DOI 10.18471/rbe.v.37.51942 Original Article

# RELATIONSHIP BETWEEN THE WORK SCHEDULE PREPARED BY NURSES AND THE NURSING ACTIVITIES SCORE

# RELAÇÃO ENTRE A ESCALA DE TRABALHO ELABORADA PELOS ENFERMEIROS E O NURSING ACTIVITIES SCORE

# RELACIÓN ENTRE EL PLAN DE TRABAJO ELABORADO POR ENFERMEROS Y EL NURSING ACTIVITIES SCORE

Ronaldo Rossi Ferreira[1]
Érica Batassini[2]
Franciele Soares Tomazi[3]
Mariur Gomes Beghetto[4]

**How to cite this article:** Ferreira RR, Batassini E, Tomazzi FS, Beghetto MG. Relationship between the work schedule prepared by nurses and the *Nursing Activities Score*. Rev baiana enferm. 2023;37:e51942.

Objective: to analyze the relationship between the patient/nursing professional distribution schedule empirically prepared by nurses, based exclusively on their experience, and the one recommended by the *Nursing Activities Score*. Method: a prospective cohort study conducted in July and August 2021 at two Intensive Care Units for adults. Characteristics of the patients, the *Nursing Activities Score*, the work schedule and the Nursing staff distribution were evaluated. Results: a total of 57 patients were monitored, generating a total of 400 observations, in a total of 60 research days. The mean *Nursing Activities Score* gradually increased during the first 10 hospitalization days. The daily staffing schedule made by nurses and the *Nursing Activities Score* did not show any correlation regarding the distribution of nurses (r=0.0785) or of nursing technicians (r=0.2526). Conclusion: there was no significant correlation between the distribution schedule of nurses and technicians and the *Nursing Activities Score*.

Descriptors: Workload. Personnel Downsizing. Nursing. Intensive Care Units. Critical Care.

*Objetivo: analisar a relação entre a escala de distribuição de pacientes/profissional de enfermagem elaborada empiricamente pelos enfermeiros, embasada exclusivamente na sua experiência, e a recomendada pelo Nursing Activities Score. Método: coorte prospectiva, conduzida em julho e agosto de 2021 em duas Unidades de Terapia Intensiva adulto. Foram avaliadas características dos pacientes, Nursing Activities Score, escala de trabalho e distribuição de pessoal da enfermagem. Resultados: foram acompanhados 57 pacientes, gerando um total de 400 observações, num total de 60 dias de pesquisa. A média do Nursing Activities Score aumentou gradualmente nos primeiros 10 dias de internação. A escala diária de pessoal feita pelos enfermeiros e o Nursing Activities Score não*

Corresponding author: Ronaldo Rossi Ferreira, ronaldorossiferreira@gmail.com

[1] Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil. https://orcid.org/0000-0003-1547-0112.
[2] Universidade Federal do Rio Grande do Sul, Hospital de Clínicas de Porto Alegre. Porto Alegre, RS, Brazil. https://orcid.org/0000-0001-7666-2076.
[3] Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil. https://orcid.org/0000-0002-8664-8988.
[4] Universidade Federal do Rio Grande do Sul, Hospital de Clínicas de Porto Alegre. Porto Alegre, RS, Brazil. https://orcid.org/0000-0002-9437-4999.

*apresentaram correlação nem quanto à distribuição de enfermeiros (r=0,0785), nem na distribuição de técnicos de enfermagem (r=0,2526). Conclusão: não houve correlação significativa entre a escala de distribuição de enfermeiros e técnicos e o Nursing Activities Score.*

*Descritores: Carga de Trabalho. Redução de Pessoal. Enfermagem. Unidades de Terapia Intensiva. Cuidados Críticos.*

*Objetivo: analizar la relación entre el plan de distribución de pacientes/profesionales de Enfermería elaborado empíricamente por los enfermeros basado exclusivamente en su experiencia y lo recomendado por el Nursing Activities Score. Método: estudio de cohorte prospectivo, realizado durante julio y agosto de 2021 en dos Unidades de Cuidados Intensivos para adultos. Se evaluaron características de los pacientes, el Nursing Activities Score, el plan de trabajo y la distribución del personal de Enfermería. Resultados: se realizó un seguimiento a 57 pacientes, generando un total de 400 observaciones, en un total de 60 días de investigación. El valor medio del Nursing Activities Score aumentó gradualmente durante los primeros 10 días de internación. El plan diario de personal elaborado por los enfermeros y el Nursing Activities Score no presentaron ninguna correlación con respecto a la distribución de enfermeros (r=0,0785) ni a la de técnicos de Enfermería (r=0,2526). Conclusión: no se registró ninguna correlación significativa entre el plan de distribución de enfermeros/técnicos y el Nursing Activities Score.*

*Descriptores: Carga de Trabajo. Reducción de Personal. Enfermería. Unidades de Cuidados Intensivos. Cuidados Críticos.*

## Introduction

Among other areas of society, the current scenario of increasingly rapid and constant technological advances influences health. In this context of countless technological devices, human resources are still the most important input to guarantee patient safety[1]. Competent, conscious and self-critical health professionals are increasingly necessary[2].

The effective distribution of Nursing human resources is discussed in several spheres. It is known that, with adequate team size and distribution allocations, it is possible to improve patient safety, to prevent possible complications associated with healthcare and to reduce costs[3]. It is also noted that work overload represents a challenge for the people management process in Nursing teams[4].

Through Resolution No. 543[5], the Federal Nursing Council (*Conselho Federal de Emfermagem*, COFEN) determined that health institutions should adopt validated instruments to establish the number of employees. Previously, the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária*, ANVISA) [6] had determined that Patient Classification Systems (PCSs) should be used in Intensive Care Units (ICUs). Such PCSs are configured as workload estimators and assist in the quantitative and qualitative assessment of Nursing human resources required for care, so as to obtain a balanced relationship between workload and available human capital, favoring quality and cost/effectiveness of the care provided. Knowing the patients' care needs also allows planning assistance, managing discharges, characterizing the patients' care profile and readjusting their allocation in units, as well as evaluating care quality and strengthening arguments in the negotiation process about additional needs in situations of undersized Nursing teams[7-8].

The *Nursing Activities Score* (NAS) is a PCS used in ICUs around the world[9] that proposes estimating the workload of Nursing professionals in ICUs and the time devoted by a given Nursing professional to a single patient. To this end, NAS evaluates seven major care categories: Basic activities, Ventilatory support, Cardiovascular support, Renal support, Neurological support, Metabolic support and Specific interventions[10].

The article that originated NAS[11] was published in 2003 after a multicenter study that included patients from 15 countries. It was later translated and validated for use in Brazil[8]. However, the scenario of Nursing professionals

in Brazil differs from the one described in the original article, where there is a greater proportion of nursing technicians than of nurses[12].

The final NAS score results from adding up the points of the 23 items that comprise it; it represents how much of a Nursing professional's time a given patient required in the last 24 hours. Each NAS point corresponds to 14.4 minutes and the maximum points possible to be reached is 176.8%. A score of 100% represents that the patient required 100% of a Nursing professional's time in their care in the last 24 hours. Scores greater than 100% represent how much extra time from another professional, in addition to 100% of one, had to be used in caring for the same patient[11].

An integrative literature review on the use of NAS examined 36 articles published from 2005 to 2014, showing that its use is widespread worldwide, especially in Europe. Furthermore, the review included 25 Brazilian studies, showing that the country contributes to research on the topic[9]. However, it is possible to observe that, in many studies, NAS is applied by researchers[13-16] but is not part of the management routines of health services. A possible limitation for the routine use of NAS is that, despite generating information to contribute to sizing Nursing staff, it has a retrospective nature. All data refer to the 24 hours that have already elapsed. Therefore, it does not guide nurses when they distribute patients/professionals, at the beginning of each work shift. In this sense, the current study aimed at analyzing the relationship between the patient/nursing professional distribution schedule prepared empirically by nurses, based exclusively on their experience, and the one recommended by NAS.

## Method

The current research derives from a matrix study, with different objectives. This is a cross-sectional study conducted between July 1st and August 30th, 2021, in two ICUs for adults of a Brazilian teaching hospital. Both ICUs are classified as type III and serve critically-ill adults from different clinical and surgical specialties (except trauma), including transplants, referred throughout the state. ICU 1 has 18 beds and ICU 2 has 10 beds. There are three isolation beds in ICU 1, whereas ICU 2 only has individual beds, two of which are fully isolated. The patients who had remained hospitalized in these units for at least 24 hours after the study was initiated were eligible. The sample was for convenience and, for operational reasons, the simultaneous monitoring of ten patients was limited. On the study start date, the first patients admitted were included consecutively, until ten patients were monitored. At each exit, the next patient admitted was eligible for inclusion.

Preparation of the NAS and the Nursing staff distribution schedules are components of the institutional policy of this service, prepared once a day and once a shift by clinical nurses. While NAS was recorded once a day, per patient, the patient/professional distribution schedules were performed three times a day, once each shift (morning, afternoon and night), and at the end of the shift. To prepare the schedule, the nurses considered diverse information about the patients, such as the number of patients hospitalized at the time, bed reservations, discharges, severity, technologies and therapies instituted and care demands, as well as the number of professionals present on that work day, according to the monthly schedule and its adjustments.

Data collection was carried out by a previously trained research team and included the NAS scale, distribution schedule of Nursing staff per shift, characteristics of the patients and performance of care and assistance routines, directly observed and reviewed by the care team records in the medical charts.

Although there is no standardized and validated classification to categorize the scores obtained in NAS, the following categories were defined, as used in a previous study[17]: NAS ≤50%, light workload; NAS between 50.1% and 99.9%, moderate/high; and NAS ≥100%, very high. Regarding the allocation of patients by the Nursing staff, the following recommendation was followed: NAS <50%, 1 professional for every 3

patients; from 51% to 75%, 1 professional for every 2 patients; from 76% to 100%, 1 professional per patient; and greater than 100%, 2 professionals per patient[18]. This classification was compared to the distribution of professionals determined by the shift schedule, empirically prepared by the nurses.

Each ICU has a number of professionals to serve its beds. The number of technicians and nurses varies depending on the work shifts and the ICU observed. The number of professionals allocated is higher in the day shift, as there are days off; in turn, due to the 12 x 72-hour regime, the night shift does not include days off. The afternoon shift in ICU 1 had the highest number of technicians, 23 (16%), whereas the night shifts in ICU 2 had the lowest number, 9 (6.2%) (Table 1).

**Table 1 –** Number of Nursing professionals available per work shift in the Intensive Care Units of the study. Porto Alegre, Rio Grande do Sul, Brazil – 2021 (N=183)

| Category/ Shift | Morning | Afternoon | Night 1 | Night 2 | Night 3 | Relief Staff/ Sixth Shift |
|---|---|---|---|---|---|---|
| | n(%) | n(%) | n(%) | n(%) | n(%) | n(%) |
| **Intensive Care Unit 1 (n=116; 63.38%)** | | | | | | |
| Nurses | 5(2.73) | 5(2.73) | 5(2.73) | 5(2.73) | 5(2.73) | 5(2.73) |
| Nursing technicians | 21(11.67) | 23(12.57) | 14(7.65) | 14(7.65) | 14(7.65) | - |
| **Intensive Care Unit 2 (n=67; 36.61%)** | | | | | | |
| Nurses | 2(1.09) | 2(1.09) | 2(1.09) | 2(1.09) | 2(1.09) | 2(1.09) |
| Nursing technicians | 14(7.65) | 14(7.65) | 9(4.91) | 9(4.91) | 9(4.91) | - |
| Total | 42(23.11) | 44(24.04) | 30(16.38) | 30(16.38) | 30(16.38) | 7(3.82) |

Source: The authors.
Note: Conventional sign used:
- Numerical data equal to zero not resulting from rounding.

The data were analyzed using the *Statistical Package for the Social Sciences* (SPSS), version 20.0. The characteristics of the participants (patients) were described respecting the features and distribution of the variables, as well as the assumptions of the statistical tests. The descriptive analysis of the continuous variables was preceded by the distribution assessment, using the Shapiro-Wilk test. The results were expressed as mean ± standard deviation, or as median (interquartile range), as indicated. The categorical data were expressed as absolute and relative frequencies.

The relationship between the empirical shift schedules (based on the nurses' experience) and NAS was evaluated using Pearson's correlation coefficient, adopting a 5% significance level. Bearing in mind that NAS is verified once a day and that the staff distribution schedules were prepared once per shift (three times a day), in order to establish the comparison in a single period, the mean value between the scale measurements and the value over 24 hours was considered.

The WinPEPI software was used to calculate the sample estimate, adopting the option of comparing means in non-inferiority studies. To identify a difference of on person between the patient/professional ratio empirically determined by the nurses and the one estimated by NAS, considering a 95% significance level, power of 0.8, a combined variance of 1 and that both schedules show a mean of 1.5 patients/ professional, a sample of 16 observations for each schedule was estimated.

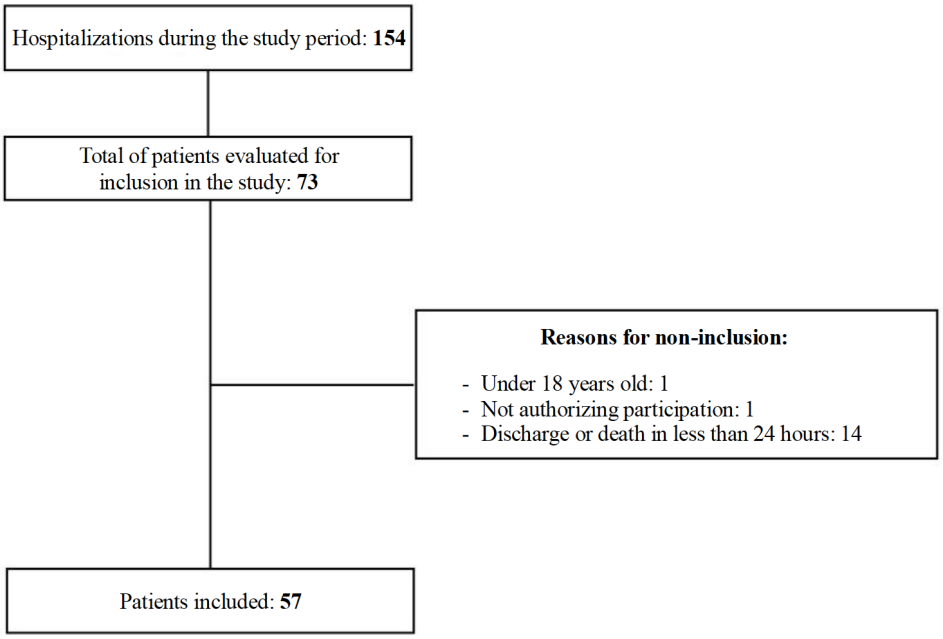
This research was approved regarding its methodological and ethical aspects by the Research Ethics Committee of the Porto Alegre Clinical Hospital Complex, under Opinion No. 4,325,599 and Certificate of Presentation for Ethical Appraisal (*Certificado de Apresentação de Apreciação Ética*, CAAE) 16288619.0.0000.5327,

approved on October 7th, 2020. The Free and Informed Consent Form (FICF) was signed by all participants or by their legal guardians.

## Results

During the collection period, 154 patients were admitted to both ICUs: 112 to ICU 1 and 42 to ICU 2. Of these, 73 were evaluated for inclusion in the study, of which 14 were hospitalized for less than 24 hours in the ICU, one of the patients was excluded for being under 18 years old and another patient for not consenting to participate. Thus, the sample included 57 patients (27 from ICU 1 and 30 from ICU 2) (Figure 1).

**Figure 1 –** Flowchart of the patients admitted to the Intensive Care Center during the study period, potentially eligible and included in the study. Porto Alegre, Rio Grande do Sul, Brazil – 2021




Source: The authors.

The patients' mean age was 52.4±17.1 years old, with a majority (52.6%) of women. The main reasons for ICU admission were respiratory causes (31%), surgical causes (22.4%) and Nephrology emergencies (10.3%). Regarding previous comorbidities, 41.4% had systemic arterial hypertension, 27.6% had diabetes *mellitus* and 20.7% had renal failure. Differences were observed in the profile of patients treated in ICUs 1 and 2. The concentration of female participants and hospitalization time was higher in ICU 2. While in ICU 1 there were more patients hospitalized for surgical causes, respiratory hospitalizations stood out in ICU 2. Furthermore, in ICU 2 there was higher frequency of need for mechanical restraints (Table 2)

**Table 2 –** Characteristics of the total number of patients in the sample at the time of admission to the Intensive Care Center and comparison between patients in Intensive Care Units 1 and 2. Porto Alegre, Rio Grande do Sul, Brazil – 2021 (N=57) (continued)

| Variables | All n=57 | Intensive Care Unit 1 n=27 | Intensive Care Unit 2 n=30 | p-value |
|---|---|---|---|---|
| **Age (Mean ± SD)** | 52.4 ± 17.1 | 55.3 ± 17.7 | 49.9 ± 16.3 | <0.001 |
| **Female Gender (Mean ± SD)** | 30 ± 52.6 | 10 ± 37 | 20 ± 66.6 | 0.99 |

**Table 2 –** Characteristics of the total number of patients in the sample at the time of admission to the Intensive Care Center and comparison between patients in Intensive Care Units 1 and 2. Porto Alegre, Rio Grande do Sul, Brazil – 2021 (N=57) (conclusion)

| Variables | All n=57 | Intensive Care Unit 1 n=27 | Intensive Care Unit 2 n=30 | p-value |
|---|---|---|---|---|
| **Hospitalization Days (Quartile)** | 10.5 (Q1:4 Q3:25) | 5 (Q1:4 Q3:11.5) | 20 (Q1:7 Q3:40) | <0.001 |
| **SAPS 3 (Quartile)** | 61 (Q1:51 13:76,5) | 61 (Q1:49.5 Q3:68.5) | 61 (Q1:55 Q3:77) | <0.001 |
| **Charlson (Quartile)** | 1.5 (Q1:0 Q3:3) | 2 (Q1:0 Q3:2.5) | 1 (Q1:0 Q3:4.5) | <0.001 |
| **Surgical Patient (n,%)** | 16 (28.1) | 9 (33.3) | 7 (23.3) | 0.94 |
| **Emergency Surgery (n,%)** | 13 (22.8) | 8 (29.6) | 5 (16.6) | <0.001 |
| **Classification of the hospitalization (n,%)** | | | | |
| Sepsis | 3 (5.2) | 1 (3.7) | 2 (6.6) | 0.55 |
| Neurological | 5 (8.6) | 3 (11.1) | 2 (6.6) | 0.63 |
| Respiratory | 18 (31.0) | 6 (22.2) | 12 (40.0) | 0.96 |
| Cardiology | 4 (6.9) | 3 (11.1) | 1 (3.3) | 0.59 |
| Gastroenterological | 4 (6.9) | 2 (7.4) | 2 (6.6) | 0.59 |
| Surgery | 13 (22.4) | 7 (25.9) | 6 (20.0) | 0.87 |
| Nephrology emergency | 6 (10.3) | 4 (14.8) | 2 (6.6) | 0.66 |
| Oncology emergency | 3 (5.2) | - | 3 (10.0) | 0.59 |
| Others | 1 (1.7) | 1 (3.7) | - | 0.47 |
| **Interventions (n,%)** | | | | |
| Mechanical Ventilation | 36 (62.1) | 17 (63.0) | 19 (63.3) | 0.99 |
| Mechanical Restraints | 34 (58.6) | 13 (48.1) | 21 (70.0) | 0.99 |
| Hemodialysis | 17 (29.3) | 8 (29.6) | 9 (30.0) | 0.94 |
| Vasoactive Drugs | 35 (60.3) | 17 (63.0) | 18 (60.0) | 0.99 |
| **Previous Diseases (n,%)** | | | | |
| Systemic Arterial Hypertension | 24 (41.4) | 14 (51.9) | 10 (33.3) | 0.99 |
| Diabetes *Mellitus* | 16 (27.6) | 8 (29.6) | 8 (26.6) | 0.93 |
| Cancer | 1 (1.7) | - | 1 (3.3) | 0.47 |
| COPD | 8 (13.8) | 4 (14.8) | 4 (13.3) | 0.73 |
| Kidney Failure | 12 (20.7) | 6 (22.2) | 6 (20.0) | 0.82 |
| Congestive Heart Failure | 2 (3.4) | - | 2 (6.6) | 0.51 |
| Stroke | 3 (5.2) | 1 (3.7) | 2 (6.6) | 0.55 |
| Others | 31 (53.4) | 15 (55.6) | 16 (53.3) | 0.99 |
| **Death** | 12 (20.7) | 4 (14.8) | 8 (26.6) | 0.85 |

Source: the authors.
Note: Conventional sign used:
- Numerical data equal to zero not resulting from rounding.
SAPS 3 Simplified Acute Physiology Score 3; CHARLSON Comorbidity Index; COPD Chronic Obstructive Pulmonary Disease.

In the 60-day period, there was a total of 400 observations during the research follow-up, and the patients were monitored for a mean of 17 days. Regarding NAS, on 334 (83.5%) of the observation days it was considered moderate/average (NAS between 50.1% and 99.9%), being similar in both ICUs. Only in ICU 2 was there a patients/day classification in the mild category (NAS <50%).

Considering both ICUs, nurses were responsible for five patients simultaneously on most observation days (78.2%). This was the predominant patient/nurse ratio both in ICU 1 (74.1%) and in ICU 2 (80.6%). Regarding the

distribution of patients by technicians, it was identified that, in most observations (62.8%), there was a ratio of 2 patients per technician. There was a difference in the frequency of this patient/nursing technician ratio between both ICUs, being more frequent in ICU 1 (71.4% vs 57,7%; p<0.001) (Table 3).

**Table 3 –** Patient/Professional ratio and *Nursing Activities Score*: Intensive Care Center, Intensive Care Units 1 and 2. Porto Alegre, Rio Grande do Sul, Brazil – 2021 (N=400)

| Variables | NAS n = 400 | ICU 1 n=147 | ICU 2 n=253 | p-value |
|---|---|---|---|---|
| **NAS (Mean ± SD)** | 85.34 ± 14.61 | 85.67 ± 13.11 | 85.15 ± 15.43 | <0.001 |
| Mild NAS | 3 (0.8) | 0 | 3 (1.2) | <0.001 |
| Moderate NAS | 334 (83.5) | 125 (85.0) | 209 (82.6) | <0.001 |
| High NAS | 63 (15.8) | 22 (15.0) | 41 (16.2) | <0.001 |
| **Nurses (Mean ± SD)** | 5.16 ± 0.78 | 5.20 ± 0.78 | 5.13 ± 0.79 | <0.001 |
| 3 patients | 21 (5.2) | 7 (4.8) | 14 (5.5) | <0.001 |
| 4 patients | 66 (16.5) | 31 (21.1) | 35 (13.8) | <0.001 |
| 5 patients | 313 (78.2) | 109 (74.1) | 204 (80.6) | <0.001 |
| **Technicians (Mean ± SD)** | 17.52 ± 5.41 | 16.81 ± 5.14 | 17.93 ± 5.53 | <0.001 |
| 1 patient | 149 (37.2) | 42 (28.6) | 107 (42.3) | <0.001 |
| 2 patients | 251 (62.8) | 105 (71.4) | 146 (57.7) | <0.001 |

Source: The authors.
NAS *Nursing Activities Score*; ICU Intensive Care Unit; SD Standard Deviation.

There was a weak correlation between the distribution of patients by Nursing professionals (sum of the number of nurses and nursing technicians) and both schedules (empirically developed by nurses and NAS) (r=0.2613). A similar correlation was identified in the distribution of patients by nursing technicians (r=0.2526). However, there was no correlation in the distribution of patients by nurses (r=0.0785) (Table 4).

**Table 4 –** Correlation between nurses, nursing technicians and the *Nursing Activities Score*. Porto Alegre, Rio Grande do Sul, Brazil – 2021

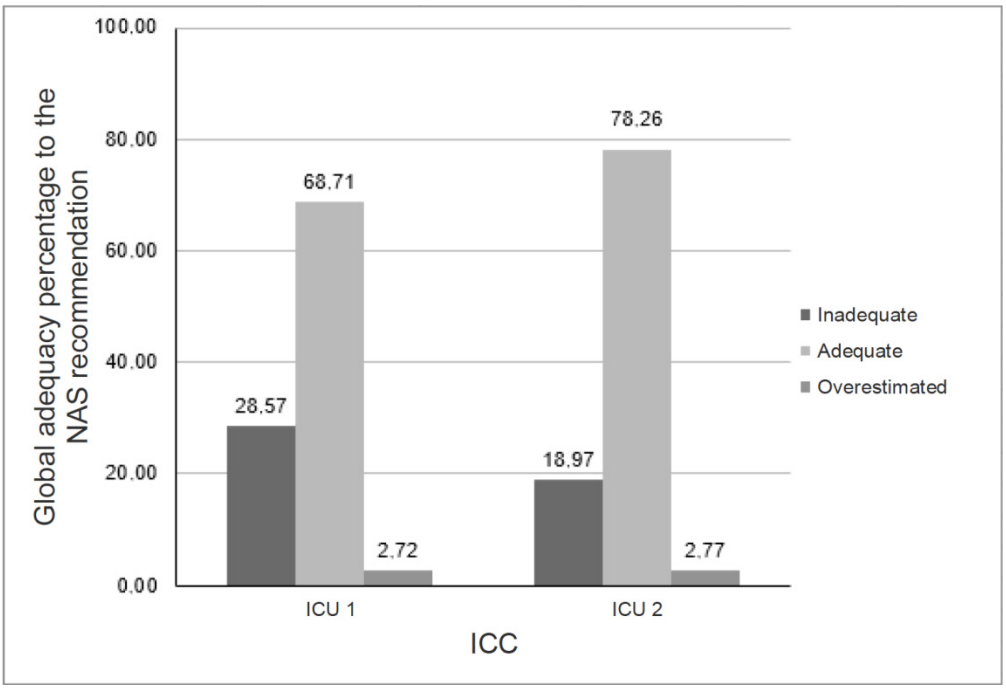
| Professionals | Pearson's Correlation | p-value | 95% Confidence Interval |
|---|---|---|---|
| Nurses | 0.078 | 0.12 | [-0.019; 0.175] |
| Technicians | 0.253 | <0.001 | [0.158; 0.342] |
| Total | 0.261 | <0.001 | [0.167; 0.350] |

Source: The authors.

When comparing the distribution data of each patient/day per Nursing professional on the schedule determined by the nurses for what was recommended for that patient that day, when applying NAS, a high proportion of days were observed in which there was agreement between both, in ICU 1 and ICU 2 (68.71% and 78.26%, respectively).

Furthermore, it was verified that the schedule made by the nurses, based on the staff available at the study *locus*, underestimated the Nursing staffing recommended by NAS in nearly one-quarter of the observations, when data from both ICUS were computed and aggregated, which was more frequent in ICU 1. Less frequently, the schedule performed overestimated the staffing recommended by NAS in 2.72% and 2.77% of the observations made in ICU 1 and ICU 2, respectively (Figure 2).

**Figure 2** –Adequacy percentage of the Intensive Care Units to the recommendation proposed by the *Nursing Activities Score*. Porto Alegre, Rio Grande do Sul, Brazil – 2021




Source: The authors.

## Discussion

Although the current study showed that there was no correlation between the distribution of the nursing staffing empirically prepared by nurses and the estimate proposed by NAS, it was found that there was correspondence between both schedules in nearly three-quarters of the observations in the distribution of patients by professionals.

Coincidence in the distribution of patients per professional between the empirical schedule and NAS was found in nearly 74% of the observations. This differs from what was detected in Brazilian studies, also carried out in public hospitals, such as the one conducted in a high-complexity general ICU for adults, evaluating 50 patients and applying NAS 50 times, in which the authors identified professional understaffing (technicians and nurses) in relation to NAS[19]. Another study, carried out in a teaching hospital, included 107 patients and showed that there was a 30% deficit in the number of Nursing workers in that service, generating work overload for the professionals[20].

In turn, a Norwegian study, which obtained a mean NAS of 96.24%, presented a higher number of nurses than recommended by NAS. The authors emphasize that, although there were more nurses working than suggested by NAS, the ICU under study had some particularities, such as lack of time restrictions for family visits, high frequency of in-hospital transfers and various administrative and managerial activities not accounted for by NAS[21].

This study obtained a high NAS mean value (85%), a result that is in line those found in a study carried out at a Brazilian public clinical reference hospital with 195 patients arranged in three general ICUs, obtaining a positive relationship between NAS and higher healthcare-associated infection rates. In this study, the authors found a NAS mean of 66.7% for those that did not contract any healthcare-associated infection during hospitalization and of 81.2% for those who had an infection[22]. This was also similar to the result obtained in a study carried out at a Brazilian ICU, but with only 10 beds and

a sample of 12 patients, which obtained a NAS mean of 76.8%[23].

On the other hand, the mean NAS found in this study is higher than those obtained in other studies carried out in other Brazilian public hospitals. The first, in a single general ICU, included 33 patients, with a NAS mean of 69.6%[24]. Another one, consisting of data from two general ICUs, included 45 patients and found a NAS mean of 67.3%[25]. In addition, in an integrative review summarizing the results of 20 academic productions that evaluated the NAS workload of several ICUs around the world, the mean NAS was found to be 62.6%[26]. This also surpassed the value found in a study that had data from 47 patients and found a NAS mean of 57.5%. However, in the latter, the ICU was characterized as a reference for trauma[27].

NAS refers to the 24 hours prior to its recording; therefore, it has a retrospective nature. Consequently, using NAS, it is not possible to reliably estimate the need for personnel for the subsequent hours, as the score obtained refers, in the practice, to the hours required for the assistance provided, not to the hours required in view of the fluctuation of the critically-ill patients' health status[20]. Also in this context, the literature reinforces the importance of having an adequate nurse/patient ratio and the relationship between this adequate proportion and lower rates of patient mortality, readmissions and hospitalization times[28]. In the Brazilian reality, it is therefore necessary to consider the existence of two professional categories that occupy the same corresponding workload distribution evaluated by NAS.

In addition to the aforementioned, the results obtained in the current study may not infer the reality of the service, as data collection took place during an atypical period experienced by the hospital, which played an important role in combating the COVID-19 pandemic at high regional and national levels. To enable this assistance, professionals from various areas, including Nursing, were hired on an emergency basis. Although the study ICU did not treat patients suffering from COVID-19, at the time of data collection there was already a reduction in admissions to the COVID-19 ICU and an increase in the number of non-COVID-19 patients[29]. The COVID-19 ICU staff, hired on an emergency and temporary basis, was gradually reassigned to care tasks in the study ICUs. Therefore, the Nursing staffing during data collection was *artificially* increased by the reinforcement of the temporary staff. It is also important to highlight that, in cases where an underestimated number of professionals was observed when compared to NAS, it was not possible to infer that the nurses distributed the team inappropriately, but this was probably mainly a product of the local working conditions.

Furthermore, if the distribution of Nursing professionals through the empirical schedule presents a high subjectivity degree, this is also true in NAS, as it can be affected by measurement bias, depending on the evaluator. In the current study, NAS was not carried out by the researchers, but by clinical nurses on a daily basis. As seen in studies that set out to evaluate interobserver agreement, there is difficulty in agreement between evaluators, especially in the multiple-choice items (monitoring, administrative tasks, hygiene, mobilization and family care) of the NAS Scale[30-31].

As a study limitation, the records in handwritten physical charts stand out, which, due to variations in handwriting and the individualized recording method, meant that some data were not identified by the research team, which might compromise generalization of the study results. Another possible limitation refers to the fact that no researcher is present 24 hours a day in the ICUs. Therefore, the data collected are the result of a point estimate and may be inaccurate regarding the dynamics corresponding to movement of patients and professionals throughout the day. On the other hand, even though NAS is related to the previous 24 hours, it is completed at a single moment of the day and can be affected in the same way.

As a contribution, the current study proposed offering a critical reflection on the components that determine the Nursing workload in the

current scenario of different care units for critically-ill patients, although without exhausting the subject matter.

## Conclusion

This study analyzed the relationship between the patient/nursing professional distribution schedule empirically prepared by nurses, based exclusively on their experience, and the one recommended by the *Nursing Activities Score*.

The empirical staff distribution schedule prepared by nurses shows correspondence to the estimated Nursing staff needs when applying NAS in nearly three-quarters of the observations. However, it cannot be stated that there is a correlation between these two ways of estimating the distribution of patients per professional.

Finally, there is a need for other studies in the national and international literature that relate the use of Nursing Professional Distribution scales to PCSs.

## Collaborations:

1 – Conception and planning of the project: Ronaldo Rossi Ferreira, Érica Batassini, Franciele Tomazzi e Mariur Gomes Beghetto;

2 – Data analysis and interpretation: Ronaldo Rossi Ferreira, Érica Batassini, Franciele Tomazzi and Mariur Gomes Beghetto;

3 – Writing and/or critical review: Ronaldo Rossi Ferreira, Érica Batassini, Franciele Tomazzi and Mariur Gomes Beghetto;

4 – Approval of the final version: Ronaldo Rossi Ferreira, Érica Batassini, Franciele Tomazzi and Mariur Gomes Beghetto.

## Conflicts of interests

There are no conflicts of interest.

## Acknowledgments

To the Research Incentive Fund (, FIPE) of the Porto Alegre Clinical Hospital Complex and to the National Council for Scientific and Technological Development (CNPq) for the scientific initiation scholarship awarded to Franciele Tomazzi.

## References

1. Costa EAM, Lobão WM, Ribas CLM, Passos NM. Segurança do paciente em serviços de saúde: uma análise na cidade de Salvador, Bahia. Rev SOBECC. 2020;25(1):17-24. DOI: https://doi.org/10.5327/Z1414-4425202000010004

2. Ouchi JD, Lupo APR, Alves BO, Andrade RV, Fogaça MB. O papel do enfermeiro na unidade de terapia intensiva diante de novas tecnologias em saúde. Rev Saúde Foco [Internet]. 2018 [cited 2021 Apr 18];10:412-28. Available from: https://portal.unisepe.com.br/unifia/wp-content/uploads/sites/10001/2018/07/054_O_PAPEL_DO_ENFERMEIRO_NA_UNIDADE_DE_TERAPIA_INTENSIVA.pdf

3. Oliveira EM, Secco LMD, Figueiredo WB, Padilha KG, Secoli SR. Nursing Activities Score and the cost of nursing care required and available. Rev Bras Enferm. 2019;72(Suppl 1):137-42. DOI: https://doi.org/10.1590/0034-7167-2017-0655

4. Cabral JVB, Silveira MMBM, Silva ANA, Xavier AT. Nursing Activities Score como ferramenta para avaliar a carga do trabalho de enfermagem. REAS. 2021;13(2):e5894. DOI: https://doi.org/10.25248/reas.e5894.2021

5. Conselho Federal de Enfermagem. Resolução COFEN 543/2017. Atualiza e estabelece parâmetros para o Dimensionamento do Quadro de Profissionais de Enfermagem nos serviços/locais em que são realizadas atividades de enfermagem [Internet]. Brasília (DF); 2019 [cited 2021 Apr 21]. Available from: http://www.cofen.gov.br/resolucao-cofen-5432017_51440.html

6. Brazil. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução-RDC Nº 7, de 24 de fevereiro de 2010. Dispõe sobre os requisitos mínimos para funcionamento de Unidades de Terapia Intensiva e dá outras providências [Internet]. Brasília (DF); 2010 [cited 2021 May 02]. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2010/res0007_24_02_2010.html

7. Perroca MG. Development and content validity of the new version of a patient classification instrument. Rev Latino-Am Enfermagem. 2011;19(1):58-66. DOI: https://doi.org/10.1590/S0104-11692011000100009

8. Abreu SP, Pompeo DA, Perroca MG. Utilização de instrumentos de classificação de pacientes: análise da produção do conhecimento brasileira. Rev esc enferm USP [Internet]. 2014 [cited 2023 Oct 30];48(6):1111-18. Available from: https://www.redalyc.org/articulo.oa?id=361060159021

9. Lachance J, Douville F, Dallaire C, Padilha KG, Gallani MC. The use of the Nursing Activities Score in clinical settings: An integrative review. Rev esc enferm USP. 2015;49(spe):147-56. DOI: http://doi.org/10.1590/S0080-623420150000700021

10. Queijo AF, Padilha KG. Nursing Activities Score (NAS): adaptação transcultural e validação para a língua portuguesa. Rev esc enferm USP. 2009;43(spe):1018-25. DOI: https://doi.org/10.1590/S0080-62342009000500004

11. Miranda DR, Nap R, De Rijk A, Schaufeli W, Iapichino G, Abizanda R, et al. Nursing activities score. Crit Care Med. 2003;31(2):374-82. DOI: https://doi.org/10.1097/01.CCM.0000045567.78801.CC

12. Silva MCN, Machado MH. Sistema de Saúde e Trabalho: desafios para a Enfermagem no Brasil. Ciênc saúde coletiva. 2021;25(1):7-13. DOI: https://doi.org/10.1590/1413-81232020251.27572019

13. Camuci MB, Martins JT, Cardeli AAM, Robazzi MLCC. Nursing Activities Score: carga de trabalho de enfermagem em Unidade de Terapia Intensiva de queimados. Rev Latino-Am Enfermagem. 2014;22(2):325-31. DOI: https://doi.org/10.1590/0104-1169.3193.2419

14. Padilha KG, Sousa RMC, Garcia PC, Bento S, Finardi EM, Hatarashi RHK. Nursing workload and staff allocation in an intensive care unit : A pilot study according to Nursing Activities Score (NAS). Intensive Crit Care Nurs. 2010;26:108-13. DOI: https://doi.org/10.1016/j.iccn.2009.12.002

15. Conishi RMY, Gaidzinski RR. Nursing Activities Score (NAS) como instrumento para medir carga de trabalho de enfermagem em UTI adulto. Rev esc enferm USP. 2007;41(3):346-54. DOI: https://doi.org/10.1590/S0080-62342007000300002

16. Altafin JAM, Grion CMC, Tanita MT, Festti J, Cardoso LTQ, Veiga CFF, et al. Nursing Activities Score e carga de trabalho em unidade de terapia intensiva de hospital universitário. Rev Bras Ter Intensiva. 2014;26(3):292-8. DOI: https://doi.org/10.5935/0103-507X.20140041

17. Batassini É, Silveira JT, Cardoso PC, Castro DE, Hochegger T, Vieira DFVB, et al. *Nursing Activities Score*: qual periodicidade ideal para avaliação da carga de trabalho? Acta Paul Enferm. 2019;32(2):162-8. DOI: https://doi.org/10.1590/1982-0194201900023

18. Vieira DFVB, Morsch CMF. Nursing Activities Score (NAS): carga de trabalho e enfermagem. In: Viana RAPP, Torre M, editores. Enfermagem em Terapia Intensiva Práticas Integrativas. Barueri (SP): Manole; 2017. p. 161-83.

19. Marques RS, Zeitoun SS, Lara MR, Fernandes MS. Dimensionamento de pessoal relacionado à assistência ao paciente crítico com o uso do *Nursing Activities Score* nas formas prospectiva e retrospectiva. J Health Sci Inst [Internet]. 2013 [cited 2021 Nov 04];31(2):149-54. Available from: https://repositorio.unip.br/wp-content/uploads/2020/12/V31_n2_2013_p149a154.pdf

20. Inoue KC, Matsuda LM. Dimensionamento de pessoal de enfermagem em Unidade de Terapia Intensiva para adultos. Acta paul enferm. 2010;23(3):379-84. DOI: https://doi.org/10.1590/S0103-21002010000300011

21. Stafseth SK, Solms D, Bredal IS. The characterisation of workloads and nursing staff allocation in intensive care units: A descriptive study using the Nursing Activities Score for the first time in Norway. Intensive Crit Care Nurs. 2011;27(5):290-4. DOI: https://doi.org/10.1016/j.iccn.2011.07.003

22. Daud-Gallotti RM, Costa SF, Guimarães T, Padilha KG, Inoue EN, Vasconcelos TN, et al. Nursing Workload as a Risk Factor for Healthcare Associated Infections in ICU: A Prospective Study. PLoS One. 2012;7(12):e52342. DOI: https://doi.org/10.1371/journal.pone.0052342

23. Pereira BSL, Pereira SRM, Mesquita AMF, Bridi AC, Paula VG, Souza KA. Application of the Nursing Activities Score (NAS) in an Intensive Care Unit (ICU). Rev Fun Care Online. 2020;12:79-87. DOI: http://dx.doi.org/10.9789/2175-5361.rpcfo.v12.7052

24. Conishi RMY, Gaidzinski RR. Nursing Activities Score (NAS) como instrumento para medir carga de trabalho de enfermagem em UTI adulto. Rev esc enferm. 2007;41(3):346-54. DOI: https://doi.org/10.1590/S0080-62342007000300002

25. Feitosa MC, Leite IRL, Silva GRF. Demanda de intervenções de enfermagem a pacientes sob cuidados intensivos: nas - nursing activities score. Esc Anna Nery. 2012;16(4):682-8. DOI: https://doi.org/10.1590/S1414-81452012000400006

26. Nobre RAS, Rocha HMN, Santos FJ, Santos AD, Mendonça FG, Menezes AF. Aplicação do Nursing Activities Score (NAS) em diferentes tipos de UTI □s: uma revisão integrativa. Enfermería Global. DOI: http://dx.doi.org/10.6018/eglobal.18.4.362201

27. Menezes MO, Souza CS, Barreto SMSS, Alves KA, Nunes MS, Vaez AC. Determinantes da Carga de Trabalho em Unidade de Terapia Intensiva de um Hospital Público. CGCBS [Internet]. 2013 [cited 2021 Oct 18];1(3):103-12. Available from: https://periodicos.set.edu.br/cadernobiologicas/article/view/972

28. McHugh MD, Aiken LH, Sloane DM, Windsor C, Douglas C, Yates P. Effects of nurse-to-patient ratio legislation on nurse staffing and patient mortality, readmissions, and length of stay: a prospective study in a panel of hospitals. Lancet. 2021;397(10288):1905-13. DOI: https://doi.org/10.1016/S0140-6736(21)00768-6

29. Rio Grande do Sul. Secretaria da Saúde. Painel Coronavírus RS [Internet]. Porto Alegre; 2021 [cited 2021 Sep 20]. Available from: https://ti.saude.rs.gov.br/covid19/

30. Matarin JV, Salamero-Amorós M, Roldán-Gil C, Quintana-Riera S. Grado de concordancia interevaluador de la escala "Nursing Activities Score" en cuidados intensivos. Enferm Clin. 2015;25(4):204-8. DOI: https://doi.org/10.1016/j.enfcli.2015.05.003

31. Lachance J, Douville F, Oliveira EM, Dallaire C, Houle J, Gallani MC. Validation of the French-Canadian version of the Nursing Activities Score. The Free Library. 2020 [cited 2021 Dec 10];31(3):12-22. Available from: https://www.thefreelibrary.com/Validation of the French-Canadian version of the Nursing Activities...-a0661722622

Received: November 24, 2022

Approved: November 09, 2023

Published: November 30, 2023