sup>29</sup> Additionally, previous studies have suggested that medical centers with more positive reports on experienced patient care are associated with stronger financial performance.<sup>30</sup>

This scoping review organizes findings from various journals into one coherent study where connections between nurse staffing, patient care, and hospital costs are found. High value care is defined as providing the best care and medical outcome for patients through medical centers’ efficient use of resources. The findings from this literature suggest that a major step towards achieving high value care or providing the best care through the efficient use of resources, may be to view nurses as more than an operating cost. Hospital administrators should consider dedicating a portion of their firms’ resources to improve nurse staffing numbers and wellbeing as a means of improving the safety

and care of patients. Ultimately, as some of the articles in this review have identified, this may lead to an overall savings in costs for hospital centers.<sup>7,16,20</sup>

Although this study was conducted under the name of a scoping review, the systematic nature of the methodology carries many strengths that bolster the legitimacy of this review's results beyond the traditional protocol. A rare part of the scoping review protocol is the critical appraisal process. This literature review critically appraised its evidence through using the JBI assessment, thereby giving an edge over other scoping review processes. Because this review discussed the comprehensively reviewed field of patient care and the disparate field of hospital finances, the preciseness of a systematic review was combined with the broad nature of a scoping review. Finally, this article not only synthesized data and summarized evidence to answer a question, but it also filled in the gaps of existing research on the topic of healthcare economics and provided future recommendations for the course of research.

This article was also limited in the quality of information it could deliver. The healthcare industry often exhibits a lack of transparency in hospital finances due to many being privately owned. As a result, it is difficult to synthesize existing data regarding how nurse staffing levels affect costs and expenses. This review sought to overcome the lack of transparency by focusing on academic health centers, as their data was more readily available, which could possibly impact its ability to be generalized to for-profit or community hospitals. Publication bias may arise from this shortcoming because hospitals may be more inclined to release information that benefits their image. Another limitation to this literature review is the prioritization of qualitative findings. Statistical interpretations were not made in this article, and only the qualitative aspects of chosen studies were reviewed. Some articles also failed to disclose the methodology and protocols used to gather and extract data.<sup>11,14,16,18,22</sup>

The results of this study suggest to future policymakers that the quantity of nurses staffing a unit affects the quality of the care they can provide. Although cutting nurse staffing may seem to decrease operating expenses and grant savings on labor—a finding this review identified as inconsistent—hospitals also leave the door open to more risk of patient complications and nurse burnout. As the deficit in the Registered Nurse workforce continues to grow, more clinical research must be conducted on the various factors that affect the nursing industry. Additionally, medical centers should consider being more transparent about their finances, as it would allow for policymakers to better understand their economic behavior and guide future research.

## Conclusion

In conclusion, this article explored the relationship between the reduction in nurse staffing levels and the quality of patient care and hospital financial performance. After conducting a scoping review of literature with a systematic protocol, the review identified that a reduction in nurse staffing compromises patient safety by increasing mortality rates and the risk of complications. Most articles related to hospital finances saw that a reduction also increased costs, while a minority of the studies discovered that a reduction either lowered expenses or had an insignificant effect.

## Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

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