Nursing Activities Score: what is the ideal periodicity for assessing workload?

Nursing Activities Score: qual periodicidade ideal para avaliação da carga de trabalho?

Nursing Activities Score: ¿cuál es la periodicidad ideal para analizar la carga de trabajo?

Érica Batassini [1]
Juliana Teixeira da Silveira[1]
Patrícia Cristina Cardoso[1]
Denise Espíndola Castro[1]
Tais Hochegger[1]
Débora Feijó Villas Boas Vieira[2]
Karina de Oliveira Azzolin[1,2]

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Abstract
Objective: To compare the workload obtained from the Nursing Activities Score (NAS), rated three times a day, at the end of each work shift, and scored once per day for a 24-hour period.
Methods: A prospective longitudinal study with adults hospitalized at an intensive care center, from a highly complex public hospital in southern Brazil. The data collection was conducted using the Epimed Monitor®. In the first period of the study (Period 1), the mean NAS score was obtained using three daily evaluations, and in the second period (Period 2) the NAS was scored once per day. The comparison of the variables was verified using the Mann Whitney and student t-test. The study was approved by the Research Ethics Committee of the institution.
Results: During the study, 1738 NAS evaluations were performed on 338 patients. The mean NAS score was 74±20.9% for the total number of patients. There was no difference between the mean of Period 1 (74.1±20.8%) and the mean of Period 2 (73.9 ± 21%) (p=0.806). Period 2 had more evaluations in the NAS category ≤50% and fewer evaluations in the NAS category 50.1-100%, as compared to Period 1 (p<0.001 and p=0.029, respectively).
Conclusion: The mean NAS score was similar when comparing assessments conducted three-times-per-day with the one performed once a day, assessing the nursing workload based on the previous 24 hours.

Resumo
Objetivo: Comparar a carga de trabalho obtida a partir do *Nursing Activities Score* (NAS) pontuado três vezes ao dia, no final de cada turno de trabalho, e pontuado uma vez ao dia considerando as 24 horas.
Métodos: Estudo longitudinal prospectivo, realizado com adultos internados em um Centro de Terapia Intensiva de um hospital público de alta complexidade do sul do Brasil. A coleta de dados foi realizada através do sistema Epimed Monitor®. No primeiro período do estudo (Período 1) a pontuação média do NAS foi obtida a partir de três avaliações diárias e no segundo período (Período 2) o NAS foi pontuado uma vez ao dia. A comparação das variáveis foi verificada por meio dos testes *t-Student* e *Mann Whitney U*. O estudo foi aprovado pelo Comitê de Ética em Pesquisa da instituição de origem.
Resultados: Durante o estudo foram realizadas 1738 avaliações de NAS em 338 pacientes. A média de pontuação do NAS foi de 74±20,9% para o total de pacientes. Não houve diferença entre a média do Período 1 (74,1±20,8%) e a média do Período 2 (73,9±21%) (p= 0,806). O Período 2 teve mais avaliações na categoria de NAS ≤50% e menos avaliações na categoria de NAS 50,1-100% em relação ao Período 1 (p<0,001 e p= 0,029, respectivamente).
Conclusão: A pontuação média do NAS é semelhante quando comparada a aferição realizada três vezes ao dia com a realizada uma vez ao dia considerando as 24 horas anteriores para avaliação de carga de trabalho de enfermagem

Resumen
Objetivo: Comparar la carga de trabajo obtenida a partir del *Nursing Activities Score* (NAS) con valoración tres veces por día, al final de cada turno de trabajo, y con valoración una vez por día considerando las 24 horas.
Métodos: Estudio longitudinal prospectivo, realizado con adultos internados en un Centro de Terapia Intensiva de un hospital público de alta complejidad en el sur de Brasil. La recolección de datos fue realizada a través del sistema Epimed Monitor®. En el primer período del estudio (Período 1), la valoración promedio del NAS fue obtenida a partir de tres evaluaciones diarias y en el segundo período (Período 2), el NAS fue valorado una vez por día. La comparación de las variables fue verificada a través de las pruebas *t-Student* y *Mann Whitney U*. El estudio fue aprobado por el Comité de Ética de Investigación de la institución de origen.
Resultados: Durante el estudio se realizaron 1738 evaluaciones de NAS en 338 pacientes. El promedio de valoración del NAS fue 74±20,9% para el total de pacientes. No hubo diferencia entre el promedio del Período 1 (74,1±20,8%) y el promedio del Período 2 (73,9±21%) (p= 0,806). El Período 2 tuvo más evaluaciones en la categoría de NAS ≤50% y menos en la categoría de NAS 50,1-100% con relación al Período 1 (p<0,001 y p= 0,029, respectivamente).
Conclusión: La valoración promedio del NAS es semejante cuando se compara la evaluación realizada tres veces por día con la realizada una vez al día considerando las 24 horas anteriores para analizar la carga de trabajo de enfermería.

Corresponding author
Érica Batassini
https://orcid.org/0000-0001-7666-2076
E-mail: ebatassini@hcpa.edu.br

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[1]Hospital de Clínicas de Porto Alegre, Porto Alegre, RS, Brazil.
[2]Escola de Enfermagem, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.
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Introduction

Intensive Care Units (ICUs) are environments for providing care to seriously ill and recovering patients, where the focus of care provided includes the complexity of the patient's illness, the severity of organ dysfunction, and the risk of imminent death.[1] The nursing staff requires, in addition to specific technical, technological and caring knowledge, skills such as decision-making, humanization, emotional balance, organization, planning and teamwork, aimed at quality of care and safety for the patient.[2] The working conditions, among these the allocation of human resources, are related to the quality of care and to the occurrence of adverse events in the intensive care settings.[3,4]

The nursing staff requirement has been widely discussed in several levels of care and services. An adequate allocation and composition of staff can improve patient safety and reduce possible complications associated with health care, and rationalize costs. The Resolution 543 of 2017 of the Federal Nursing Council establishes that the minimum requirements for nursing professionals must be based on characteristics related to the health service, the nursing service, and the patient. Regarding the patient, the resolution establishes that the degree of dependence in relation to the nursing team should be measured, by means of a system of patient classification which addresses the socio-cultural reality.[5]

For the specific population of patients hospitalized in ICUs, the Collegial Board Resolution No. 7 of the National Health Surveillance Agency - Agência Nacional de Vigilância Sanitária (ANVISA), of February 24, 2010, recommends that these patients should be evaluated by means of a nursing care needs classification system, recommended by specialized scientific literature.[6] Among the available instruments to evaluate the workload of the nursing team in the ICU is the Nursing Activities Score (NAS).[7]

The NAS was developed from the Therapeutic Intervention Scoring System (TISS-28), which comprised only 43.3% of the activities undertaken by the nursing team.[8] In order to ensure that nursing activities that are related to patient care would be more accurately represented, the NAS presents a restructuring of the TISS-28 variables, which includes 80.8% of the nursing activities performed for the critical patient, allowing a more reliable assessment of the workload in the ICU.[7]

The NAS was translated into Portuguese, and validated for Brazilian Portuguese in 2009.[9] The instrument is divided into seven major categories: basic activities, ventilatory, cardiovascular, renal, neurological, and metabolic support, and, specific interventions. The score attributed to a patient results from the sum of the scores of the items that correspond to the patient's direct and indirect care needs; which range from a minimum of 1.2 to a maximum of 32.0. This score represents how much time a nursing professional has been required by the patient in the past 24 hours. Thus, if the NAS score is 100, it is interpreted that the patient required 100% of a nursing professional's time for their care within the last 24 hours. The total score obtained can reach a maximum of 176.8%.[7]

Although it is the most widely used instrument in the ICUs, and it is quite comprehensive, as it also includes administrative and management activities, time spent on care of the family, and interventions outside the ICU, the NAS has some limitations that deserve to be discussed. One of these is the use of retrospective data, which may not reliably reflect the patient's care and demands in subsequent hours, limiting its use in the construction of work shift scales and staffing requirements.[10]

One of the validation steps of the original NAS study was the recording of nursing activities for patient care, which was performed every day at the same time by the same evaluator or team of evaluators, considering the previous 24 hours.[7] However, there are studies that administer the NAS with different periodicities: once daily,[11,12] three times a day,[13,14] and still others that administer it only at specific moments, such as admission or discharge from the ICU;[15,16] thus the observation is that there is no consensus on the appropriate periodicity for the administration of the instrument. Thus, the objective of this study was to compare the workload obtained from the NAS, scored three times a day

at the end of each work shift, with the workload obtained from the NAS administered once daily, considering the past 24 hours.

Methods

This was a prospective longitudinal study with adult patients hospitalized at an intensive care unit (ICU) of a highly complex public university hospital in southern Brazil. The ICUs of this institution have a 39-bed capacity, which are located in different physical areas: ICU 1, 20 beds for clinical and surgical patients; ICU 2, 13 beds designated for patients in isolation for multiresistant germs, and the postoperative cardiac surgery ICU, with six beds. In these units, completion of the NAS has occurred each work shift, three times a day, since 2011, and the nurse completes it according to the demands of his shift.

The study population consisted of patients admitted to the ICU. The inclusion criteria for the sample were: patients of both sexes, hospitalized in ICUs 1 and 2. No exclusion criteria were identified.

The data collection was performed through the period from November to December of 2017, using the Epimed Monitor® system. The study was divided into two periods: the first, named Period 1, considered data from 10/22/2017 to 11/22/2017, and the second, Period 2, considered the period from 11/23/2017 to 12/23/2017. In Period 1, the mean NAS score was obtained from three daily evaluations, performed at the end of each shift: morning, afternoon, and night.

To calculate the daily NAS value, the Epimed Monitor® system considers the highest score in each sub-item. The selection of the worst value by the program does not necessarily determine a 24 hour assessment; for example, in the item "Mobilization and positioning", it is possible that the patient was mobilized by a professional, twice in that shift, therefore the nurse will choose sub-item 6a. In the next shifts, if the same number of mobilizations are performed, the nurse will again choose sub-item 6a, and this will be the worst value chosen by the system to compute the 24-hour NAS value. However, when summing the mobilizations of each shift, if the patient was mobilized by a professional more than three times in the 24 hours, then the right selection would be sub-item 6b.

In Period 2, the NAS was scored once a day, according to the schedule programed when the nursing process is planned, considering the previous 24 hours. Bedside nurses, previously qualified regarding the use of the instrument, performed the NAS scoring. The workload was classified according to an adaptation of the workload categories defined by the Epimed Monitor® system: NAS≤50%: light; NAS 50.1-100%: moderate/high; and NAS ≥100%: very high.

The variables of the study represent the sociodemographic and clinical characteristics of the sample: sex, age, previous location, cause of hospitalization, severity scores, invasive medications and devices used, length of hospital stay, and daily NAS score. The data collection was performed directly into the Epimed Monitor® system, transferred to an Excel for Windows® spreadsheet, and were then exported, processed, and analyzed using the Statistical Package for Social Science® (SPSS), version 23.0.

In the statistical analysis, descriptive and analytical statistical techniques were used. Continuous variables were expressed as mean and standard deviation, or median and percentiles (25-75), and categorical variables, with absolute (n) and relative (%) frequencies. The normality of the data was tested using the Kolmogorov Smirnov test.

The comparison of the study variables was verified using Student's t-tests and Mann Whitney U for independent samples according to their distribution. To evaluate the association of sociodemographic and clinical variables, the Chi-Square test was used. The results were considered statistically significant if $p < 0.05$, with a 95% confidence interval.

The study was approved by the Research Ethics Committee of the Hospital de Clínicas of Porto Alegre, under opinion 2,157,007/2017. The study respected research recommendations involving human beings, according to Resolution 466/2012.[17]

Results

During the study period, 338 patients were hospitalized in the ICUs, distributed equally in Periods 1 and 2. The patients in the two periods were similar for sex, age, and severity according to the Simplified Acute Physiology Score 3 (SAPS 3), organic dysfunction according to the Sequential Organ Failure Assessment (SOFA), previous location reason for ICU stay, use of mechanical ventilation and vasoactive medication, length of ICU stay, and mortality. The use of hemodialysis was more frequent in patients in Period 1, as shown in table 1.

Table 1. Patients hospitalized in the ICU according to demographic characteristics, severity scores, origin, reason and time of hospitalization, use of therapies and mortality

Variables	Total (n= 338)	Period 1 NAS 3x day (n=169)	Period 2 NAS 1x day (n= 169)	p-value
Male sex	179 (53)	90(53.3)	89(52.7)	0.913
Age (years)	56.8±18.1	55.3±17.9	58.3±18.2	0.127
SAPS 3	58±15.1	57.8±15.7	58.1±15.3	0.842
SOFA	5 (3 – 8)	5 (2.25 – 9)	5(3 – 8)	0.899
Previous location*				0.666
Ward	119(35.8)	60(35.9)	59(35.8)	
Emergency	101(29.8)	51(29.9)	50(29.7)	
Surgical unit	48(14.5)	21(12.6)	27(16.4)	
Other hospital	47(14.2)	28(16.8)	19(11.5)	
Other ICU	13(3.9)	6(3.6)	7(4.2)	
Hemodynamics	6(1.8)	2(1.2)	4(2.4)	
Cause of ICU hospitalization*				0.636
Infection/sepsis	94(27.8)	50(29.6)	44(26)	
Respiratory	59(17.5)	26(15.4)	33(19.5)	
Neurologic	48(14.2)	26(15.4)	22(13)	
Cardiologic	43(12.7)	23(13.6)	20(11.8)	
Post-operative	30(8.9)	12(7.1)	18(10.7)	
Renal	12(3.6)	8(4.7)	4(2.4)	
Transplant	8(2.4)	5(3)	3(1.8)	
Onco-Hematology	5(1.5)	3(1.8)	2(1.2)	
Endovascular	5(1.5)	1(0.6)	4(2.4)	
Other	30(8.9)	14(8.3)	16(9.5)	
Mechanical ventilation	198(59.3)	94(56)	104(62.7)	0.213
Hemodialysis*	60(18)	39(23.2)	21(12.7)	0.012
Vasoactive medication use	130(38.9)	62(36.9)	68(41)	0.447
Length of ICU stay (days)	5(2 – 9)	5(2 – 10)	4(2 – 9)	0.617
Death*	76(22.8)	39(23.2)	37(23.2)	0.84

SAPS 3 - *Simplified Acute Physiology Score 3*; SOFA - *Sepsis-related Organ Failure Assessment;* ICU – Intensive Care Unit; Comparison of groups using Student's t-tests or Mann Whitney U for continuous variables, and Chi-Square for categorical variables; * n = 334

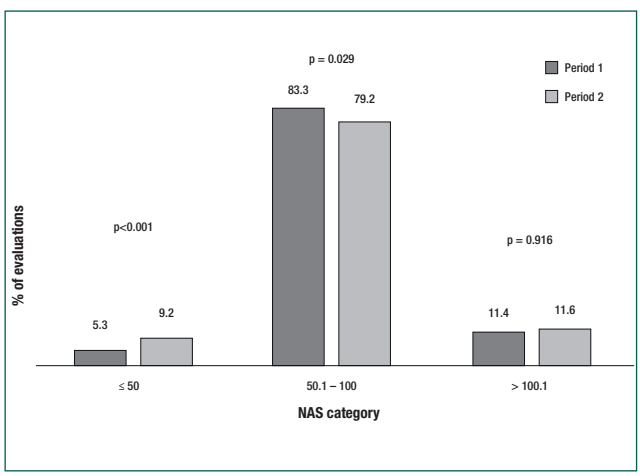
The mean NAS score was 74±20.9% for the total number of patients. There was no difference between Period 1 (74.1±20.8%) and Period 2 (73.9±21%) (p=0.806) (Table 2). The mean number of hours of care required by the patients was 17.8±5 for the total number of patients, similar to that found in Periods 1 and 2 (17.8±5 and 17.7±5, respectively, p=0.806).

Table 2. NAS score, hours of care and number of evaluations in Periods 1 and 2

Variables	Total (n= 338)	Period 1 NAS 3x day (n=169)	Period 2 NAS 1x day (n= 169)	p-value
NAS	74±20.9	74.1±20.8	73.9±21	0.806
Hours of care	17.8± 5	17.8± 5	17.7± 5	0.806
Evaluations*	1738	988	750	

NAS - Nursing Activities Score; * In Period 1, only the final computation of the day was used and not the three evaluations performed; Comparison of the groups performed using Student's t-tests

Figure 1 shows the NAS classification in three categories regarding the workload, and it is possible to perceive that the majority of patients presented NAS between 50.1 and 100% in both periods. When comparing the two periods, Period 2 showed more evaluations in the NAS category ≤50, and fewer evaluations in the NAS category 50.1-100 in relation to Period 1 (p<0.001 and p=0.029, respectively). In the NAS category ≥100, the two periods presented similar evaluations.



NAS - Nursing Activities Score; Comparison of groups performed using Chi-Square tests

Figure 1. NAS classification by categories and percentage for patients in Periods 1 and 2

Discussion

This study showed that no difference was found in the mean NAS score measured three times a

day by the nurse at each work shift, and once daily, considering the previous 24 hours for evaluation of the nursing workload in the ICU. An integrative review of the literature, which included 36 articles, aimed to analyze how the studies have addressed the results obtained with the NAS, most of them (n=25) defined once a day evaluation as a strategy for implementation of the instrument.[18]

Diverging from the aforementioned review, some studies used the NAS rating with different periodicities: twice a day,[19] three times a day,[13,14] or only at admission and/or discharge from the ICU,[15,16] as already cited. Therefore, there is a lack of consensus among the studies regarding the ideal periodicity for NAS evaluation, and it is necessary to analyze them in different intensive care settings.

In our service, the NAS is already the instrument adopted to evaluate nursing workload, in accordance with the current resolutions, however, in the work shifts with greater care demands, the administration of NAS can be difficult, because the nurse prioritizes activities of bedside care for the patient, which may lead to underestimated scores precisely at times of greater workload, although this hypothesis was not investigated in the present study. Also, nurses' adherence to the NAS punctuation routine can be facilitated when the periodicity is lower, as the application of the instrument itself is an activity that demands time and increases the nurse's workload. In the present study, the mean NAS score was similar in the two manners of evaluation, demonstrating that the once-a-day analysis can be accurate and considered as a form of standardization, which would also facilitate the comparison between the studies performed in different centers.

In Period 1, considering the same number of patients, there were more NAS punctuations compared to Period 2 (988 and 750, respectively). Difference in the first two categories of the NAS score was identified, considering both periods of the study. These differences can be explained by the fact that completing the NAS three times a day was already a routine established in daily practice in the ICU under study, while once-a-day completion was a change in the routine.

The study sample consisted predominantly of young male patients, with increased SAPS 3, mostly from the ward and emergency due to sepsis, and these data are similar to other studies. A retrospective cohort study conducted between 2010 and 2015, in a 19 bed Brazilian public university ICU, including 957 patients, predominantly male, with a mean age of 52±19 years, and median SAPS 3 of 65 (P25: 50, P75: 79).[20] The Brazilian ICU project, conducted by the Brazilian Intensive Care Medicine Association (AMIB), gathered data from 802 ICUs from the five regions of the country, and showed a mean SAPS 3 of 43.9 in 2017.[21]

The characteristics, severity, and outcomes of the patients of the two groups were similar, except for the need for hemodialysis, which was more frequent in patients of Period 1 when compared to Period 2 (23.2 and 12.7%, respectively, p=0.012). However, in 2017, the mean NAS score was 76.8±5.3%, similar to the one identified in this sample, reinforcing no seasonality in the nursing workload.

The workload required, according to the NAS classification, obtained a mean of 74± 20.9%. This result can be compared with a Brazilian study conducted with 437 patients, admitted to the ICU of a university hospital, with a similar profile to the patients in this sample, in which the mean NAS was 74.47±8.77%.[11] In the literature the score changes according to the clinical profile and severity of the patients, as well as the specific characteristics of each ICU, as identified in a study that evaluated 758 patients admitted to 19 ICUs from seven different countries (Norway, the Netherlands, Spain, Poland, Egypt, Greece).[22] In another study conducted in three hospitals in the north of Portugal, with different management models (public/private, private, and public), an oscillation in the NAS values was noted, with a minimum of 38.00% and a maximum of 115.00%.[23]

The hours of care required by the patients identified in the present study (Period 1: 17.8±5 hours, and Period 2: 17.7±5 hours) were similar to the recommendation of Resolution number 543/2017 of the Federal Nursing Council (COFEN) , which establishes that for calculation purposes, 18 hours of nursing care per patient

should be considered every 24 hours in intensive care services.[5]

This study was performed in a reference hospital for several specialties, which allows its comparison with other centers, in Brazil and abroad.

Another possible limitation of the present study refers to the fact that two different groups were included to compare the two strategies of the instrument rating. Applying the two strategies with the same group of patients simultaneously could bring results that assessed the agreement between the two methods. However, this would imply the need to have an external researcher, unrelated to direct patient care, to perform one of the two strategies of instrument analyses to be compared. However, the two groups compared in the two periods had very similar clinical characteristics.

Conclusion

This study showed that the mean NAS score is similar when comparing the three-times-a-day assessment with that done once per day, considering the previous 24 hours for assessing the nursing workload in the ICU. Since the strategies are shown to be similar, each organization can evaluate and select the best model according to its routine and specificities of each unit. From these findings, a training program was initiated in our service, to change the periodicity of NAS application to once per day. Further studies may be conducted with the intention of evaluating the agreement between the different methods of instrument rating, in different intensive care settings.

Collaborations

Batassini E, Silveira JT, Cardoso PC, Castro DE, Hochegger T, Vieira DFVB and Azzolin KO contributed to the study design, analysis, data interpretation, article writing, critical analysis of the relevant content, and final approval of the version to be published.

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