Article

The Clinical Severity of Patients in Intensive Care Units Determines Nurse Assignments*

* This article stems from the master's thesis entitled ***Nurse-Patient Ratio According to Clinical Severity in Two Intensive Care Units in the Colombian Caribbean***, presented to the Universidad del Norte, Colombia.

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Theme: Nursing management and administration

Contribution to the nursing field

The results of this study become scientific and methodological evidence that allows the management of human resources in terms of nursing professionals in hospital institutions and the creation of allocation policies based on patients' conditions rather than on the installed capacity. All of the above translates into improved quality of care and this has a direct impact on patient outcomes and the care experience they perceive. Furthermore, it is a valid and essential element that allows an objective approach to the nursing workload, thus becoming a tool for managing human resources and impacting safety, quality, and management. Beyond the strictly numerical aspects and their implication in safety and quality, these results become a vital tool to demonstrate the true role of nursing in intensive care units and the importance of having adequate human resources in terms of number and preparation.

Abstract

Introduction: Intensive care units are highly complex services designed to maintain the vital functions of patients who require specialized care and assistance, so it is necessary to allocate an adequate number of nursing professionals, according to the clinical conditions, to provide a response and continuity of care. In Colombia there is no legislation that quantitatively establishes this ratio, so it is usually determined by the installed capacity and not by the complexity of nursing interventions; therefore, this study becomes an asset to promote public policies for personnel allocation. **Objective:** To determine the nurse-patient ratio according to clinical severity in two intensive care units in the Colombian Caribbean. **Materials and Methods:** This is a quantitative, descriptive, cross-sectional study conducted in two intensive care units (Sincelejo and Barranquilla), for which the TISS-28 (Simplified Therapeutic Intervention Score System) instrument was used for a three-month period. A total of 15 nursing professionals and 469 patients participated. Approval was granted by the Ethics Committee of the Universidad del Norte. **Results:** According to the severity of patient conditions, grade III was prevalent, that is, requiring intensive monitoring, with a time for nursing interventions ranging from 201.5–413.4 min (3.3 h – 6.89 h), and the need for a nurse-patient ratio of 1:2. **Conclusions:** There is a shortage of nursing professionals in the participating units to meet care needs.

Keywords (Source: DeCS)

Nurse-patient relationships; intensive care units; health care resource allocation ; workload; health services management.

La gravedad clínica del paciente en Unidad de Cuidado Intensivo determina la dotación de enfermeras

* Este artículo es derivado de la tesis de maestría "Relación enfermero-paciente según la gravedad clínica en dos unidades de cuidado intensivo del Caribe colombiano" presentada a la Universidad del Norte, Colombia.

Resumen

Introducción: las unidades de cuidados intensivos son servicios de alta complejidad diseñados para mantener las funciones vitales de los pacientes que requieren cuidado y atención especializada, por lo que se necesita contar con profesionales de enfermería suficientes, según las condiciones clínicas, que den respuesta y continuidad al cuidado. En Colombia no existe una legislación que establezca cuantitativamente esta relación, por lo que suele determinarse por la capacidad instalada y no por la complejidad de las intervenciones de enfermería; esta investigación se convierte en un insumo para promover políticas públicas de asignación de personal. **Objetivo:** determinar la relación enfermero-paciente de acuerdo a la gravedad clínica en dos unidades de cuidados intensivos del Caribe colombiano. **Materiales y métodos:** estudio cuantitativo de alcance descriptivo, transversal, en dos unidades de cuidado intensivo (Sincelejo y Barranquilla), para el cual se utilizó el instrumento TISS-28 (Simplified Therapeutic Intervention Score System) durante tres meses. Participaron 15 profesionales de enfermería y 469 pacientes. Se obtuvo aval del Comité de Ética de la Universidad del Norte. **Resultados:** de acuerdo a la gravedad de los pacientes, predominó el grado III, es decir, requerimiento de vigilancia intensiva, con un tiempo para las intervenciones de enfermería de entre 201,5–413,4 min (3,3 h – 6,89 h) y necesidad de una relación enfermero–paciente 1:2. **Conclusiones:** existe un déficit de profesionales de enfermería en las unidades participantes para cumplir con las necesidades de cuidado.

Palabras clave (DeCS)

Relaciones enfermero-paciente; unidades de cuidado intensivo; asignación de recursos para la atención en salud; carga de trabajo; administración de los servicios de salud.

A gravidade clínica do paciente na Unidade de Terapia Intensiva determina a equipe de enfermagem

* Este artigo é derivado da tese de mestrado "Relación enfermero-paciente según la gravedad clínica en dos unidades de cuidado intensivo del Caribe colombiano", apresentada à Universidad del Norte, Colômbia.

Resumo

Introdução: As unidades de terapia intensiva são serviços de alta complexidade destinados a manter as funções vitais dos pacientes que requerem atenção e cuidados especializados, o que exige profissionais de enfermagem em número suficiente, de acordo com as condições clínicas, para dar resposta e continuidade aos cuidados. Na Colômbia, não há legislação que estabeleça quantitativamente essa relação, de modo que ela é geralmente determinada pela capacidade instalada e não pela complexidade das intervenções de enfermagem; esta pesquisa se torna um insumo para promover políticas públicas para a alocação de pessoal. **Objetivo:** determinar a relação enfermeiro-paciente de acordo com a gravidade clínica em duas unidades de terapia intensiva no Caribe colombiano. **Materiais e métodos:** estudo quantitativo, descritivo e transversal em duas unidades de terapia intensiva (Sincelejo e Barranquilla), para as quais foi utilizado o instrumento TISS-28 (Simplified Therapeutic Intervention Score System) durante três meses. Participaram 15 profissionais de enfermagem e 469 pacientes. Foi obtida a aprovação do Comitê de Ética da Universidad del Norte. **Resultados:** de acordo com a gravidade dos pacientes, o grau III foi predominante, ou seja, exigindo monitoramento intensivo, com um tempo para intervenções de enfermagem entre 201,5-413,4 min (3,3 h - 6,89 h) e a necessidade de uma relação enfermeiro-paciente de 1:2. **Conclusões:** há um déficit de profissionais de enfermagem nas unidades participantes para atender às necessidades de cuidados.

Palavras-chave (Fonte DeCS)
Relações enfermeiro-paciente; unidades de terapia intensiva; alocação de recursos para a atenção à saúde; carga de trabalho; administração dos serviços de saúde.

Introduction

Intensive care units (ICU) are services within the hospital institutional framework that have a structure designed to maintain the vital functions of patients who require constant care and specialized attention 24 hours a day, and their purpose is patient recovery (1). Given the needs of this service, it is essential to have a sufficient number of professionals, according to the severity of the patients, with whom to provide a response and continuity of care, so the workload must be systematized, establishing a professional nurse-patient ratio that considers patients' needs.

Studies that associate nursing workload with patient safety have demonstrated the need to establish clear policies for the allocation of nursing personnel in the ICU, such as the one conducted by (2), in Australia, which showed the significant results of a policy designed to achieve better allocation of nursing personnel per patient, and whose effects were: A 12% decrease in 30-day mortality, an 8% decrease in 7-day readmissions, and a 26% decrease in hospital stay days. This is substantial evidence that patient outcomes are more favorable in institutions with better nursing personnel allocation.

Other studies have associated nursing personnel allocation with multiorgan failure (3), hospital survival (4), in-hospital mortality (5), hypoxemia, arterial hypotension, and bradycardia (6), as well as with the occurrence of near accidents and adverse events, noncompliance with care guidelines, and inadequate monitoring (7, 8, 22). In all cases, they have been found to be associated with worse patient outcomes, demonstrating the deleterious effects of an inadequate nurse-to-patient ratio, as well as the fact that quality of care and safety may be compromised if acuity or severity is not matched by sufficient nursing resources; for this reason, an optimal level of professional personnel should be a prerequisite for the availability and quality of critical care services.

In Colombia, the regulations for defining the nurse-patient ratio in the ICU, in quantitative terms, are nonexistent. It should be noted that within the qualification standards of healthcare institutions (9) it is stipulated that ICUs must employ nurses with specialization or certified experience in the care of critical patients; however, it is not established what the numerical ratio should be, and the severity of patients and the complexity of the nursing interventions are not established. Other general provisions are the Nursing Code of Ethics (10) and Law 266 of 1996 (11) which do not specify a nurse-patient ratio for the ICU. This gap in the regulations has led to the number of nurses being defined according to the capacity installed and available to healthcare providers.

The present study enables identifying the status of two institutions in terms of nurse-patient ratio in ICUs, which paves the way

for discussion on the impact of the deficit of nursing personnel to meet the demands of care on patient outcomes, quality of care, and professional attrition. It also shows that it is feasible to use objective instruments that assess workload to facilitate safe, clear, and congruent decision-making, in line with patient needs, and that becomes an input for efficient personnel planning and for transforming care through high-quality measures, which ultimately impacts directly and significantly on outcomes and ensures care. The objective was to determine the nurse-patient ratio according to clinical severity in two ICUs in the Colombian Caribbean.

Materials and Methods

Type of Study

The study employed a quantitative, observational, descriptive, cross-sectional, descriptive design.

Spatial-Temporal Delimitation

The study was conducted in two tertiary care institutions with adult ICUs in the Colombian Caribbean. The first corresponds to a private institution, licensed and located in the city of Sincelejo, with an installed capacity of 26 adult intensive care beds and a personnel ratio of one nurse for every 11 beds. The other institution is located in the Atlántico department, in the municipality of Soledad, with an installed capacity of 14 beds and a ratio of one nurse for every 7 beds. The measurements were performed during a period of three months: February, March, and April 2023, for the first institution; and March, April, and May of the same year, for the second one.

Study Subjects and Sample

Patients who were hospitalized in the ICUs and permanent nursing professionals who performed care duties and patient care interventions for critical adult patients in the participating institutions during the study period. This was a non-probabilistic sample, selected at the convenience of the research group, given the dissimilar conditions of the ICUs in the region and the country; all the participants who met the inclusion criteria during the study period in both hospitals were included. A total of 15 nurses and 469 patients in the two institutions participated (Table 1). The exclusion criterion was nursing professionals who were not in administrative positions, or on disability or vacation leave during the study period, although there were no personnel absent from the units for these reasons; and for the patients, those who were not minors and did not have a hospital stay of less than 24 hours.

Table 1. Sample Characterization by Institution

	Nurses	Patients
	(N = 15)	(N = 469)
Institution 1	7	303
Institution 2	8	166

Source: Prepared by the authors.

Data Collection Instruments

For the collection of the participants' sociodemographic and clinical variables, a self-made characterization form was used, and for the variables severity, time of interventions, and number of nurses per patient according to severity, the TISS 28 instrument was used, created by (12), and which has been used in ICUs to calculate the complexity of interventions and the time to perform these tasks, with the purpose of managing the personnel resources required in this unit. This instrument establishes that a nurse can provide care corresponding to 46.35 points of TISS 28 per shift; therefore, each point of TISS 28 is equivalent to 10.6 minutes.

The elements included in TISS 28 are grouped into seven main sections that focus on the treatment of critically ill patients, consisting of seven Likert-type sections, each with several actions to which a score of 1 to 8 is assigned (the higher the complexity, the higher the score), according to the therapeutic intervention applied; therefore, patients are classified into four grades (Table 2).

Table 2. Classification According to TISS 28

Grade	TISS Score	Classification	Nurse-Patient Ratio
I	Lower than 10	Observation	1:4
II	10-19	Active monitoring	1:4
III	20-39	Intensive monitoring	1:2
IV	Higher than 40	Intensive therapy	1:1 o 2:1

Source: collected from (13) Prognostic scores and diagnostic criteria in patients in critical condition.

The TISS 28 instrument was validated by (12) on each one of the items, in a prospective multicenter study, in addition to a panel of ICU specialist nurses who inventoried the nursing activities, categorizing them into six groups. Internal validation was also conducted with the participation of 22 Dutch ICUs which scored a Cronbach's alpha of 0.90. In Colombia, the instrument was validated in a prospective multicenter study in six institutions in the city of Medellin (21).

The selection of the instrument was based on the care activities performed by the nursing professionals in the Colombian Caribbean to measure direct care, excluding administrative and other types

of work such as bathing patients, changing positions, and cleaning rooms, among others, which in this context are performed by other members of the care team. In addition, it is evident that in Colombia there is no consensus on the methods for measuring workload for nursing work (23).

Procedure

The instruments used to conduct this study were in digital format and were filled out daily, during the morning shift, by three research personnel who had experience in the field of healthcare and who were not contractually bound to the participating units during the study period; these personnel were previously trained on how to adequately fill out the instruments, through practical exercises and workshops, evaluating their understanding of the instruments.

This study complied with the national and international ethical standards that regulate health research and that aim to preserve the dignity and well-being of individuals. This study was classified, according to resolution 8430 of 1993 of the Colombian Ministry of Health, as research without risk, since it uses a documentary method (application of the TISS 28 scale through direct observation) and does not perform any intervention or intentional modification of the participants' biological, physiological, or psychological variables.

The research project was submitted for review by the research and ethics committees of the participating institutions; subsequently, it was submitted to the Ethics Committee of the Universidad del Norte, which granted a waiver of informed consent since the research did not involve any risk for the patients, and the information provided by the professionals was basic in terms of their level of training, years of experience, and social variables, that is, no sensitive information was included, in compliance with Act No. 275.

For the statistical analysis of the data collected, organized, and coded, these were processed using the SPSS (Statistical Package for the Social Sciences) program IBM version 27, and the distribution of frequencies of each variable, measurements of central tendency, and tests of statistical significance were obtained.

Results

Sociodemographic Characterization

From a total of 15 nursing professional participants (total n = 15, Institution 1 = 7, Institution 2 = 8), the age group with the highest frequency was 30 – 49 years (Institution 1, 71%, Institution 2, 75%). The female sex was prevalent (Institution 1, 71%, Insti-

tution 2, 75%). For the level of education, in Institution 1 the undergraduate category was prevalent (100%) while in Institution 2, the specialization category was prevalent (75%). For the variable years of experience, in both institutions the categories 1-4 years and more than 8 years were prevalent.

Regarding the patients' sociodemographic and clinical characteristics, the mean age was 57.9 years in Institution 1 and 58.3 years in Institution 2. In both institutions the senior adult category was prevalent (54.1% in Institution 1, and 56.6% in Institution 2).

In Institution 1, 53.5% of the patients were male, and in Institution 2 the distribution was equal for both sexes. Regarding the length of stay, it was 1-3 days (43.2% in Institution 1 and 63.3% in Institution 2), and the diagnostic categories were neurological (25.7%) and others (26.7%) in Institution 1; and cardiovascular (30.7%) and neurological (17.5%) in Institution 2.

Table 3. Sociodemographic and Professional Characteristics of the Nursing Professionals

Variables	Institution 1		Institution 2	
	Total (N=7)		Total (N=8)	
	Frequency	Percentage	Frequency	Percentage
Age				
18-29 years	2	29	2	25
30-49 years	5	71	6	75
Over 50 years old	0	0	0	0
Sex				
Male	2	29	2	25
Female	5	71	6	75
Level of Education				
Undergraduate	7	100	1	12.5
Specialization	0	0	6	75
Master's	0	0	1	12.5
Doctorate	0	0	0	0
Years of Experience				
Less than 1 year	0	0	0	0
1-4 years	4	57	4	50
5-8 years	1	14	0	0
More than 8 years	2	29	4	50

Source: Prepared by the authors.

Table 4. Patients' Sociodemographic and Clinical Characteristics

Variables	Institution 1		Institution 2	
	Total (N = 303)		Total (N= 166)	
Patient's Age	Mean	SD	Mean	SD
	57.94	20.67	58.39	19.68
Patient's Age	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Young adult (18-39 years old)	70	23.1	35	21.1
Middle-aged Adult (40 -59 years old)	69	22.8	37	22.3
Senior adult (60 years or older)	164	54.1	94	56.6
Total	303	100	166	100
Patient's Sex				
Male	162	53.5	83	50
Female	141	46.5	83	50
Total	303	100	166	100
Days of Stay				
1-3 days	131	43.2	105	63.3
4-7 days	105	34.7	43	25.9
8-10 days	29	9.6	6	3.6
More than 10 days	38	12.5	12	7.2
Total	303	100	166	100
Diagnostic Category				
Infectious	42	13.9	20	12
Respiratory	30	9.9	26	15.7
Neurological	78	25.7	29	17.5
Cardiovascular	58	19.1	51	30.7
Renal	8	2.6	7	4.2
Metabolic	6	2	14	8.4
Others	81	26.7	19	11.4
Total	303	100	166	100

Note: SD = standard deviation.

Source: Prepared by the authors.

Severity Classification according to TISS 28

A total of 1475 measurements of TISS 28 were performed, and it was found that the mean TISS score in both institutions was of grade III (intensive monitoring), in institution 1 the score was 26.2 points and in institution 2 it was 34.6 points (Table 5). It was found that most patients were classified as grade III according to TISS 28.

Table 5. Severity classification according to TISS 28 measurements

	Institution 1		Institution 2	
Variables	**Total (N = 1121)**		**Total (N= 354)**	
TISS score	Mean	SD	Mean	SD
	26.26	10.046	34.67	10.643
TISS score	Frequency	Percentage	Frequency	Percentage
Lower than 10 points	0	0	0	0
10-19 points	338	30.2	13	3.7
20-39 points	656	58.5	230	65
40 points or higher	127	11.3	111	31.4
Total	1121	100	354	100
Severity according to TISS 28				
Grade I: Observation	0	0	0	0
Grade II: Active monitoring	338	30.2	13	3.7
Grade III: Intensive monitoring	656	58.5	230	65
Grade IV: Intensive therapy	127	11.3	111	31.4
Total	1121	100	354	100

Note: SD = standard deviation.
Source: Prepared by the authors.

Time and Number of Nurses Required for Nursing Interventions

It was found that in both institutions the time interval needed the most ranged from 201.5 – 413.4 min, with a percentage of 58.5% in institution 1 and 65% in institution 2 (Table 6). Regarding the variable number of nurses per patient, according to severity based on TISS 28, the most needed ratio was 1:2, that is, 1 nurse for every 2 patients in intensive monitoring.

Table 6. Time and Number of Nurses Required for the Interventions

	Institution 1		Institution 2	
Variables	**Total (N = 1121)**		**Total (N= 354)**	
Intervention Time	**Frequency**	**Percentage**	**Frequency**	**Percentage**
106 min – 201. 4 min	338	30.2	13	3.7
201.5 – 413. 4 min	656	58.5	230	65
More than 413.5 min	127	11.3	111	31.4
Total	1121	100	354	100
Nurse-Patient Ratio				
1:4	338	30.2	13	3.7
1:2	656	58.5	230	65
1:1	127	11.3	111	31.4
Total	1121	100	354	100

Source: Prepared by the author.

Discussion

The nursing workload, according to (14), consists of five attributes that define it: 1) The amount of time dedicated to care (patient acuity), 2) The weight of nursing intensity (direct care), 3) The physical, mental, and emotional effort required from the professional, 4) The complexity of care, and 5) The level of knowledge, skills, and behavior required from the professional (nursing competence). It is then necessary to define the sociodemographic and labor characteristics of the professionals participating in the study. In this study, the prevalent age ranged from 30 to 49 years, the prevalent sex was female, and the prevalent level of training was undergraduate and specialization, although this level of training was only found in Institution 2, which is similar to the findings of (15), which in a larger sample (70 nurses) found a mean age of the professionals of 35.7 +/- 6.1 years, with a prevalence of the female sex; it is inferred that these professionals have a characteristic sociodemographic pattern.

It is worth noting the competence of nurses in intensive care units in the Colombian Caribbean, since as the findings of this study show, only in Institution 2 were found professionals with a postgraduate level of education; this allows reflecting on the current conditions of nursing in Colombia and the academic training needs of healthcare professionals to improve their autonomy and impact on the quality of care, as demonstrated by (24) through a linear regression, where, for instance, a nurse specialist in ICU manages to impact on key figures such as the decrease in the risk of mortality (odds ratio (OR): 0.52, 95% CI: 0.36-0.73, p < ,001) and the need for mechanical ventilation for patients (OR: 0.20, 95% CI: 0.15-0.26, p < ,001), concluding that the experience and knowledge of a nurse specialist in a given field significantly contribute to the safety of the patients receiving their care.

Regarding the patients' sociodemographic and clinical characteristics, it was found that their mean age was in the category of senior adults (60 years or older), with a prevalence of male sex, a hospital stay of 1-3 days, and neurological, cardiovascular, and other diagnostic categories. These findings are related to those found by (16), among which the male sex, senior adults, and a hospital stay of 3 days were prevalent. The diagnostic category differs, which may be justified by the epidemiological profile of the region where the study was conducted (Santander), in contrast to the Caribbean region (Sincelejo and Barranquilla).

The measurements performed enabled estimating that the patients were in severity grade III, that is, they needed intensive monitoring, a finding close to that of other authors such as (5, 17, 18) since the mean score of their measurements was also classified as grade III. This allows analyzing and discussing the difference in the nurse-patient ratio between one institution and the

other. Being placed in grade III implies requiring intensive monitoring and a professional nurse-patient ratio of 1:2, which is far from the reality of the participating institutions whose ratios are much higher. Similarly, the time deficit to meet care needs is evident; in Institution 2, 31.4 % of patients required more than 413.5 minutes of a nurse's shift; this situation questions the fact of how these professionals manage to meet the direct care and demands of patients with such a time deficit, having large numbers of patients with similar clinical conditions under their care. This becomes one of the reasons for the excessive delegation of nursing interventions to auxiliary technicians.

The shortage of nursing personnel to meet the care needs, depending on clinical severity, should be analyzed in light of its impact on patient outcomes, quality of care, and burnout; studies such as RN4CAST-Australia (2) have shown that adequate nurse allocation policies significantly decrease mortality rates, hospital readmissions, and length of hospital stay. Similarly, lower personnel allocation levels are related to an increased risk of ventilator-associated pneumonia (19), and an increased risk for nurses to suffer from burnout syndrome (20).

Among the study limitations, it should be mentioned that it was necessary to include ICUs from two different cities, with distinct structural characteristics and dissimilar conditions of admitted patients, which did not allow the research group to generalize the findings; despite this, the results show that the prevalent grade was grade III and the differences between the two institutions allow determining that aspects such as the diagnostic category may influence the nursing workload, which becomes an opportunity to conduct more studies that include the clinical differences of the patients and their relationship with the nursing interventions, as well as including other intensive care units that allow generalizable results to be obtained.

Conclusions

The results of the present study show that there is an insufficient professional-patient ratio according to clinical severity in the participating institutions; this demonstrates the deficit in the time required for the care and interventions provided to the rest of the patients under the care of a single nursing professional. Similarly, it shows that the tasks to be performed by nurses become disproportionate in relation to the time, quantity, and complexity of the care required by the patients and the scarce number of personnel; as a result, nurses are gradually being displaced from the care tasks that require their scientific knowledge.

These results highlight the pressing need to increase the number of nurses per number of patients ratio and indicate that more nurses per shift are needed to provide quality care and, thus, meet the demands of care in the ICU, allowing for the improvement of the

autonomy and recognition of the profession. Similarly, the workload relative to the severity of patients, the number of patients, and the time required for interventions, measured in this study, was found to be much higher than the international guidelines and the TISS 28 standards. According to these findings, it is necessary to emphasize the importance of establishing, through legislation, a nurse-patient ratio that is in line with the severity of the patients, which is relevant for the management of nursing personnel in the ICU and should not be evaluated solely on the basis of the installed capacity of the institutions.

In Colombia, the nurse-patient ratio, according to the severity of patients, still contains gaps to be addressed, such as the instrument that best adapts to the characteristics and roles in each institution, the specific roles of professional and auxiliary nursing profiles, and the ratio that suits the institutional costs, among others. It is recommended conducting further studies that measure the workload and are as close as possible to the reality of the Colombian context to perform a national diagnosis that will allow the creation of healthcare models and policies that include the nursing human resources and ensure an approach based on patient safety as the core axis of care.

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