REVIEW

Staffing nurses to reduce health care-associated infections: systematic review

Dotación del personal de enfermería para disminuir infecciones asociadas a atención en salud: revisión sistemática

Contratação de enfermeiros para reduzir as infecções associadas à assistência à saúde: revisão sistemática

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Abstract

Introduction: Nursing staffing in adult intensive care has been at a ratio of two patients per nurse or one patient for one nurse. Currently, patients require complex and specialized care that provides safety and reduces Healthcare-Associated Infections. **Objective:** Evidencing the importance of equipping nursing personnel according to the severity of the patient compared to the nurse-patient ratio in order to reduce Healthcare-Associated Infections in patients in the adult intensive care unit. **Methodology:** This is a systematic review based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, conducted from September 2021 to March 2022. The databases PubMed, ScienceDirect, Epistemonikos and CUIDEN were used, and the following terms were utilized, i.e., nursing personnel, patient severity, nurse-patient ratio, healthcare-associated infections, and the Boolean operators AND, OR, and WITH. The sample consisted of 8 studies that were assessed using the Critical Reading Cards (FLC 3.0) and graded according to the National Institute for Health and Care Excellence. **Results:** Staffing according to patient severity compared to the nurse-patient indicator reduced healthcare-associated infections, mortality, sepsis occurrence, and medication errors. The impact on patients and nursing personnel showed improved quality of care and reduced burnout and work stress, which benefited the patient. **Conclusion:** It is important to provide nursing personnel according to the severity of the patient and with personnel having an academic level of at least a bachelor's degree in order to improve the quality of care and reduce healthcare-associated infections.

Keywords: Nursing personnel; Nurse-Patient Ratio; Intensive Care Unit; Healthcare-Associated Infections; Severity of the Patient (DeCS).

Resumen

Introducción: Dotar al personal de enfermería en la terapia intensiva adultos ha sido en proporción dos pacientes por enfermera o 1:1. Actualmente, los pacientes que ingresan requieren cuidados complejos y especializados que proporcionen seguridad y disminución de infecciones asociadas a la atención en salud. **Objetivo**: Evidenciar la importancia de dotar al personal de enfermería según gravedad del paciente comparado con indicador Healthcare-Associated Infections enfermera-paciente para disminuir infecciones asociadas a la atención en salud en pacientes de la unidad de terapia intensiva adultos. **Metodología**: Revisión sistemática, basada en la declaración Preferred Reporting Items for Sistematyc Reviews y Meta-analyses, realizada en septiembre 2021 a marzo 2022, se utilizaron las bases de datos PubMed, ScienceDirect, Epistemonikos y CUIDEN, empleando términos: personal de enfermería, gravedad del paciente, relación enfermero-paciente, infecciones asociadas a la atención a la salud, operadores boléanos AND, OR, WITH. La muestra fue de 8 estudios, evaluados mediante los programas de Fichas de Lectura Crítica y gradados según el National Institute for Health and Care Excellence. **Resultados:** Dotar de personal según gravedad del paciente comparado con indicador enfermera-paciente disminuyó infecciones asociadas a la atención en salud, mortalidad, aparición de sepsis y errores en la medicación. Las repercusiones en pacientes y personal de enfermería mostraron mejor calidad de la atención, disminución de agotamiento y estrés laboral lo que benefició al paciente. **Conclusión:** Es importante dotar al personal de enfermería según gravedad del paciente, con personal de nivel académico licenciatura para mejorar la calidad de atención y disminuir las infecciones asociadas a la atención en salud.

Abstrato

Introdução: A equipe de enfermagem na terapia intensiva de adultos tem estado em uma proporção de dois pacientes para um enfermeiro ou um paciente para um enfermeiro. Atualmente, os pacientes que chegam exigem cuidados complexos e especializados que ofereçam segurança e reduzam as infecções associadas à assistência à saúde. **Objetivo:** Demonstrar a importância do dimensionamento do pessoal de enfermagem de acordo com a gravidade do paciente em comparação com o indicador enfermeiro-paciente, para reduzir as infecções associadas à assistência à saúde em pacientes adultos internados em unidades de terapia intensiva. **Metodologia:** Revisão sistemática com base nas diretrizes do Preferred Reporting Items for Systematic Reviews and Meta-Analyses, realizada entre setembro de 2021 e março de 2022, mediante os bancos de dados PubMed, ScienceDirect, Epistemonikos e CUIDEN, e usando os seguintes termos: pessoal de enfermagem, gravidade do paciente, relação enfermeiro-paciente, infecções associadas à assistência à saúde, operadores AND, OR, WITH. A amostra consistiu em 8 estudos, avaliados usando os programas Critical Reading Card e classificados de acordo com o Instituto Nacional de Excelência em Saúde e Cuidados. **Resultados:** O dimensionamento de profissionais de acordo com a gravidade do paciente, em comparação com o indicador enfermeiro-paciente, reduziu as infecções associadas à assistência à saúde, mortalidade, ocorrência de sepse e erros de medicação. O impacto sobre os pacientes e o pessoal de enfermagem mostrou uma melhor qualidade de atendimento, redução do esgotamento e do estresse no trabalho, o que beneficiou o paciente. **Conclusão:** É importante fornecer pessoal de enfermagem de acordo com a gravidade do paciente e com pessoal com nível acadêmico de, no mínimo, bacharelado, a fim de melhorar a qualidade do atendimento e reduzir as infecções associadas à assistência à saúde.

Introduction

The Adult Intensive Care Unit (AICU) is a specialized unit where care is provided through invasive procedures with the use of technology, which further increases safety risks (1-8), and through the Nursing Care Process care is provided according to the health needs of the individuals and their environment [9-12]. Consequently, the organizational culture of the institution encompasses transformations and constitutes a challenge for the manager of the AICU who must provide quality in the care provided by the staff and their quality of life [6,7,13-15].

For the above reason, health systems, patients and family members monitor outcomes associated with care [7]. One of those outcomes is adverse events, which could be considered a public health problem with extrinsic and system factors, which in turn influence staffing and supplies, and both are important in preventing adverse events [6,16,17]. In this context, healthcare-associated infections are the most frequent adverse event, representing 37.1 % of the adverse events. According to the World Health Organization (WHO), more than 1.4 million people contract it, and between 5% and 10% will develop one or more healthcare-associated infections, which in Mexico range from 2.1% to 21% [18-20].

Likewise, for the Centers for Disease Control and Prevention (CDC) and the WHO, "healthcare-associated infection" is an infection resulting from an adverse event in a medical facility during the patient's treatment when such an infection was not present or incubating at the time of admission but can also appear after discharge [7,21]. This situation includes catheter-associated blood stream infections, ventilator-associated pneumonia, urinary tract infections, and surgical site infections [6,16,18,22,23].

Since Healthcare-Associated Infections are preventable adverse events, institutions should establish mechanisms to prevent and correct them [24,25], such as human resources, through the provision of nursing personnel [26, 27], which is in short supply [28]. In Mexico, the number of nursing

personnel is 72% lower than the average rate established by the Organization for Economic Cooperation and Development (OECD) [29].

Therefore, the nurse-patient ratio indicator, which is a tool for care management, determines personnel needs and increases patient safety [30,31]; studies have shown that by increasing this indicator in Intensive Care Units, healthcare-associated infections, mortality, and complications of daily practice were reduced [6,29-32]. Additionally, the International Council of Nurses affirms that variations in this ratio provide negative consequences for patients and nursing personnel [26, 33-36].

Thus, supplying the needs of nursing human resources has been modified over time, with various criteria [33], such as the nurse-patient ratio indicator, which considers the number of beds or the ratio 1:2 or 1:1, that is, one specialist nurse for every two patients or one specialist per patient [37], implemented by the Permanent Nursing Commission of Mexico since 1997 [38]. There is also the indicator of the patient's severity, which considers the complexity of the care provided by the nursing personnel to the patient to improve the quality of care [33,35,39,40].

Therefore, indicators for staffing nurses are a fundamental part of nursing management, thus, the healthcare manager should choose to use the appropriate indicator, seeking the proper functioning of the AICU to improve the quality and safety of patient care. The above contributes scientifically to the interest towards the nursing profession, which has an impact on the recovery, quality and safety of the patient. Based on the above, the objective of this review was to demonstrate the importance of nursing personnel according to the severity of the patient compared to nurse-patient ratio indicator, to decrease healthcare associated infections in patients at the AICU.

Methodology

The study design is a systematic review. The scientific literature search strategy followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method. The searches were conducted from September 30, 2021, to March 15, 2022;

the sources consulted were the databases of the U.S. National Library of Medicine (PubMed), Epistemonikos, CUIDEN, ScienceDirect, using the medical information search engines in Spanish (MEDES), and Google Scholar. Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) descriptors were used, using keywords such as personal de enfermería (nursing personnel), gravedad del paciente (severity of the patient), relación enfermero-paciente (nurse-patient ratio), infección hospitalaria (nosocomial infections), infecciones asociadas a la atención de la salud (healthcare-associated infections) and the Boolean operators AND, NOT and WITH as positional operator.

The selection criteria included meta-analysis, systematic reviews (SR), randomized clinical trials, and articles from primary sources. The sample is made up of adult patients hospitalized in the AICU, articles in Spanish, English and Portuguese whose publication is not older than 5 years and published during the period from 2016 to 2021, with an approach focused on nursing personnel according to the severity of the patient and on the nurse-patient ratio indicator. Exclusion criteria included studies that did not include the topic of nursing personnel in the AICU, letters to the editor, guidelines, reviews, and news items; in addition, repeated articles and those published before 2016 were also eliminated. The search was divided into two phases, the first consisted of the search and collection of studies, and a total of 1,762 articles were found, of which, after reading the title and abstract, the duplicate articles and those not related to the topic were eliminated.

In the second phase, the remaining 86 articles were reviewed by reading their titles, abstracts, and conclusions, of which 73 were subsequently excluded. The remaining 13 articles were read using the Critical Reading Cards version 3.0 (FLC 3.0), of which 5 were eliminated because they did not meet the minimum criteria necessary to classify, rank and evaluate the available evidence; the National Institute for Health and Clinical Excellence (NICE) grading scale applicable to meta-analyses, systematic reviews, randomized clinical trials and primary studies was used for this

purpose. The result was the selection of 8 articles that met the quality criteria for this systematic review, (Figure 1).

Figure 1. Search and selection process, September 2021 to March 2022.
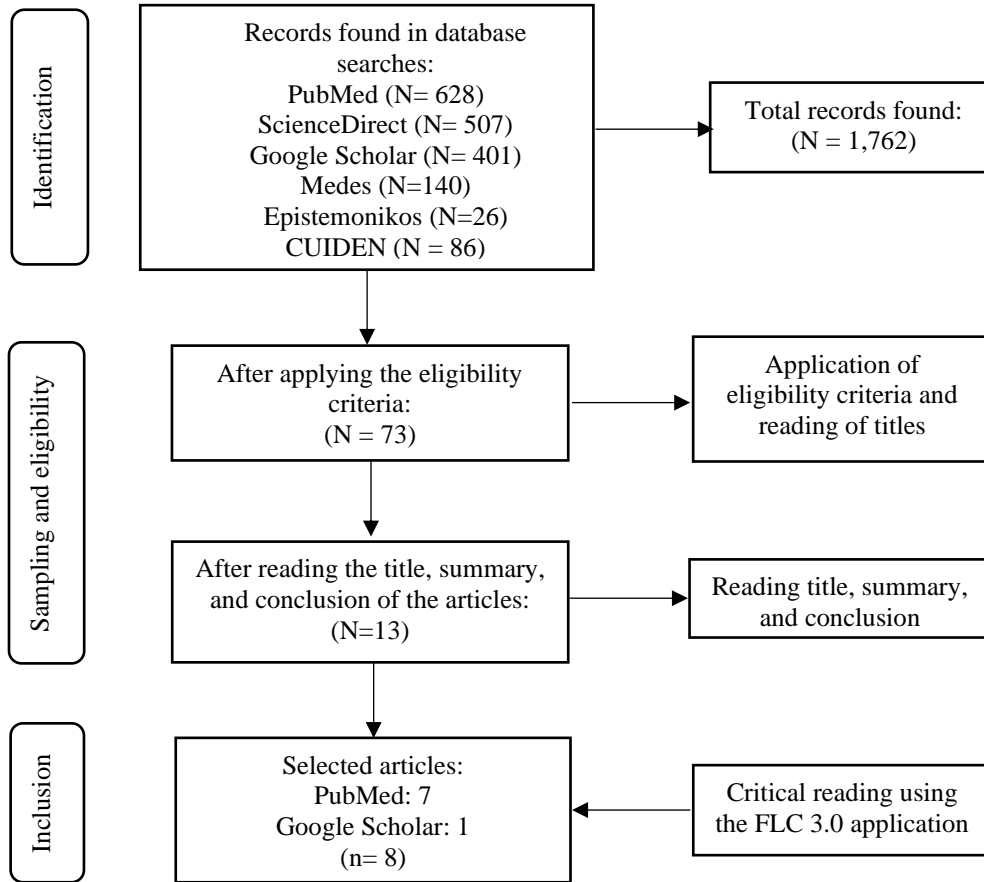
Source: Own-development

Results

Of the articles reviewed, 62.5% were found in PubMed and 37.5% in Google Scholar. With regard to study design, 88% were systematic reviews [41-43, 45-47] and 11% were primary studies [44,48], (Table 1).

Table 1: Characteristics of the selected studies, 2022.

No.	Study	Study Design	Sample
1	Identifying nurse-sensitive indicators for stand-alone high acuity areas: a systematic review [41].	Systematic Review	39 articles
2	The effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units: a systematic review and meta-analysis [42].	Systematic Review	44 articles
3	Nursing personnel and hospital-acquired conditions: a systematic review [43].	Systematic Review	19 articles
4	Nursing personnel and healthcare associated infection, unit-level analysis [44].	Longitudinal Descriptive	100,264 patients
5	Outcomes sensitive to critical care nursing personnel levels: a systematic review [45].	Systematic Review	55 articles
6	Nursing-sensitive indicators for nursing care: a systematic review [46].	Systematic Review	30 articles
7	Analysis of the workload of nursing personnel, according to the severity of the patient. [47].	Systematic Review	35 studies
8	Association between the patient–nurse ratio and nurse outcomes in acute care hospitals [48].	Descriptive Cross-sectional	25 patients

Source: Own-development

The result of the analysis shows a significant relationship between staffing the AICU according to indicators that measure the severity of the patient and the reduction of Healthcare-Associated Infections, including Catheter-Associated Bloodstream Infections [42-45,49], Urinary Tract Infections (UTI) [42-46,49], Ventilator-Associated Pneumonia (VAP) [42,44,46,49], and Surgical Site and Postoperative Infections [46,49].

Regarding mortality, this study found that staffing according to the indicator of the patient's severity decreased the mortality rate compared to the nurse-patient indicator [42,46,47,49]. Staffing the AICU according to the severity of the patient reduced the occurrence of sepsis [42,49], intubation [49] and adverse events, including medication errors [42,49], pressure ulcers and falls [49]; it also showed a reduction in hospital stay compared to the nurse-patient indicator.

In relation to the repercussions on the patient and on the nursing personnel, also, staffing according to the severity of the patient in comparison with the nurse-patient indicator improved the quality of care, decreased the exhaustion of the nursing personnel and prevented injuries in the staff due

to the interventions they performed [48]; likewise, it was shown that staffing the nursing personnel according to severity of the patients decreased work stress due to excessive workload, and consequently the respective repercussions on the patient [45].

Regarding the educational level, education, skills, and work environment were considered [48]; registered nurses [43,45,46,49], registered nurse practitioners or vocational nurses [43,46], and unlicensed nursing assistants [43,46] were considered in staffing; however, in this review nursing assistants were not considered within AICU staffing.

Discussion

The findings obtained from the review of the selected articles met the eligibility criteria of the proposed main objective: nursing personnel according to patient severity decreased Healthcare-Associated Infections in the AICU. Among the infections mentioned above, the most frequent were Urinary Tract Infections or UTIs [42-46,49], followed by Catheter-Associated Bloodstream Infections [42-45, 49], Ventilator-Associated Pneumonia [42,44,46,49] and Surgical Site Infections [46,49].

The above shows that the objective proposed in this study is met, which considers that staffing the AICU according to the severity of the patient gives us an overview of the various interventions that the nursing personnel needs to perform on the patient, such as early diagnosis, prevention, and surveillance practices, which contribute to the patient's safety.

Similarly, numerous different nursing personnel indicators were found, which were classified as follows: a) an indicator according to the patient's severity, which included the nursing hours per day indicator [42,43,45,46,49] and the assessment of the time to perform the activities [47]; b) the nurse-patient indicator [42,49] and the nurse-bed-patient indicator [42].

Among the findings of this review, 4 studies found a relationship between the increase in nursing personnel and the reduction of mortality [42,46,47,49] in patients in the AICU, that is, as the level of nursing personnel increases, the mortality rate in the AICU decreases. This highlights the need to

increase nursing personnel in the AICU taking into account the severity of the patient and the combination of the qualifications and skills of the nursing personnel, to improve the clinical outcomes of patients.

The results of this review showed that nursing personnel was composed of three academic grades: licensed registered nurses [35,36,38,39], registered nurse practitioners or vocational nurses [43,46], and unlicensed nursing assistants [43,46]. However, studies showed that a higher staffing of registered nurses with bachelor's degrees and above contributed to a decrease in Healthcare-Associated Infections and mortality among the patients attended, which is associated with better outcomes. Since nursing personnel alone is not sufficient to ensure quality care, it is necessary to consider the level of education and skills acquired through higher academic degrees.

Conclusions

Through the findings obtained in this review, we observed the importance of nursing personnel according to the severity of the patient in comparison with the nurse-patient indicator for the reduction of Healthcare-Associated Infections. Therefore, when the AICU is understaffed and there is an increase in admissions to the area or due to an increase in the patient's severity, prevention practices and surveillance activities for early detection are omitted, thus compromising the unit and potentially leading to the appearance of healthcare-associated infections, among which catheter-associated bloodstream infections, ventilator-associated pneumonia, and surgical site infections stand out. Also, nursing personnel according to the severity of the patient helps reduce ventilator-associated pneumonia, intubation, sepsis, falls, days of hospital stay, and patient mortality rates.

For all of the above, it is important that nursing personnel be in accordance with the severity of the patient, preferably with nursing personnel with a bachelor's degree and, if possible, with a specialty in the care of critically ill patients, since they will have the necessary knowledge to improve the

quality of care, reduce Health Care Associated Infections, decrease the exhaustion of nursing personnel, and thus prevent injuries to staff due to the interventions that are performed.

Conflict of interest

The authors stated that there was no conflict of interest.

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