

# The Impact Of Nurse-To-Patient Ratios On Patient Outcomes

Abdullah Mashlah Aldosari , Aysha Ali Alsalman , Ghazlan  
Maseer Albathali , Haya Fayed Marzouq Alshamaray ,  
Reem Nassser Ali , Ghanem Abdollah Al Ghanem ,  
Ebtihaj Metab Mohsen Almutiri , Sahar Atih Maeyud  
Alharthi , Maram Abdullah Almutairi , Maytha Ali  
Aldosari , Faisal Abdullah Alharbi , Anwar Sabr Alanazi ,  
Musaed Matar Alenzi

## Abstract

Nurses play a crucial role in delivering excellent healthcare in acute hospitals. Nevertheless, determining the ideal dosage of nurses required to care for patients remains uncertain. Therefore, it is necessary to conduct a revised evaluation of the available data on the impact of nurse staffing levels on patient outcomes. The objective is to conduct a comprehensive study and meta-analysis to investigate the correlation between the levels of nurse staffing and patient outcomes that are influenced by nursing care in specialized acute care units. Increased staffing levels were linked to decreased death rates, medication mistakes, ulcers, usage of restraints, infections, pneumonia, increased use of aspirin, and a larger proportion of patients having a percutaneous coronary procedure within 90 minutes. A meta-analysis of six trials, covering 175,755 patients admitted to the emergency room and/or cardiac/cardiothoracic units, found that increasing the number of nurses on duty reduced the risk of in-hospital death by 14% (0.86, 95% confidence range 0.79–0.94). Nevertheless, the meta-analysis also revealed a significant level of heterogeneity, with an I<sup>2</sup> value of 86%. The ratio of nurses to patients has a significant impact on many patient outcomes, particularly in terms of in-hospital mortality. Further study is required to investigate the correlation between nurse-to-patient ratios and nurse-sensitive patient outcomes in order to address the lack of information and limitations in existing studies on this topic. This would provide further substantiation for the suggestions on the most advantageous nurse-to-patient ratios in acute specialized units.

**Keywords:** Nursing, staffing, workforce, nurse-to-patient ratio, patient-focused outcomes.

## 1. Introduction

In the last ten years, there has been a renewed emphasis on determining the appropriate amount of nurse staffing that is considered sufficient. This may be attributed, at least in part, to notable instances of care provision failures for hospitalized patients resulting in fatalities (1,2). Organizations in many nations have used several strategies for managing the nursing staff. Victoria, Australia, and California, USA, have implemented standardized and compulsory nurse staffing levels for more than ten years. In the UK and Ireland, there are national nurse staffing guidelines; however, these standards are not legally enforced.(3-5) Wales has implemented the Nurse Staffing Levels Act 2016, which provides suggestions rather than compulsory nurse-to-patient ratios (NPRs) to inform choices about nurse staffing levels.(6) The concept of determining the ideal amount of nurse staffing is contentious due to the absence of a universally applicable method for evaluating staffing requirements. The absence of clear understanding is exacerbated by a lack of agreement over the optimal method for determining the size and composition of nursing teams, since all assessment methodologies have inherent limits.(4-7)

Managers responsible for staffing confront the problem of comprehending the impact of several aspects that contribute to each unique care environment, which might vary across organizations and nations. Donabedian categorized potential factors into three overarching domains: structural factors (including the individuals, equipment, and physical environment that constitute the healthcare delivery system); processes of care (referring to the manner in which healthcare is provided through the interactions between healthcare professionals and patients); and subsequent outcomes (representing the ultimate results of the care provided within the organizational context).(8)

In order to establish appropriate nurse staffing levels, managers must have a comprehensive understanding of the key elements that contribute to this determination. These considerations include patient-related aspects such as the amount of nursing care required based on acuity and dependence levels, ward-related factors such as patient throughput, and nursing staff-related factors such as the quantity and skill level of the nurses.(9) The results of a systematic review and meta-analysis conducted ten years ago revealed a strong correlation between higher levels of nursing personnel in hospitals and better patient outcomes that are

influenced by nursing care.(10) A recent literature study conducted by Penoyer discovered a correlation between the levels of nurse staffing and the outcomes of patients in the intensive care unit (ICU).(11) Nevertheless, their assessment just included research conducted between 1998 and 2008. Considering this, it is necessary to do an updated literature review. This review will analyze newly published research that explore the connections between nurse staffing levels and nurse-sensitive patient outcomes in acute specialty units.

## **2. Methods**

To locate research done in acute specialty units that investigate the correlation between nurse staffing levels (NPRs) and nurse-sensitive patient outcomes.

### **2.1. Search Strategy**

The research team devised the search approach with contributions from skilled information technologists. The following electronic databases and grey literature sources were systematically searched: Medline (OvidSP), Medline in Process (OvidSP), CINAHL (Cumulative Index to Nursing and Allied Health Literature) (EBSCO), PsycInfo (OvidSP), Embase (OvidSP), HMIC (Health Management Information Consortium) (OvidSP), Cochrane Database of Systematic Reviews, Web of Science; Science Citation Index Expanded (ISI Web of Knowledge), Web of Science; Social Sciences Citation Index (ISI Web of Knowledge), Web of Science; Conference Proceedings Citation Index – Science (ISI Web of Knowledge), Web of Science; Conference Proceedings Citation Index- Social Science and Humanities (ISI Web of Knowledge), Index to Theses, Proquest Dissertations and Theses. A mix of selected keywords and regulated language, such as MeSH (medical topic headings), was used, wherever possible .

### **2.2. Criteria For Inclusion**

After conducting the literature search, a group of reviewers collaborated in pairs to independently evaluate the titles and abstracts based on the predefined criteria for inclusion. A third reviewer handled any disagreements among the reviewers. Studies that satisfied the specified inclusion criteria were included. Adult patients are admitted to specialized units such as intensive therapy units, critical care units, intensive care units, coronary care units, high dependency units, and cardiothoracic surgery units. In these units, some nurses are

required to have a postgraduate critical care qualification. Studies that included a ward with a diverse population were included. Examining the impact of nurse-to-patient ratios (NPRs) by using either the ratio of nurses to patients over a 24-hour period or the Nursing Hours Per Patient Day (NHPPD).

### **2.3.Data Extraction**

An ad hoc data extraction technique was created and tested before being improved. Data was also taken from each trial and documented in the following categories: The user is requesting information on bibliographic details, the location or nation of a study, the research design, the results or findings, conclusions, and quality evaluation .

### **3. Staffing Ratio Between Nurses And Patients**

Nurse-to-patient ratios (NPRs) are often measured in two ways: either by calculating the number of nurses working each shift or throughout a 24-hour period divided by the number of beds occupied by patients during that same time period, or by determining the number of nursing hours per patient bed days (NHPPD). There are alternative and intricate methods to assess nurse staffing needs, but there is no universally endorsed method.(3) A significant number of the research included in this evaluation have established non-performing rates (NPRs). Increased nursing staff levels correspond to a greater number or percentage of nurses available to care for assigned patients. Smaller nurse staffing refers to a situation where there are fewer nurses, or a smaller percentage of nurses, compared to the number of patients they are allocated to.(11)

Furthermore, there is less knowledge about the management of nurse staffing levels in European hospitals. Nurse-to-patient ratios (NPRs) may be monitored inexpensively and accurately, however they provide a limited perspective. While NPRs can serve as one indication, they should be combined with other assessment methods to determine appropriate nurse staffing levels.

### **4. Nurse-Focused Patient Outcome Metrics**

The patient outcomes measures in this investigation were derived from prior studies that have shown sensitivity to changes in nurse staffing and focused on adverse events.(10-13) The nurse-sensitive patient outcome measures we considered encompassed a range of factors, including

mortality, failure to rescue (FTR), shock (including sepsis resuscitation), cardiac arrest, unplanned extubation, hospital acquired pneumonia, respiratory failure, surgical bleeding, heart failure/fluid overload, catheter-associated urinary tract infection, pressure sores, patient falls, nosocomial bloodstream infection, medication error, length of stay, hospital-acquired sepsis, deep vein thrombosis, central nervous system complications, death, wound infection, pulmonary failure, and metabolic derangement.(14-18)

## **5. Staffing Levels Of Nurses In Relation To The Number Of Patients**

Diverse methodologies were used to quantify non-performing loans ratios. Schwab et al. computed the Nurse-to-Patient Ratio (NPR) each shift by dividing the number of nurses per day by three (per shift) and then dividing it by the number of patients per day. They used monthly census data for their calculation. Thirty-eight Other research used similar methodologies.(19, 25, 26, 31, 33, 34) Several writers supplied insufficient information about the calculation of the NPR.(18, 28, 30, 32) Valentin et al. computed the NPR by shift and the occupancy rate, which is the maximum number of occupied beds divided by allotted beds. They also determined the NPR for each shift in each unit and the relative turnover, which is the number of admitted and discharged patients divided by the number of unit beds.(35) Cho et al. computed the NPR by using the bed occupancy rate and then classified it into several classes.(21) Grade 1 denoted a nurse-to-bed ratio of less than 0.5, while grade 9 suggested a ratio more than 2.0. The study conducted by Cho et al. used the ratio of bed occupancy rate to the number of full-time equivalent (FTE) nurses for the purpose of computation. The bed occupancy rate provided was derived from the data collected over a 3-month period in the ICU survey. Tourangeau et al. computed the 'nursing staff dosage' instead of the NPR.(36). The calculation included dividing the total number of nurse hours performed by the combined number of weighted patient cases discharged from all hospitals.

Stone et al. computed the Nursing Hours per Patient Day (NHPPD) using payroll and Intensive Care Unit (ICU) census data.(37) Diya et al.(22) computed the Net Hospital Patient Per Day (NHPPD) but did not specify the methodology used for the calculation. Van den Heede and colleagues(38,39) computed the NHPPD (Nursing Hours per Patient Day) on a daily basis for

each ward. The information was derived from the daily ward census data. Shulldham et al.(40) and Hart and Davis (23) both used a similar method where they differentiated between the hours worked by permanent employees and temporary employees. The failure to consistently include in staff sick leave and yearly leave indicates that the staffing ratios may have been overstated.(16) If the staffing requirements on a daily basis were not achievable, a substitute value representing the greatest number of NPRs during a 24-hour period was used.(17)

The research revealed that an increased level of nurse staffing was linked to a reduction in the likelihood of in-hospital mortality (odds ratio [OR] 0.86, 95% confidence interval [CI] 0.79–0.94) as well as nurse-sensitive outcomes. Because of the differences across studies, especially in non-performing ratios (NPRs), it is not possible to provide a suggestion about the best ratio needed to enhance patient outcomes. Nevertheless, research indicates that there is a direct correlation between the degree of nurse staffing and a decrease in in-hospital mortality. Regrettably, all of these studies were conducted using a cross-sectional design, which means that it is not possible to establish a cause-and-effect link. This systematic review expands on the findings of a previous study conducted by Kane et al.(10), which showed that increasing the number of nurses in intensive care units (ICUs), surgical wards, and medical wards was associated with a decrease in mortality rates. Specifically, for each additional full-time equivalent (FTE) nurse per patient day, the odds ratio (OR) for mortality decreased to 0.91 (95% confidence interval [CI] 0.86–0.96) in ICUs, 0.84 (95% CI 0.8–0.89) in surgical wards, and 0.94 (95% CI 0.94–0.95) in medical wards.<sup>10</sup> Our meta-analysis revealed a 14% reduction in the probability of death inside the hospital for each extra drop of one patient load during a 24-hour period. All of the studies included in the meta-analysis were assessed to have a high rating according to the NOS quality assessment instrument.

We also investigated the impact of nurse-to-patient ratios (NPRs) on patient outcomes that are influenced by nursing care. Due to the significant variation in the types of nurse-sensitive patient outcomes evaluated, a meta-analysis was not performed. Park et al. investigated the impact of nurse staffing on FTR rates. The term "35 FTR rates" refers to the mortality rate after an adverse event that is linked to post-surgical complications. Park et al. examined data from an

administrative dataset including 159 non-ICUs and 158 ICUs across 42 institutions.

Researchers discovered that in Intensive Care Units (ICUs), a greater NHPPD (Nursing Hours per Patient Day) was linked to a reduced FTR (Failure to Rescue) rate. The odds ratio (OR) was -0.022, with a 95% confidence interval (CI) ranging from -0.39 to -0.005 (adjusted).(42) Stone et al. also investigated the impact of nurse-patient ratios (NPRs) on outcomes that are influenced by the actions of nurses.(37) The outcomes observed were central line bloodstream infections, ventilator-assisted pneumonia, catheter-associated urinary tract infection, 30-day mortality, and the occurrence of decubitus pressure ulcers. Their sample included 15,846 individuals from 51 intensive care units (ICUs) from 31 institutions. Stone et al. discovered that patients who had a larger number of NHPPD had a 68% lower chance of developing bloodstream infections (95% CI 0.15–0.17), a 79% lower chance of developing pneumonia (95% CI 0.08–0.53), and a 31% reduced risk of developing a decubitus pressure ulcer (95% CI 0.49–0.98).41 The presence of a greater number of nurses resulted in enhanced cardiac outcomes. Each additional 10% of nurses resulted in a 7.1% rise in the prescription of aspirin at admission and a 6.3% reduction in the time taken for a percutaneous coronary intervention within 90 minutes of hospital arrival.(27)

O'Brien-Pallas et al. examined the correlation between nurse-to-patient ratios (NPRs) and patient outcomes that are influenced by the quality of nursing care.(33) Their outcomes included a range of medical conditions, including deep vein thrombosis, pressure ulcers, falls resulting in injury, medical mistakes with subsequent implications, pneumonia, catheter-associated urinary tract infection, and wound infections. O'Brien-Pallas et al. examined a dataset including information on 1230 individuals from 24 cardiac and cardiovascular units across six hospitals.(33) The NPR was determined by computing the mean number of patients attended to by a nurse during the day shift during the data collecting period. Researchers discovered that with each extra patient assigned to a nurse, the likelihood of patients receiving 'excellent or high quality treatment' decreased by 22% and the likelihood of experiencing a longer than planned length of stay increased by 35%.

## 6. Conclusion

This comprehensive research identified a potential correlation between increased nurse staffing levels and improved patient outcomes. Each additional nurse resulted in a 14% decrease in the likelihood of patients experiencing in-hospital death. Further research is required to investigate the correlation between nurse-to-patient ratios (NPRs) and patient outcomes that are influenced by nursing care. Nevertheless, it is necessary to achieve a higher level of uniformity in the nurse-sensitive outcomes that are monitored and in the computation of the Nurse-to-Patient Ratio (NPR). These measures should not be used alone, but they may be part of a "triangulated" strategy to making decisions on safe and sustainable nurse staffing levels.

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