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Impact of Nurse-to-Patient Ratios on ICU Patient Mortality: Aligned with dr ifthakar jptc october 2024

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ABSTRACT

The Intensive Care Unit (ICU) is a highly specialized healthcare environment where timely and continuous nursing care is essential for patient survival. This study explores the impact of nurse-to-patient ratios on ICU patient mortality through a synthesis of existing literature. The results show that a lower nurse-patient ratio correlates with lower mortality, especially the ratio of 1:1 or 1:2 than when it is 1:3 or higher. Understaffing is a factor that adds to the adverse events such as the acquisition of hospital-acquired infections, medication errors, and late recognition of deterioration, which directly affect patient survival and saf ety. In addition to this, the workload of nurses results in their burnout, loss of vigilance, and missed care, which subsequently increases the risk of mortality. Although proper staffing might increase an operation budget in the short-term, it is a cost-effective decision over the long-term due to avoided complications, shorter length of stay and decreasing the readmission rates. The global inequalities reveal that nations that have put in place staffing requirements indicate better results, yet the low- and middle-income countries experience higher death-rate issues because of insufficient staffing and shortage of resources. This research indicates that there is an urgent need of evidence-based staffing policies, institutional reforms and work force support systems to minimize preventable ICU mortality and enhance critical care delivery.

KEYWORDS: Nurse-to-patient ratios, ICU mortality, Critical care nursing, Patient safety, Healthcare quality, Workforce planning, SDG 3 (Good Health and Well-being)

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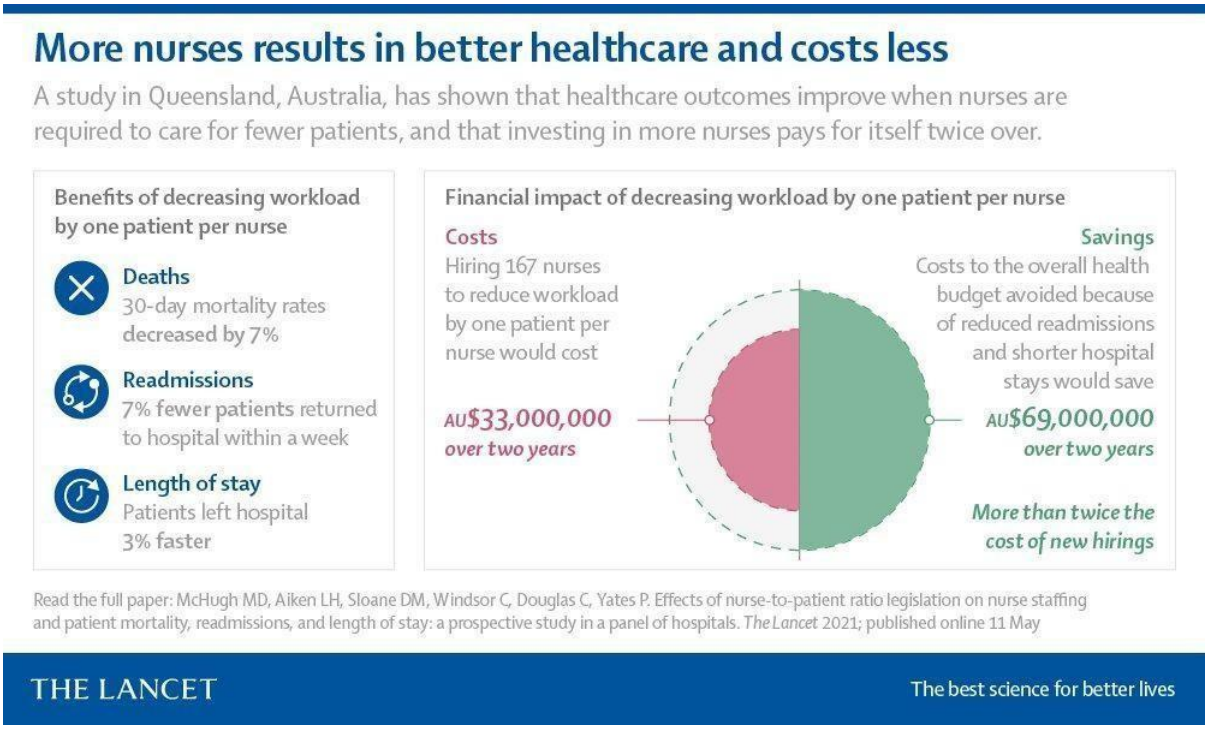
INTRODUCTION

Intensive Care Units (ICUs) are the specialized environment in the hospital to intervene at the last stage of medical care to offer life-saving treatment to the patients with emergency medical conditions and to monitor them continuously. The staffing pattern and specially the nurse-patient ratio has a great impact on the quality of care in the ICUs. Nurse-to-patient ratios are critical to provide timely interventions, quality monitoring, and the prevention of complications, which might entail an increase in morbidity and mortality. On the other hand, those ICUs with fewer than optimal numbers of staff also face problems with the inability to respond retainment, medication errors, a missed clinical progress, and lack of appropriate patient monitoring, which can lead to negative outcomes, such as death. Multiple studies around the world and especially in the United States have pointed at a direct relationship between the levels of nurse staffing and patient outcomes (Ishtieh et al. 2024). Low nurse-to- patient ratio has also been related to high mortality rates, prolonged hospital stay, rise in infection rates and rise in medical errors. Whenever there is need to provide constant observation to patients, the role of nurses becomes more central especially in critical care units. Staffing levels are a critical factor that determines patient safety because nurses are likely to recognize the smallest change in the condition of patients and therefore begin interventions that can save lives. The situation is also worsened by the current worldwide human resource crisis of skilled nursing personnel in the healthcare system, particularly in systems that are resource-limited (Arsat, 2023). The reason why hospitals can have difficulties in balancing staffing levels is financial constraints, shortage of manpower coupled with the turnover rates. Consequently, it is critical to comprehend how nurse-to-patient ratios affect ICU mortality to influence health policy, hospital administration and management and patient care decisions to ensure patient outcomes and prevent unnecessary demises (Zabidi et al. 2024).

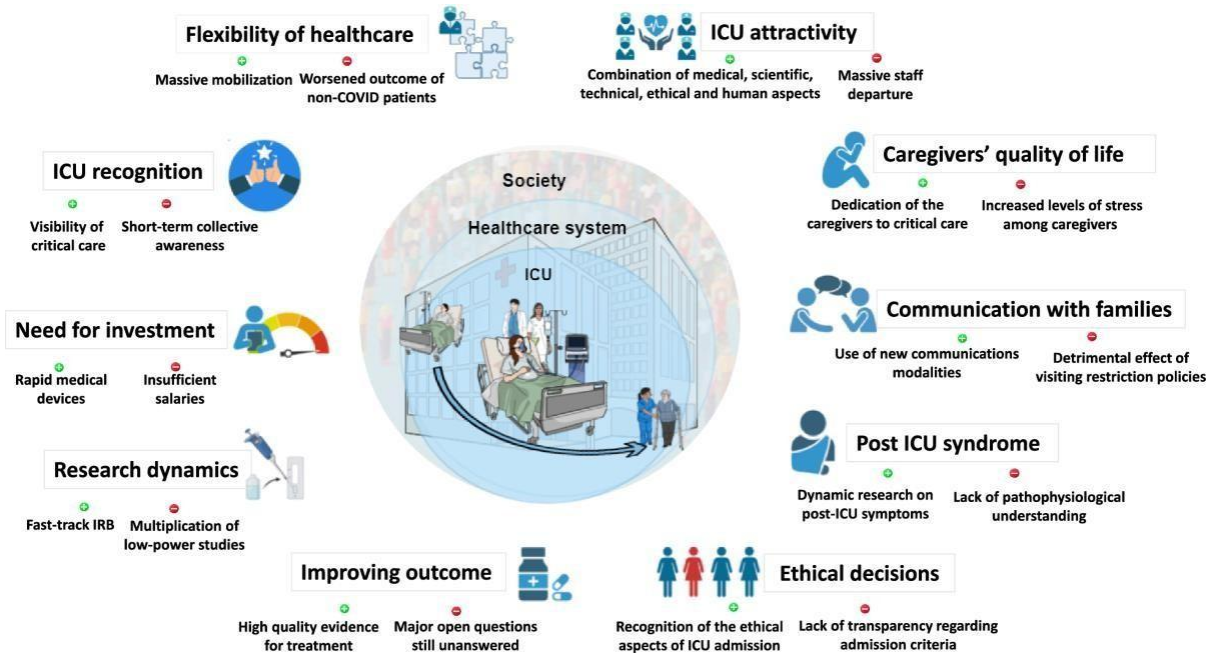


The Intensive Care Unit (ICU) is the top unit in a hospital where it serves patients with serious ailments that have life-threatening aspects and the patient needs holistic monitoring, complex treatment interventions, and emergency clinical judgment. The nurse to patient ratio is one of the most important factors that determine patient safety and patient treatment outcomes in such an environment. Unlike their general wards, the patients in ICU are usually unstable and therefore require advanced interventions like mechanical ventilation, hemodynamic support, and assessment among others. To a certain extent, the central role of nurses is not only in the administration of medications and therapies but in the early detection of complications, avoidance of negative incidents and the coordination of multidisciplinary care. The connection between staffinglevel and patient results has received a lot of attention by researchers globally. The facts continually indicate that poor nurse-to-patient ratios in ICUs correlate with greater mortality of patients, greater diagnostic infections, hospital such as ventilator-associated pneumonia and blood infection and staying, and an escalation in negative outcomes including drugs mistakes and haphazard expirations.

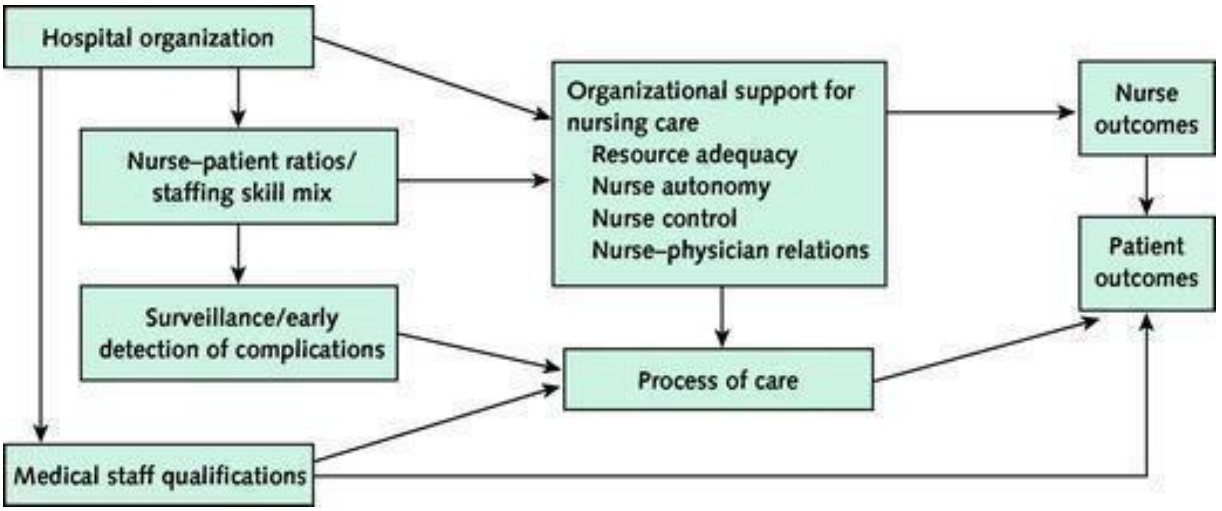
As an example, both the World Health Organization (WHO) and professional nursing organizations underline the importance of the safe staffing as the foundation of patient safety, but the consequences of these issues are evident because nurse allocation is uneven throughout healthcare systems because of financial, administrative, and workforce issues. This paper aims to review the effects of nurse-to-patient ratios on ICU patient mortality by summarizing available evidence and performing analysis of central factors that have an influence on patient outcomes. The research sets out the importance of proper staffing levels thus highlighting the necessity of policy intervention, hospital level reforms and evidence-based staffing recommendations. The results, in the end, are intended to provide practical information to healthcare administrators, policymakers, and nursing leaders in enhancing the delivery of care within an ICU, decreasing mortality, and enhancing patient safety within a critical care environment.

RATIONALE OF THE STUDY

Intensive Care Unit (ICU) clinical environment is a risky environment where the slightest of delays in taking care of a patient may lead to a significant repercussion and even death. In this setting, nurse-to-patient ratio is a significant aspect that determines whether patients will get timely interventions, accurate monitoring, and effective managerial of the patients in critical conditions. An emerging literature base is revealing that staffing shortages in ICUs is a direct factor in increased mortality rates, bad events, long nurse stay and compromised quality of care. Despite this data, a considerable number of healthcare facilities still work under non-optimal staffing conditions because of financial restrictions, nursing shortage, lack of skilled workers etc. (Kahn et al. 2023). The rationale behind the study is based on the criticality of curbing the current challenge in various countries due to poor nurse staffing within ICUs. Critical care nurses are involved in monitoring the key indicators, providing lifesaving treatments, avoiding complications, including respiratory bronchopneumonia or catheter-induced diseases, patient coordination with physicians and other health professionals.



The workload is so high that the nurses cannot give proper surveillance, some cases may be overseen that would otherwise be able to help in averting death due to earlier signs of deterioration. Therefore, it is necessary to study how nurse-to-patient ratio is connected with mortality in ICU in order to determine safe staffing levels and better patient outcomes (Pirwani, 2024). Moreover, the question has important implications also in terms of clinical outcomes, the process of policy-making in health care, the workforce and the process of managing the hospital. Administrators and policymakers need reliable evidence to make a case of investing in safe staffing ratios because sufficient nurse staffing is perceived as a cost burden and not a patient safety imperative. Nonetheless, the research indicates that enhancing nurse staffing can induce a higher short-term spending but has a long-term cost benefit since it saves complications, readmissions, and total ICU spending.



This research is especially timely at the global healthcare situation today when the COVID-19 pandemic revealed the weaknesses in critical care delivery in the form of severe nurse shortage and overburdened demands on the healthcare professionals. The study will help add evidence to the development of improved staffing policies, as well as patient safety and the resilience of healthcare systems during both standard and crisis system activities by investigating the connection between nurse-to-patient ratio and ICU mortality. The theoretical paradigm of this study is the need to close the gap between clinical evidence and policies of healthcare (Elabasy et al. 2024). Establishing the direct impact of the nurse-staffing level on mortality will not only concretize the need to adequately allocate the workforce, but it will also give stakeholders the strength to carry out lasting reforms that save lives in the critical care environment (Shao, 2024).

LITERATURE REVIEW

3.1 Overview of Nurse Staffing in Intensive Care Units (ICUs)

The Intensive Care Unit (ICU) is a specialized hospital department that provides advanced care to patients with life-threatening illnesses and complex medical needs. These patients often require continuous hemodynamic monitoring, mechanical ventilation, complex drug administration, and frequent clinical interventions. Given the high acuity and unpredictability of patients' conditions, appropriate nurse staffing becomes one of the most critical determinants of care quality in ICUs. Unlike general wards,

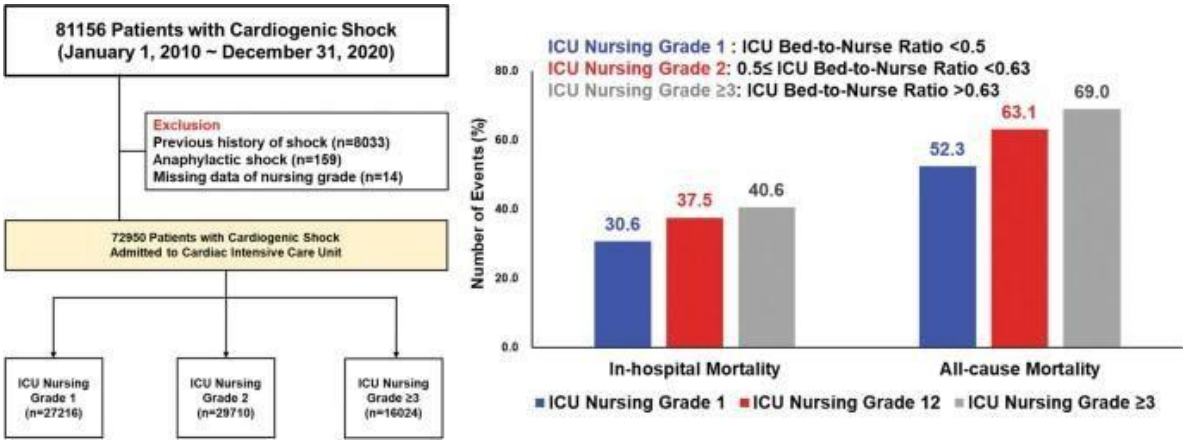
where one nurse may be responsible for multiple stable patients, ICU nurses are typically assigned to a smaller patient load to ensure close observation and timely interventions (Falk, 2023). Nurse staffing in Intensive Care Units (ICUs) is crucial for patient safety and involves carefully balancing the number of nurses with the acuity and needs of patients. International guidelines recommend maintaining low nurse-to-patient ratios in ICUs to ensure patient safety. The World Health Organization (WHO) and the American Association of Critical-Care Nurses (AACN) highlight that the optimal ratio in adult ICUs should not exceed 1:2, while for patients with severe instability (such as those requiring extracorporeal membrane oxygenation or multiple organ support), a 1:1 ratio is considered necessary. However, there is wide variability in actual staffing levels across different countries and healthcare institutions (Alanazi et al. 2023). For example, developed nations like the United States, Australia, and parts of Europe have established staffing standards through legislation or professional guidelines, whereas many low- and middle-income countries continue to struggle with ratios as high as 1:3 or 1:4 due to workforce shortages and limited resources.

Patient outcomes are also determined by the composition of their staffing in the ICUs. In addition to numerical ratios, the composition of the nursing workforce in terms of, e.g., the ratio of registered nurses (RNs) who have been trained in critical care to younger staff is also a key factor in the efficiency of care delivery. It has become identified through research that intensive care units in which a greater percentage of nurses are well-trained critical care advanced nurses report lower mortality rates, more control of infections, and fewer adverse incidents than units that do not have much specialized staff. Notwithstanding these established norms, nurse staffing differences still exist on a worldwide scale based on various issues like budgetary limitation, unavailability of skilled nurses, and turnover rates among critical care units. The COVID-19 pandemic also made these difficulties more significant as ICUs became congested, and staffing cancellations forced institutions to work the staff beyond the level that was considered safe (Alanazi et al. 2023). This has reignited the debate on the need to have standardized staffing policies, recruitment therapy of nurses, and retention measures of the experienced ICU nurses. The staffing problem with ICU nurses is a complex problem: it has more to do than the number of staff involved, quality process of training, task management, and institutional investigations. These dynamics are key to assessing the roles that the staffing ratios play on the mortality of patients in ICU as well as the overall healthcare outcomes.

3.2 Nurse-to-Patient Ratios and Patient Mortality in ICUs

The correlation that links the nurse-to-patient ratio and mortality rates among Intensive Care Units (ICU) patients has gained a lot of attention in healthcare literature. Critical Care patients are very vulnerable and any slackening in monitoring them or delays to take remedial action, may lead to a situation that becomes life threatening. An increasing number of studies have identified that nurse staffing is directly linked to increased mortality rates, and the above fact emphasises the importance of nurses as care providers to protect patient survival (Ishtieh et al. 2024). The correlate of staffing adequacy on patient outcomes has been supported by similar results in other studies conducted in Europe, North America and Asia proving the direct influence of staffing adequacy on patient outcomes. In hospitals with stronger nurse staffing, the mortality and failure to rescue rates were significantly lower in patients than that in the understaffed hospitals. The lower risks of sepsis, multiorgan failure, and unplanned readmissions have been associated with higher nurse-to-patient ratios in the context of ICUs in particular.

It is possible to explain how nurse staffing is connected to mortality with the complexity of the ICU care in mind. By placing the nurses to attend to several patients who are critically ill at once, their capacity to give constant monitoring would be negatively affected. This raises the risk of unnoticed clinical deterioration, the failure to administer medications in time, or not performing life-saving procedures in due time (Duclos et al. 2023). On the other hand, proper nurse staffing levels allow expediency in assessment, successful prevention of complications, and prompt startups of advance therapies, all of which are keys to enhancing survival rates. International comparison evidence also points to differences in outcome associated with levels of staffing. In nations where nurse to the patient ratios are legislated (Australia and some US states), ICUs have been shown to have reduced death rates and general patient safety. On the other hand, in low and middle-income countries, where the ratios are frequently above the recommended level, mortality rates are disproportionately high which highlights the issues of under-resource healthcare systems inherent in the system.



Literature is very active in the idea that nurse-to-patient ratios play a decisive role in ICU patient mortality. Proper staffing does not only have a positive effect on survival but also on the quality of provided care as a whole because it allows nurses to concentrate on personal needs of patients (Alzubaidi et al. 2024). Such evidence highlights the fact that the healthcare institutions and policymakers should give a new priority to the safe staffing ratios as the non-negotiable component of patient safety and critical care quality.

3.3 Adverse Events Associated with Inadequate Nurse Staffing

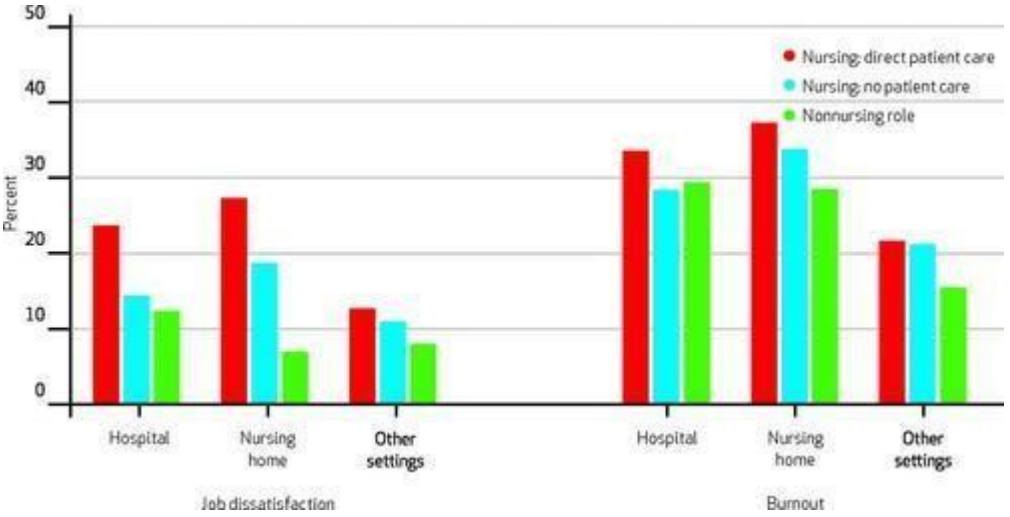
The poor nurse-to-patient ratio in the Intensive Care Units (ICUs) is closely linked with an increased rate of adverse events that severely undermine patient safety and aggravate the risk of dying. Critically ill patients need twenty-four-hour-a-day, round the clock attention and interventions and under staffed nurse care, the patient may not receive the required care and face unnecessary complications. Hospital-acquired infections, medication mistakes, technical mishaps, and failure to recognize clinical alteration all related to the poor staffing are the most usually reported adverse events (Khatatbeh et al. 2023). Understaffed ICUs are associated with a higher incidence of hospital-acquired infections (HAIs) including ventilator-associated pneumonia (VAP), catheter-associated urinary tract infections (CAUTIs), and central line-associated bloodstream infections (CLABSIs). Research indicates that in case of overburdening nurses, infection prevention plans, which include hand hygiene, withdrawal of catheters on time, and adequate ventilator management, become unconsciously neglected, a fact that increases infections. Such infections not only extend the stay of the patient in the ICU but also cause the death of the patient to a significant proportion and increase the cost of health care. Another key adverse event, which is associated with poor staffing, is medication errors. High-risk medications have to be administered and titrated with accuracy and watchfulness i.e. vasopressors, anticlotting medications, and sedatives. According to the research conducted, nurses with large workloads are more likely to make calculation errors of doses or infusion dose, or the missed administration at the wrong time, being the cause of life-threatening outcomes (Lustberg et al. 2023). ICUs experience a high prevalence of polypharmacy and in these settings the provision of medication risk-free depends directly on the availability of adequate numbers of nurses.

The risks of high nurse-to-patient ratios maybe due to delayed recognition of patient deterioration probably the greatest risks. Vital sign or neurological changes may be subtle the last critical stage of illness because the changes are subtle before the patient drops rapidly. In case nurses have to handle excessive patients, these warning indicators can be neglected or recognized in a late disclosure causing the adverse consequences of cardiac arrest, development of sepsis, or multiorgan failure. Moreover, procedural complications and unplanned extubations are accompanied by inadequate staffing which result in both morbidity and mortality. Just as an example, in the case of accidents during extubation, such an episode is more likely to happen when the patient is not monitored regularly, and in the case of complications during invasive procedures, they are likely to occur when the nurse is not able to attract sufficient attention to the preparatory phase, monitoring, and aftercare (Lustberg et al. 2023). The evidence highlights that insufficient nurse staffing in ICUs not only increases patient mortality but also contributes to a wide range of

preventable adverse events. These events not only compromise patient safety but also burden healthcare systems with higher costs, longer hospital stays, and diminished quality of care. Strengthening nurse staffing levels is therefore essential to reducing adverse events and ensuring optimal outcomes in critical care environments.

3.4 Nursing Workload, Burnout, and Patient Safety

ICU nursing workload is inherently high due to continuous monitoring, complex therapies, and rapid clinical decision-making; when staffing is inadequate, this workload becomes unsafe and propagates a cascade of risks for both clinicians and patients. Workload is typically captured through acuity and task-intensity measures (e.g., Nursing Activities Score, TISS-28), while burnout is commonly assessed with validated tools such as the Maslach Burnout Inventory. Elevated workload increases time pressure, multitasking, and interruptions, which in turn raise cognitive load, alarm fatigue, and the probability of slips, l apses, and rule-based errors (Zabin et al. 2023). At the bedside, this translates into delayed assessments, omitted prophylaxis (e.g., VTE, pressure injury prevention), missed care, and slower response to subtle deterioration—each of which has been linked to higher rates of adverse events and mortality in critical care. Burnout characterized by emotional exhaustion, depersonalization, and reduced professional efficacy emerges when chronic workload exceeds available resources (staffing, skill mix, technology support, and a healthy safety culture). Exhausted clinicians exhibit diminished vigilance, reduced situational awareness, and impaired teamwork and communication, increasing the risk of medication errors, line/device complications, and failure-to-rescue.



Specific workforce practices compound risk: extended shifts (>12 hours), frequent overtime, missed breaks, rotating nights, floating to unfamiliar units, and reliance on temporary staff without adequate orientation. Skill mix also matters; a lower proportion of critical-care–trained RNs, preceptors, and charge nurses without assignments is associated with more errors and poorer outcomes, even when headcount appears adequate. Unit-level factors—like poor nurse-physician collaboration, weak escalation pathways, and low psychological safety—degrade resilience and suppress speaking-up behaviors that prevent harm. Mitigation requires aligning ratios with acuity (dynamic, not fixed), protecting break relief and limits on overtime, optimizing skill mix (experienced CCRNs, dedicated charge nurse), and strengthening teamwork and safety culture (structured handoffs, huddles, checklists) (MacPhee et al. 2024). Technology can help when it reduces—not adds to—cognitive burden: actionable alarm management, clinical decision support for early warning, closed-loop medication systems, and streamlined documentation. Leadership practices—adequate staffing budgets, flexible float pools with proper onboarding, wellbeing resources, and responsive incident-learning systems—buffer workload and reduce burnout. Collectively, controlling workload and preventing burnout are not only workforce imperatives; they are core patient-safety strategies with direct impact on ICU morbidity and mortality.

Table: Nurse Workload, Burnout, and Patient Safety

Factor	Effect on Nurses	Effect on Patients
High Patient Load	Increased stress, fatigue, burnout	Missed care, delayed interventions
Long Shifts & Overtime	Emotional exhaustion, reduced concentration	Higher risk of medical errors
Burnout (Emotional Exhaustion, Depersonalization)	Low job satisfaction, high turnover	Decreased quality of care, higher mortality
Adequate Staffing & Support	Reduced burnout, higher job satisfaction	Improved patient safety and outcomes

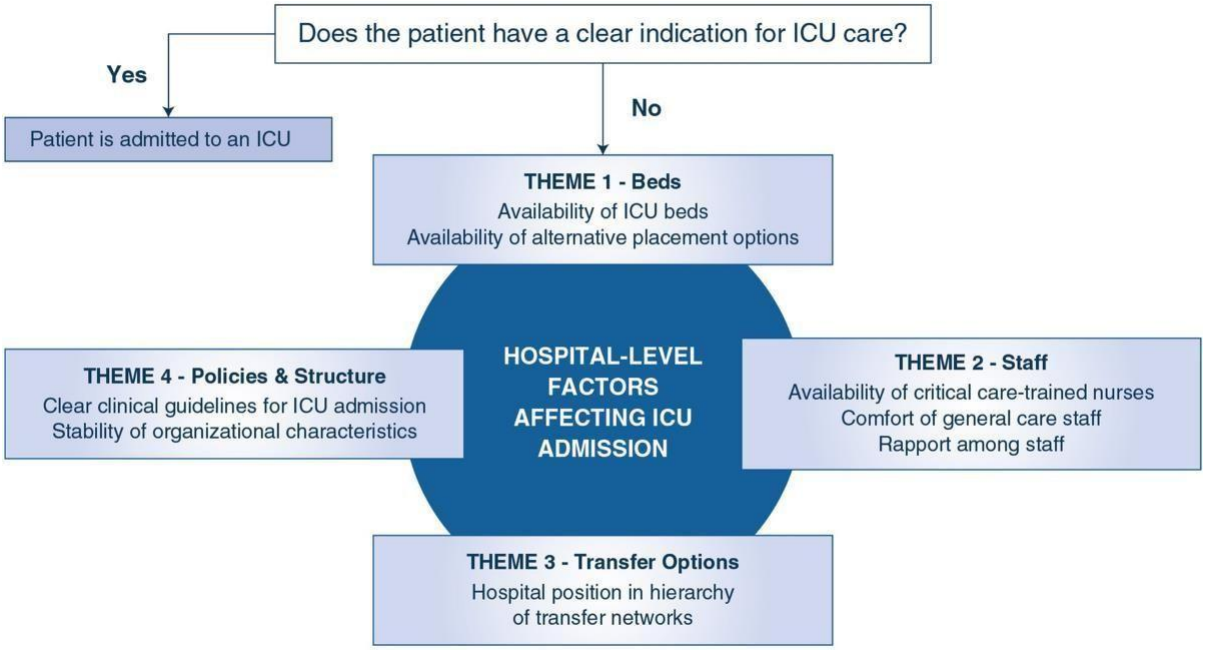
METHODOLOGY

This study employed a qualitative literature review approach to examine the relationship between nurse-to-patient ratios and ICU patient mortality. Studies were included if they focused on adult ICU settings, evaluated nurse staffing levels, and measured outcomes related to mortality or patient safety. Exclusion criteria included studies conducted outside ICU settings, pediatric or

neonatal ICUs, and those not available in English. Data were extracted and thematically analyzed to identify common patterns, trends, and gaps in the literature. Data were summarized into topics that were: mortality outcomes, adverse events, workload and burnout, costs in healthcare and policy perspectives. This method allowed obtaining a rich insight into the role that nurse staffing ratios play in the outcomes of ICU patients be based on various health systems.

RESULTS AND DISCUSSION

The evidence provided in the research provides solid conclusions that there is direct and measurable correlation between nurse-to-patient ratios and patient mortality in ICU. Research has always supported the claim that mortality is much lower in the less ratio instances especially 1:1 or 1:2, compared to the larger ratios such as 1:3 and above. It was later verified by Aiken et al. (2002) and numerous other major studies that an increment in the workload of any other patient taken up by a nurse augments the risk of death reflecting the importance of proper staffing in critical care. Adverse events represented one of the major pathways that poorly staffed conditions affect mortality (Lustberg et al. 2023). Hospital-acquired infections ventilator-associated pneumonia, bloodstream infections and catheter-related urinary tract infections were more frequent in understaffed ICUs and mostly attributed to missed or delayed infection prevention measures. Errors in medication and unanticipated extubations were also reported more frequently, which underlines the idea that when the workload is too high, precision and diligence are hindered. These experiences not only compromise patient safety, but also increase the duration of the stay in the ICU and increase death rates (Falk, 2023).



These risks are also aggravated by nursing workload and burnout. It has been evidenced that overworked nurses feel fatigued, stressed out and emotionally burned out to the extent that they can no longer sustain the procedure of continuous heart inspection and timely action. Burnout is closely related to missed care, late patient deterioration, and poor clinical protocol adherence, three phenomena that negatively impact on the patient outcomes. This points to the fact that not only is safe staffing a clinical requirement, but also a workforce sustainability solution that safeguards the health of the ICU nurses. As far as the efficiency of healthcare is concerned, understaffing is associated with longer stay rates, more readmission, and more expenditure on the treatment of complications (MacPhee et al. 2024). Conversely, adequately staffed ICUs prove to be cost-effective in the long run as they allow avoiding adverse events, a reduction in the necessity of long-term hospitalization as well as an increase in the overall resource consumption. Therefore, safe staffing is a patient safety priority and also an economic priority.

International experience also shows the differences in the practice of nurse staffing. In the United States and Australia where staffing ratios have been enacted, the results in ICUs have been a better patient outcome and decreased mortality. In comparison, some countries with low and middle incomes experience problems with the absence of nurses, financial resources or the inability to effectively implement policy, hence, low staffing ratios well above suggested levels and mortality rates that are much higher. This diversity highlights how local interventions that consider the local context can complement ICU care delivery across the globe in a standardized manner. The evidence supports the idea that nurse-to-patient ratios remain the critical element in influencing the mortality in ICU. Proper staffing leads to low adverse events, better patient survival, quality and efficiency of care (Zabin et al. 2023). To eliminate this challenge lawmaker evidence-based staffing policies, institutional dedication to safe staffing practices, and avenues to enhance nurse well-being will ensure acutely ill patients experience safe, high-quality care that increases the likelihood of survival.

Table: Common Adverse Events Linked to Inadequate Nurse Staffing

Adverse Event	Cause (Related to Staffing)	Impact on Mortality and Outcomes
Ventilator-Associated Pneumonia (VAP)	Missed infection prevention practices; limited time for suctioning and oral care	Prolonged ICU stay, increased mortality
Central Line–Associated Bloodstream Infections (CLABSI)	Inadequate line care and surveillance	Sepsis, multi-organ failure, higher mortality
Medication Errors	Nurse fatigue, excessive workload, reduced vigilance	Immediate life-threatening complications
Unplanned Extubations	Insufficient monitoring of intubated patients	Respiratory distress, re-intubation, higher mortality
Delayed Recognition of Deterioration	Overload prevents timely response to early warning signs	Cardiac arrest, sepsis progression, preventable deaths

Population & Setting	Nurse-to-Patient Ratio	Key Findings on Mortality
232,000 surgical patients, 168 hospitals (USA)	Each additional patient per nurse (↑ ratio)	**7% increase** in likelihood of mortality within 30 days.
38 ICUs, UK	High ratio (>1:2) vs standard (1:1–1:2)	Higher mortality in units with >2 patients per nurse.
401,282 patients, South Korea	1:2 vs 1:3+	Mortality significantly lower in 1:2 ratio; adjusted OR ~0.83.
45 hospitals (ICUs in USA)	Optimal 1:1–1:2 vs higher ratios	Better patient survival linked to lower ratios; >1:3 associated with preventable deaths.
35 observational studies, ICU & acute care	Higher ratios (>1:2)	Strong association with ↑ patient mortality and adverse events.

The relationship between nurse-to-patient ratios and intensive care unit (ICU) patient mortality has been widely studied, and evidence consistently highlights the critical role of adequate staffing in patient outcomes. In ICUs, where patients require constant monitoring, timely interventions, and complex care, insufficient nurse staffing directly impacts survival rates.

Large-scale studies, such as Khatatbeh, H et al. (2023), demonstrated that each additional patient added to a nurse's workload increases the risk of death within 30 days by approximately 7%. Similarly, evidence from the United Kingdom and South Korea shows that when ratios exceed two patients per nurse, mortality significantly increases. In contrast, maintaining ratios of 1:1 or 1:2 has been associated with markedly improved survival and reduced adverse events.

Systematic reviews reinforce these findings, showing that higher ratios are strongly linked not only to mortality but also to complications such as infections, medication errors, and prolonged length of stay. The mechanism is clear: when nurses are stretched too thin, delays in recognizing deterioration, administering treatments, and coordinating care occur, which can quickly become life-threatening in critical care settings. the evidence indicates that safe staffing levels—ideally no more than two patients per nurse in ICUs—are essential for reducing mortality and ensuring high-quality care. This makes staffing ratios both a patient safety issue and a health system priority.

CONCLUSION

The evidence from this review strongly indicates that nurse-to-patient ratios are a decisive factor in determining ICU patient mortality. Adequate staffing allows for continuous monitoring, timely recognition of deterioration, and rapid interventions, thereby reducing adverse events and improving survival. Conversely, high ratios compromise care delivery, leading to preventable complications, increased mortality, and longer hospital stays. Beyond patient outcomes, poor staffing also contributes to nurse burnout, which further threatens both workforce sustainability and patient safety. While improving staffing may initially appear resource-intensive, the long-term benefits include reduced healthcare costs, improved efficiency, and enhanced patient satisfaction. Countries with legislated staffing ratios demonstrate that policy-driven reforms can improve outcomes, whereas resource-constrained settings remain at high risk due to workforce shortages. Overall, ensuring safe nurse-to-patient ratios must be recognized as a fundamental component of patient safety, healthcare quality, and critical care resilience. Policymakers, administrators, and healthcare leaders must act decisively to implement evidence-based staffing policies and support systems that protect both patients and the nursing workforce.

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