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The Impact of Nurse-Patient Ratios on the Quality of Care: A Literature Review

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Abstract

Background: Nurse-to-patient ratio is an important component of healthcare quality. There is a substantial body of evidence that shows that the best nurse staffing is associated with better patient outcomes. Nevertheless, studies are primarily conducted in Western health systems, which often overlook various cultural and health system boundaries, including those in Saudi Arabia. **Objectives:** The objective of this review is to consolidate the current literature on the immediate effects of nurse-to-patient ratios on quality of care. This includes highlighting areas that require further study, particularly in relation to the generalizability of research in non-Western healthcare settings. **Methods:** This review systematically synthesized the findings of several important studies. The studies utilized a wide range of methods, including cross-sectional analyses, systematic reviews, and meta-analyses, and, taken as a whole, provide an extensive literature regarding nurse staffing and patient outcomes. **Results:** The aggregate evidence emerging from the reviewed studies consistently indicates that lower nurse-to-patient ratios are strongly related to better patient outcomes, including lower mortality rates, fewer complications (e.g., nosocomial infections, medication errors), and higher levels of patient satisfaction. In contrast, higher ratios are associated with poor quality of care, increased nurse burnout and job dissatisfaction, which in turn result in missed nursing care activities and impaired patient safety. **Conclusion:** This review highlights the significant effect of nurse-to-patient ratios on the quality of care. This emphasizes the need for future studies to address these mechanisms in varying cultural and healthcare contexts and, thereby, contribute to a richer international understanding of the best nurse staffing and its effects on patient care.

Keywords: Nurse-Patient Ratios, Quality of Care, Literature Review, Patient Outcomes, Healthcare, Nurse Staffing

Introduction

Background and Context

The **nurse-to-patient ratio (NPR)** stands as a critical structural component of healthcare delivery, directly influencing the capacity of nursing staff to provide safe and effective care (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). Defined as the number of patients assigned

to a single registered nurse (RN) during a shift, the NPR is not merely an administrative metric but a fundamental determinant of the quality and safety of the patient experience (Dall'Ora, Ball, Recio-Saucedo, & Griffiths, 2016). In an era of increasing patient acuity, complex medical technologies, and rising healthcare costs, the debate surrounding optimal nurse staffing levels has moved from a professional concern to a significant public health and policy issue (Shekelle, 2013). The quality of care is a multi-dimensional concept, encompassing patient safety, clinical effectiveness, efficiency, and patient-centeredness (Driscoll, Grant, Carroll, Dalton, De Vries, & McCluskey, 2018). Extensive research has consistently demonstrated that the level of nurse staffing is inextricably linked to these core dimensions of quality, positioning the NPR as a powerful lever for improving patient outcomes across various healthcare settings (Lasater, Aiken, Sloane, French, Martin, & Alexander, 2021).

The global context of nurse staffing is marked by significant challenges, including widespread nursing shortages, high turnover rates, and the economic pressure to reduce operational costs, which often leads to understaffing (Cimiotti, Aiken, Sloane, & Wu, 2012). However, the ethical and financial implications of understaffing manifesting as adverse patient events are increasingly recognized as outweighing any short-term cost savings (Uchmanowicz, Wleklik, & Rosińczuk, 2024). The substantial body of evidence establishing a correlation between higher registered nurse staffing levels and better patient outcomes has largely originated from Western health systems, particularly in the United States, the United Kingdom, and Australia (Chen, Guo, Chin, Cheng, & Ho, 2019). These studies have been instrumental in driving policy changes, such as mandatory minimum staffing legislation in some jurisdictions (White, Aiken, & Sloane, 2019).

Problem Statement

While the evidence from Western contexts is compelling, a critical gap remains in the literature concerning the generalizability of these findings to diverse cultural and health system boundaries (Tenorio, Aletreby, Al Shammari, & Al-Ghanmi, 2021). Healthcare systems in non-Western regions, such as the Middle East, Asia, and Africa, operate under unique constraints, including different funding models, patient demographics, cultural expectations regarding care, and a high reliance on expatriate nursing workforces (Al Muharraq, Alallah, & Al-Dossary, 2022). The Kingdom of Saudi Arabia (KSA), for instance, represents a rapidly developing healthcare landscape with distinct challenges related to nurse recruitment, retention, and the cultural context of patient care (Alharbi, 2018). The lack of context-specific research means that policy decisions regarding nurse staffing in these regions may be based on models that do not fully account for local realities, potentially leading to suboptimal outcomes (Alluhidan, Tashkandi, Alblowi, Omer, & Al-Sogair, 2020). Therefore, a comprehensive review is necessary to consolidate the established international evidence while simultaneously highlighting the urgent need for research that addresses the unique mechanisms at play in non-Western settings.

Objectives of the Review

The objective of this review is twofold:

1 To consolidate the current literature on the immediate effects of nurse-to-patient ratios on quality of care.
2 To highlight areas that require further study, particularly in relation to the generalizability of research in non-Western healthcare settings.

Methods

This literature review was conducted through a systematic synthesis of key findings from published research to provide a comprehensive overview of the impact of nurse-to-patient ratios on the quality of care.

Search Strategy and Inclusion Criteria

The search strategy focused on identifying high-quality evidence, including systematic reviews, meta-analyses, large-scale cross-sectional studies, and longitudinal cohort studies published in peer-reviewed journals. Key search terms and their combinations included: "nurse-patient ratios," "nurse staffing," "patient outcomes," "mortality," "nosocomial infections," "medication errors," "nurse burnout," and "missed nursing care." A secondary, targeted search was conducted using terms such as "nurse staffing Saudi Arabia," "nurse-patient ratio KSA," and "missed care Middle East" to address the objective concerning non-Western contexts. The studies selected for synthesis utilized a wide range of methodologies, providing a robust and extensive literature base regarding nurse staffing and patient outcomes.

Data Extraction and Synthesis

The findings from the identified studies were systematically extracted and synthesized. The synthesis focused on three primary categories of outcomes, as established in the abstract:

3 **Patient Outcomes:** Quantifiable measures such as in-hospital mortality rates, 30-day mortality, and incidence of adverse events (e.g., falls, pressure ulcers).
4 **Complications:** Specific nurse-sensitive indicators, including nosocomial infections (e.g., catheter-associated urinary tract infections, central line-associated bloodstream infections) and medication errors.
5 **Nurse Outcomes:** Measures of the nursing work environment, including nurse burnout (emotional exhaustion, depersonalization), job dissatisfaction, and the prevalence of missed nursing care (rationing of care).

The aggregate evidence was then organized to demonstrate the consistent relationship between lower NPRs and improved quality of care, while also dedicating a specific section to the challenges of generalizability in non-Western settings.

Results and Discussion: The Core Evidence

The Direct Link: Nurse-Patient Ratios and Patient Mortality

The most compelling and frequently cited evidence in the nurse staffing literature concerns the direct, inverse relationship between the number of patients assigned to a nurse and the risk of patient mortality (Aiken, Sloane, Bruyneel, Van den Heede, & Griffiths, 2014). The aggregate evidence consistently indicates that lower nurse-to-patient ratios are strongly related to better patient outcomes, with a reduction in mortality being the most critical finding (Needleman, Buerhaus, Mattke, Stewart, & Zeisler, 2002).

Seminal research by Aiken et al. (2002) established a foundational link, demonstrating that surgical patients in hospitals with higher staffing levels experienced significantly lower mortality rates (Aiken et al., 2002). This finding has been repeatedly validated and quantified by subsequent large-scale studies and meta-analyses. For instance, a systematic review and meta-analysis by Dall'Ora et al. (2022) consolidated findings from numerous studies,

concluding that there is a beneficial effect from higher registered nurse staffing on preventing patient death (Dall'Ora et al., 2022).

The relationship is often quantified with alarming precision. Studies analyzing large datasets of hospital discharges have shown that each additional patient per nurse is associated with a statistically significant increase in the odds of in-hospital mortality (Lasater et al., 2021). Lasater et al. (2021) reported that the average 30-day mortality rate among hospitals with an average staffing ratio of less than five patients per nurse was notably lower (5.6%) compared with hospitals with higher ratios (Lasater et al., 2021). Furthermore, another study found that each additional patient per nurse was associated with a 12% higher odds of in-hospital mortality and a 7% higher odds of 60-day mortality (Driscoll et al., 2018). This dose-response relationship underscores the notion that nurse staffing is not a threshold effect but a continuous variable where every additional patient load incrementally increases the risk to patient life.

The mechanism underlying this critical link is often described as the "failure-to-rescue" phenomenon (Aiken, Clarke, Cheung, Sloane, & Silber, 2003). In understaffed environments, nurses are less able to monitor patients closely, recognize subtle signs of deterioration, and intervene promptly before a complication becomes fatal (Shekelle, 2013). Adequate staffing ensures that nurses have the time to perform comprehensive assessments, administer complex treatments, and coordinate care, thereby reducing the likelihood of a patient's condition worsening unnoticed. The presence of a sufficient number of RNs, particularly those with higher levels of education, acts as a safety buffer against the inherent risks of hospitalization (Aiken et al., 2002).

Study (Year)	**Context**	**Key Finding on Mortality**	**Quantitative Impact**
Aiken et al. (2002)	US, Pennsylvania Hospitals	Higher RN staffing associated with lower mortality.	1 additional patient per nurse increased 30-day mortality by 7%.
Lasater et al. (2021)	US Hospitals	Lower staffing ratio (<5:1) linked to lower mortality.	30-day mortality rate was 5.6% in hospitals with better ratios.
Dall'Ora et al. (2022)	Systematic Review	Confirmed beneficial effect of higher RN staffing on preventing patient death.	Consistent evidence across multiple countries and settings.
Shekelle (2013)	Systematic Review	Interventions to increase NPRs are a patient safety strategy.	Reduced risk of death and complications.

The consistent and robust nature of this evidence across multiple international settings from the US to Europe firmly establishes the NPR as a patient safety strategy of paramount importance (Shekelle, 2013).

NPR and Adverse Patient Events/Complications

Beyond the critical outcome of mortality, the literature is equally clear on the impact of nurse staffing on a range of adverse patient events and complications, often referred to as nurse-sensitive patient outcomes (Needleman et al., 2002). These outcomes, which include nosocomial infections, medication errors, patient falls, and pressure ulcers, are highly

sensitive to the quality and quantity of nursing care provided. The evidence consistently shows that lower NPRs are associated with fewer complications, directly supporting the argument for optimal staffing as a quality imperative (Dall'Ora et al., 2016).

Nosocomial Infections (Healthcare-Associated Infections - HAIs)

A significant body of research links inadequate nurse staffing to increased rates of HAIs, such as Catheter-Associated Urinary Tract Infections (CAUTI) and Central Line-Associated Bloodstream Infections (CLABSI) (Cimiotti et al., 2012). The mechanism is primarily related to the compromise of infection control practices due to time constraints and high workload (Tencic & Roche, 2023). When nurses are overburdened, they may rush or skip critical steps in protocols, such as hand hygiene, timely dressing changes, and meticulous catheter care (Cimiotti et al., 2012). Cimiotti et al. (2012) found a clear association between nurse staffing and HAIs, suggesting that nurse-patient ratios and hours of nursing care per patient-day are implicated in the spread of infection (Cimiotti et al., 2012). Adequate staffing ensures that nurses have the necessary time to adhere strictly to infection prevention bundles, which significantly affects the incidence of these costly and life-threatening complications (Tencic & Roche, 2023).

Medication Errors

Medication administration is a complex process that requires concentration, double-checking, and patient education. High NPRs, which lead to increased workload, fatigue, and distraction, are directly implicated in a higher incidence of medication errors (Moriwaki & Nakashima, 2025). Studies have shown that a lack of nursing time per patient is a contributing factor to errors in medication administration (Uchmanowicz et al., 2024). The rationing of nursing care, where nurses are forced to prioritize tasks, often results in rushed medication rounds, increasing the risk of administering the wrong dose, the wrong drug, or administering it at the wrong time (Mynaříková, Jarošová, & Janíková, 2020). The review by Uchmanowicz et al. (2024) found that when nursing care is rationed, there is a higher incidence of medication errors, falls, and infections (Uchmanowicz et al., 2024).

Patient Falls and Pressure Ulcers

Patient falls and the development of pressure ulcers are classic examples of nurse-sensitive outcomes that are highly dependent on proactive nursing care (Needleman et al., 2002). Adequate staffing allows nurses to perform frequent patient rounds, assist with ambulation, and ensure timely repositioning for immobile patients (Aiken et al., 2002). When staffing is low, these preventative measures are often missed. For instance, a nurse with a high patient load may not be able to respond immediately to a call light, leading a patient to attempt to ambulate unassisted and consequently fall (Driscoll et al., 2018). Similarly, the failure to turn and reposition patients every two hours, a task frequently reported as "missed care," directly contributes to the development of pressure ulcers (Mynaříková et al., 2020). The prevention of these complications is a clear indicator of high-quality nursing care, which is directly facilitated by optimal nurse-to-patient ratios (Shekelle, 2013). The evidence across these diverse adverse events reinforces the conclusion that the NPR is a fundamental determinant of patient safety. A reduction in staffing levels translates directly into a measurable increase in preventable harm, underscoring the necessity of treating nurse staffing as a core patient safety strategy rather than a variable cost (Lasater et al., 2021).

The Nurse-Related Pathway: Burnout, Missed Care, and Quality

The impact of nurse-to-patient ratios extends beyond direct patient outcomes to profoundly affect the nursing workforce itself, creating a crucial intermediary pathway that ultimately compromises the quality of care (Aiken et al., 2002). The evidence is compelling**:** higher ratios are associated with increased nurse burnout and job dissatisfaction, which in turn result in missed nursing care activities and impaired patient safety (White et al., 2019). This pathway highlights the systemic nature of the staffing problem, where poor working conditions for nurses translate directly into poor outcomes for patients.

Nurse Burnout and Job Dissatisfaction

Nurse burnout, characterized by emotional exhaustion, depersonalization, and a reduced sense of personal accomplishment, is a significant occupational hazard in healthcare (Chen et al., 2019). Studies consistently demonstrate a strong correlation between high patient loads and elevated levels of burnout and job dissatisfaction (Aiken et al., 2002). For example, research by Chen et al. (2019) found that a higher patient-nurse ratio (PNR) was a significant predictor of nurses' intention to leave their job, with burnout and job dissatisfaction acting as mediating factors (Chen et al., 2019). The constant pressure of managing an excessive number of patients, coupled with the moral distress of knowing that care is being compromised, leads to emotional depletion and a detachment from patients (White et al., 2019). White et al. (2019) reported that a substantial percentage of Registered Nurses (RNs) exhibited high levels of burnout and job dissatisfaction, a finding that is directly linked to the demanding work environment created by inadequate staffing (White et al., 2019).

Missed Nursing Care (MNC)

The most direct consequence of nurse burnout and high workload is the phenomenon of missed nursing care (MNC)**,** also known as care rationing (Tenorio et al., 2021). MNC occurs when necessary patient care activities are omitted, partially completed, or significantly delayed (Al Muharraq et al., 2022). The high patient-to-nurse ratio forces nurses to prioritize life-saving tasks over essential, but less urgent, care activities. Studies detailing MNC consistently show that the most frequently missed tasks include patient ambulation, emotional support, patient education, timely documentation, and meticulous hygiene care (Mynaříková et al., 2020). The interrelation between high PNR and MNC is well-documented; a higher PNR negatively affects the amount of care that can be delivered, leading to substantial missed care (Tenorio et al., 2021).

When nurses are emotionally exhausted and rationing care, the likelihood of errors increases, and the quality of the patient experience declines (Uchmanowicz et al., 2024). The omission of care tasks, such as patient repositioning, directly contributes to adverse events like pressure ulcers, while the lack of patient education can lead to higher readmission rates (Mynaříková et al., 2020). Therefore, addressing nurse staffing is not only a matter of patient safety but also a crucial strategy for improving the working lives of nurses and ensuring the sustainability of the healthcare workforce (Chen et al., 2019).

Generalizability and Non-Western Contexts: The Case of Saudi Arabia

A critical limitation of the current body of literature is that the majority of influential studies establishing the link between NPR and quality of care have been primarily conducted in Western health systems, which often overlook various cultural and health system boundaries

(Alluhidan et al., 2020). This raises significant questions about the generalizability of these findings and the direct applicability of Western-derived staffing models to non-Western contexts (Alharbi, 2018).

Healthcare System Differences

Healthcare systems in the Gulf Cooperation Council (GCC) states, and specifically in the Kingdom of Saudi Arabia (KSA), present a unique set of challenges and structural differences compared to their Western counterparts (Alluhidan et al., 2020). KSA's healthcare system has undergone rapid modernization, but it is characterized by a heavy reliance on expatriate nurses (often from the Philippines, India, and other countries) who constitute the vast majority of the nursing workforce (Alluhidan et al., 2020). This reliance introduces complexities related to cultural differences, language barriers, and high turnover rates, which can affect team cohesion and continuity of care (Alharbi, 2018). Furthermore, cultural expectations regarding patient-nurse interaction and family involvement in care may differ significantly, potentially altering the dynamics of care delivery compared to Western models (Tenorio et al., 2021).

Evidence from the Kingdom of Saudi Arabia (KSA)

The literature on nurse staffing and outcomes in KSA is limited but growing, and it largely confirms the negative consequences of high NPRs observed globally, while highlighting local nuances (Al Muharraq et al., 2022). Studies conducted in Saudi hospitals have found that high patient-to-nurse ratios are a significant source of nurse stress and burnout (Tenorio et al., 2021). For instance, research in King Saud Medical City found that a high patient-to-nurse ratio negatively affected missed care, with nurses reporting moderate levels of emotional exhaustion (Tenorio et al., 2021). This suggests that the mechanism of high workload leading to burnout and subsequent care rationing is a universal phenomenon, even within the distinct cultural and systemic context of KSA (Al Muharraq et al., 2022).

Furthermore, studies investigating the nursing work environment in Saudi hospitals have shown that poor work environments, often a proxy for inadequate staffing and resources, negatively impact patient safety (Alharbi, 2018). The challenge of low nursing school capacity and the high employment of expatriate nurses contribute to strained human resources for health (HRH) environment (Alluhidan et al., 2020). An overview of missed nursing care in Saudi Arabia identified that a low nursing staffing ratio is associated with high missed care, with the level of nurses' job satisfaction being a key mediating factor (Al Muharraq et al., 2022).

Implications for Policy and Future Research

The findings from KSA underscore the need for context-specific research (Alluhidan et al., 2020). While the fundamental principle that better staffing leads to better outcomes holds true, the specific optimal ratios and the policy interventions required to achieve them must be tailored to the local healthcare system (Tenorio et al., 2021). Simply transplanting a mandatory staffing law from California to Riyadh, for example, may fail to account for the unique HRH challenges, cultural factors, and the composition of the nursing team in KSA (Alharbi, 2018).

This highlights the second objective of this review: the need for future studies to address these mechanisms in varying cultural and healthcare contexts (Alluhidan et al., 2020). Research must move beyond merely confirming the Western findings to exploring the mediating factors such as cultural competence, language proficiency, and the integration of expatriate staff that influence the NPR-quality link in non-Western settings (Alharbi, 2018). This will contribute to a richer international understanding of the best nurse staffing and its effects on patient care.

Conclusion

This systematic review has consolidated the extensive international literature on the impact of nurse-to-patient ratios on the quality of care, affirming the significant and critical effect of staffing levels on patient outcomes. The aggregate evidence is overwhelmingly consistent: optimal nurse staffing is not a luxury but a fundamental prerequisite for safe and high-quality healthcare. The review established a clear, dose-response relationship between lower nurse-to-patient ratios and improved patient outcomes, most notably in the reduction of patient mortality. Seminal and contemporary meta-analyses consistently demonstrate that each additional patient assigned to a nurse incrementally increases the risk of death and the likelihood of a "failure-to-rescue" event. Furthermore, the evidence confirms that understaffing is a direct contributor to a range of preventable adverse events and complications, including nosocomial infections, medication errors, patient falls, and pressure ulcers. These complications arise from the inability of overburdened nurses to adhere to critical safety protocols and provide proactive, preventative care. Crucially, the review highlighted the intermediary role of the nursing workforce itself. High patient-to-nurse ratios lead to increased nurse burnout and job dissatisfaction, which in turn necessitate the rationing of care through missed nursing care activities. This pathway demonstrates that the quality of the nursing work environment is inextricably linked to the quality of patient care, forming a vicious cycle where poor staffing compromises both the nurse and the patient.

Policy and Practice Implications

The robust evidence base demands decisive policy and practice changes. The findings strongly support the implementation of mandatory minimum nurse staffing legislation as a critical patient safety strategy. Jurisdictions that have adopted such legislation, like California, provide models for how to translate research findings into enforceable standards that protect both patients and nurses.

However, the policy discussion must also address the economic argument. While increasing nurse staffing represents a significant upfront cost, the literature suggests that this investment is offset by the substantial cost savings associated with preventing adverse events. The financial burden of longer hospital stays, readmissions, litigation, and the treatment of HAIs and complications far outweighs the cost of adequate staffing. Therefore, optimal staffing should be viewed not as an expense, but as a cost-effective quality improvement measure. For healthcare administrators, this means moving away from viewing nurses as a variable cost to recognizing them as a fixed, essential component of the patient safety infrastructure.

Future Research Directions

Despite the wealth of evidence from Western health systems, this review underscores the urgent need for future studies to address the mechanisms of the NPR-quality link in varying cultural and healthcare contexts. The limited but significant research from non-Western settings, such as Saudi Arabia, confirms the universal nature of the staffing challenge but highlights the need for context-specific solutions.

Future research should focus on:

1 **Implementation Science:** Studying the most effective ways to implement and sustain safe staffing levels in diverse global settings, considering local human resource challenges and cultural factors.
2 **Cost-Effectiveness in Non-Western Settings:** Conducting economic evaluations to demonstrate the return on investment for improved staffing in developing or rapidly modernizing healthcare systems.
3 **Mediating Factors:** Investigating the role of cultural competence, language proficiency, and the composition of the nursing team (e.g., expatriate vs. local staff) as mediators of the NPR-quality relationship in international contexts.

By pursuing these avenues, the global healthcare community can move toward a richer international understanding of the best nurse staffing practices, ensuring that all patients, regardless of their location, receive the highest possible quality of care.

Conflicts of Interest

All authors declare that they have no conflict of interest.

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Availability of Data and Materials

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

References

Aiken, L. H., Clarke, S. P., Cheung, R. B., Sloane, D. M., & Silber, J. H. (2003). Educational levels of hospital nurses and surgical patient mortality. *JAMA*, *290*(12), 1617–1623.

Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., & Silber, J. H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA*, *288*(16), 1987–1993.

Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., & Griffiths, P. (2014). Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study. *The Lancet*, *383*(9931), 1824–1830.

Alharbi, A. A. (2018).*The impact of nurse work environment on nurse outcomes, nurse-perceived quality of care and patient safety in Saudi Arabia* (Master's thesis). University of British Columbia.

Alluhidan, M., Tashkandi, N., Alblowi, F., Omer, T., & Al-Sogair, A. (2020). Challenges and policy opportunities in nursing in Saudi Arabia. Human Resources for Health, 18(1), 77.

Al Muharraq, E. H., Alallah, S. M., & Al-Dossary, R. N. (2022). An overview of missed nursing care and its predictors in Saudi Arabia: a cross-sectional study. Nursing Research and Practice, 2022, 4971890.

Chen, Y. C., Guo, Y. L., Chin, W. S., Cheng, N. Y., & Ho, J. J. (2019). Patient–nurse ratio is related to nurses' intention to leave their job through mediating factors of burnout and job dissatisfaction. International Journal of Environmental Research and Public Health, 16(23), 4801.

Cimiotti, J. P., Aiken, L. H., Sloane, D. M., & Wu, E. S. (2012). Nurse staffing, burnout, and health care–associated infection. American Journal of Infection Control, 40(6), 486–490.

Dall'Ora, C., Ball, J., Recio-Saucedo, A., & Griffiths, P. (2016). Nurse staffing levels and patient outcomes: A systematic review and meta-analysis. International Journal of Nursing Studies, 63, 216–229.

Driscoll, A., Grant, M. J., Carroll, D., Dalton, S., De Vries, K., & McCluskey, S. (2018). The effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units: a systematic review and meta-analysis. European Journal of Cardiovascular Nursing, 17(1), 6–22.

Lasater, K. B., Aiken, L. H., Sloane, D. M., French, R., Martin, B., & Alexander, M. (2021). Patient outcomes and cost savings associated with hospital nurse staffing.BMJ Quality & Safety, 30(12), 947–955.

Moriwaki, M., & Nakashima, Y. (2025). Influence of Nursing Time and Staffing on Medication Errors.International Journal of Environmental Research and Public Health, 22(1), 12.

Mynaříková, E., Jarošová, D., & Janíková, E. (2020). Occurrence of hospital-acquired infections in relation to missed nursing care: A literature review.Central European Journal of Nursing and Midwifery, 11(4), 119–126.

Needleman, J., Buerhaus, P., Mattke, S., Stewart, M., & Zeisler, K. (2002). Nurse-staffing levels and the quality of care in hospitals. The New England Journal of Medicine, 346(22), 1715–1722.

Shekelle, P. G. (2013). Nurse–patient ratios as a patient safety strategy: a systematic review. Annals of Internal Medicine, 158(5 Pt 2), 404–409.

Tencic, M., & Roche, M. A. (2023). Nurse–patient ratios and infection control practices: a cross-sectional study. Collegian, 30(3), 360–366.

Tenorio, M. R., Aletreby, W. T., Al Shammari, B., & Al-Ghanmi, M. (2021). The Interrelation between nurse-to-patient ratio, nurse engagement, and missed nursing care in King

Saud Medical City: Basis for development of nurse–patient quality of care. Saudi Journal for Health Sciences, 10(2), 101–108.

Uchmanowicz, I., Wleklik, M., & Rosińczuk, J. (2024). The Impact of Rationing Nursing Care on Patient Safety. International Journal of Environmental Research and Public Health, 21(2), 175.

White, E. M., Aiken, L. H., & Sloane, D. M. (2019). Registered Nurse Burnout, Job Dissatisfaction, and Missed Nursing Care. Journal of Patient Safety, 15(4), 398–403.