Usage analysis of the *Nursing Activities Score* in two Spanish ICUS

ANÁLISE DA UTILIZAÇÃO DA ESCALA *NURSING ACTIVITIES SCORE* EM DUAS UCIS ESPANHOLAS

ANÁLISIS DE LA UTILIZACIÓN DE LA ESCALA *NURSING ACTIVITIES SCORE* EN DOS UCIS ESPAÑOLAS

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ABSTRACT

The aim of the present study is to analyze the differences in NAS scoring in two Spanish critical care units. Prospective study performed in two polyvalent Spanish ICUs during the months of October and November 2011. Data regarding nursing workload was collected daily in both units for all the patients admitted in the ICU during the study period through the Nursing Activities Score (NAS). Data from 103 patients was collected obtaining 941 NAS measures. Statistically significant differences were found in the collection of the following items: monitoring and titration, hygiene procedures, mobilization and positioning, administrative and managerial tasks and left atrium monitoring ($p < .001$). Using standardized instruments to measure workload is important in order to be able to compare between different ICU. The NAS scale has several items with an important subjective assessment component. It is important to establish unified assessment criteria so comparisons between units can be made.

DESCRIPTORS
Workload
Intensive care
Critical care
Nursing, staff

RESUMO

Estudo prospetivo cujo objetivo foi analisar as diferenças no preenchimento da escala *Nursing Activities Score* (NAS) em duas UTI polivalentes de dois hospitais espanhóis. Dados relativos internados nas unidades durante o período de outubro a novembro de 2011. Os dados recolhidos de 103 pacientes produziram 941 medições na escala NAS. Diferenças significativas foram encontradas nos itens: monitoramento, procedimentos de higiene, mobilização e posicionamento, atividades administrativas e monitoramento auricular à esquerda ($p < 0,001$). Conclui-se que o uso de instrumentos padronizados é essencial quando se compara a carga de trabalho em unidades diferentes. A escala apresenta itens com uma componente de avaliação subjetiva, sendo por isso importante a unificação de critérios para a comparação de resultados entre diferentes unidades.

DESCRITORES
Carga de trabalho
Terapia intensiva
Cuidados críticos
Equipe de enfermagem

RESUMEN

Estudio prospectivo cuyo objetivo fue analizar las diferencias en el llenado de la escala *Nursing Activities Score* (NAS) en dos UCIs polivalentes de dos hospitales españoles. Datos relacionados a la carga de trabajo se recogieron diariamente, mediante la escala para los pacientes internados en las unidades durante el periodo de octubre a noviembre del 2011. Se recogieron datos de 103 pacientes obteniéndose un total de 941 medidas de la escala NAS. Diferencias significativas se encontraron en los ítems: monitorización, procedimientos de higiene, movilización y posición, tareas administrativas y monitorización de la aurícula izquierda ($p < 0.001$). Se concluyó que el empleo de instrumentos estandarizados es fundamental para poder comparar la carga de trabajo en diferentes unidades. La escala presenta ítems con un componente de valoración subjetiva, siendo importante la unificación de criterios para poder comparar los resultados entre las distintas unidades.

DESCRIPTORES
Carga de trabajo
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INTRODUCTION

Intensive Care Units (ICUs) admit critical patients whose conditions are of vital importance. However, not all admitted patients present conditions of the same clinical severity; hence, they require different attention. Consequently, the personnel of an ICU treat a diverse group of patients in terms of pathological features, condition severity and required nursing assistance[1].

In each particular unit, it is necessary to identify the characteristics of the admitted patients to compare different patient groups and analyze the nursing workload and assistance required to attend to the different conditions. Workload indicators have become necessary to guarantee patient assistance, improve ICU quality and balance its effectiveness[2]. Moreover, we have to consider that severity level and required workload fluctuations may occur during the stay of a patient in the ICU[1]; in this regard, a working group[3] found that patients with more severe conditions required greater nursing care support.

In recent years, hospital healthcare proximity, specifically in ICUs, has gained special attention. Healthcare personnel should provide emotional support and all necessary information to patients and their relatives. Thus, a lack of quantity and quality in nursing personnel directly jeopardizes hospital healthcare. Moreover, this insufficiency could legally compromise the institution because of excessive nursing workload and healthcare quality deficits[4].

Nursing workload evaluation scores permit the classification of patients based on the assistance needed. In this way, the scores favor quality control and results comparison between units with different characteristics. These scores objectively reflect nursing workload and personnel-specific needs in a determined unit, leading to adequate nursing personnel[1]. Different organizations have highlighted the significance of accurate personnel allocation not only to increase patient security but also to decrease healthcare-associated complications[5-6] such as nosocomial infections[7-8], post-operative complications[9-10], pressure ulcers[11], extubations and reintubations[10], and mortality[12]. Moreover, adequate nursing personnel allocation is important for the proper adjustment of medical costs for patient assistance. Studies have compared NAS points to those obtained by other ICU workload evaluation scores such as the NEMS or TISS-28. They have found that the NAS offers greater accuracy in workload evaluation[13].

The first score used to evaluate nursing workload was based on items determining patient condition severity and focused on the interventions or treatments received. This score was named the *Therapeutic Intervention Scoring System* (TISS)[14]. The TISS allows the specification of nursing personnel workload and needs, but it is not widely used due to its complexity and the time required to complete its 76 activities[14]. Efforts were made to simplify data collection, and the number of interventions was reduced to 28 (TISS-28), maintaining only those that, after statistical analysis, showed the greatest contributions to the total score[15].

In 1994, the *Foundation for Research in Intensive Care in Europe* (FRICE) developed and validated a new score named the *Nine Equivalents of Nursing Manpower Use Score* (NEMS). The NEMS achieved an unbiased and simplified evaluation of the healthcare effort through the analysis of only nine parameters[14]. The NEMS was developed from the TISS-28 by selecting those items with major utility in patient stratification. This explains why the NEMS remains an indirect measurement of nursing workload. It evaluates only patient therapeutic intervention activities, leaving aside the huge amount of nursing activities not directly linked to these interventions.

The *Nursing Activities Score* (NAS) was developed to quantitatively assess this kind of nursing workload. The NAS aims to evaluate not only those nursing activities related to the severity of illness and therapeutic intervention but also the patient assistance activities that are independent of illness severity[14]. This score was developed by Dr. Miranda and members of the TISS Working Group. The design of the NAS was based on the identification of nursing activities that better describe the workload in an ICU. A specific score is attributed according to the time consumption of each activity to appropriately attend to patient needs. The NAS does not relate to the severity of illness, and its main advantage is its accuracy in calculating the time consumption of healthcare activities, defining its scores to the 81% of total nursing time, thus increasing its reliability and validity[15-16].

The NAS was developed to overcome existing problems with previous scores, such as a medical design not oriented to nursing (TISS)[17], a time-consuming completion and a lack of adjustment in personnel calculation (NEMS)[17-19] and a continuous need for updating. NAS items were selected and defined by consensus in a multicentric study between different groups of experts (15 doctors and 10 nurses of intensive care units). Twenty-three routine nursing activities were included. The average time for each nursing activity was estimated and this parameter was used to allocate the weight of each item composing the new scoring system.

The NAS has been used in different national and international studies to calculate nursing workloads in ICUs, including those in Brazil, Spain and Norway. The

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NAS has also been used to establish adequate allocation of available resources to personnel needs[2,20-26]. Although there has been almost a decade since the first NAS publication, its usage as a tool to measure ICU nursing workload is still relatively new in the national and international literature[27].

The NAS was originally developed in English[15] and has been translated to Spanish by Arias-Rivera et al. The NAS was adapted for its application to shift work following the recommendations of the research group of Miranda et al.[28]. In 2004, Queijo et al.[27] published an NAS adaptation and its following intercultural validation in Portuguese. The results showed that the NAS is a valid and reliable tool to measure nursing workload in Brazilian ICUs[27].

A small user guide supplements the NAS to guarantee homogeneity in the registration of different items. However, despite these guidelines, the subjective component could hinder some item scoring, resulting in differences in NAS points. These differences are not because of patient characteristics but are due to altered interpretations by healthcare professionals. The results of Queijo et al.[27] have indicated nursing workload variability between different Brazilian studies.

In Brazil, after the introduction of the NAS Portuguese translation, some problems were observed in its application by ICU nursing staffs[29]. The major difficulties were related to a lack of clarity in the operational explanations of several items. A lack of ICU nursing registration was observed specifically in relation to items 1 (monitoring and serotherapy), 4 (hygiene procedures), 6 (mobilization and positioning), 7 (support and assistance to the patient's companions) and 8 (administrative and management tasks). Moreover, the NAS considers and recommends an 8-hour work shift, while in the majority of Brazilian ICUs, nursing personnel work in 6- or 12-hour shifts. These discrepancies motivated Gonçalves et al.[29] to develop a proposal for NAS functional application. They considered providing guidelines for the problematic items and ensuring that all nursing personnel from the same ICU systematically collect the data. To use this system as a tool for personnel allocation, it is important to analyze possible score variations produced independently from the patient's real condition. Moreover, it is important to ensure that the difficulties in determined items in Portuguese were also found in other languages.

The extended use of tools for the unbiased measure of nursing workload in ICUs will favor a better adjustment of the available resources to the real needs of the patients[30]. For this reason, the aim of the present work is to analyze the nursing workload in two ICUs of two Spanish hospitals and the existing differences in the completion of controversial items. This work aims at applying appropriate corrective measures to obtain a precise calculation of nursing workload.

METHOD

Design and site of study

A descriptive, prospective study was performed during 47 days between October and November 2011. The study was carried out in two Spanish University Hospitals (one in the Community of Madrid [H1] and the other in the Basque Country [H2]). Data collection was performed in the adult intensive care units of these centers. The H1 unit was comprised of 12 beds with patients admitted because of medical pathologies. The nurse/patient ratio in all shifts was 1:2 or 1:3. Nursing personnel worked in a 12-hour shift. The H2 unit included 10 beds and also admitted patients with fundamental medical pathologies. The nurse/patient ratio was 1:2 or 1:3. In this unit, there were morning, afternoon and night working shifts (7 hours in day shifts and 10 hours in night shifts).

Participants

Patients admitted to the ICUs who were older than 18 years old were included in the study. A total of 103 patients, 66 from unit H1 and 37 from unit H2, constituted the final sample size.

Data collection

Demographic and clinical data related to the admitted patients of both units were collected. Moreover, unit workload for each patient was collected daily through the NAS. Data registration was performed at 7 hours in the H1 unit and at 21 hours in the H2 unit. In both cases, information corresponding to the 24 hours before admission was also collected through the nursing chart.

The NAS is comprised of 23 items. Each item has an assigned weight, which evaluates the time required to perform the nursing activities. This weight represents the estimated time percentage that nursing personnel dedicate to activities included in the NAS tool (during 24 hours). The sum of the weights of the individual items reflects ICU nursing activities in a determined day. The maximum NAS score is 178.7 points and the minimum is 0 points. A full-time working nurse during 24 hours can handle a workload of 100 points.

This project was approved by the Ethical and Research Committees of both centers (H1 project 11/74; H2 project 8/2011).

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS), version 18.0 for Windows, was used for statistical analysis. Data are presented as the mean with a confidence interval of 95%.

Student's t-test was used to analyze differences between continuous variables. For categorical variables, the Chi-squared test was used. Effect size was calculated by

Cohen's d test. P < 0.05 was considered statistically significant (bilaterally).

RESULTS

Sample characteristics

The main reasons for admission were coronary pathologies, constituting more than half of the patients admitted during the study (52.3%), and medical-type pathologies (40.5%), in units H1 and H2, respectively. In both cases, there were more men than women. No statistically significant differences were found between the two units in regard to mean age, mortality rate and average stay in the unit (see Table 1).

In unit H1, a mean of 12.17 patients were admitted daily (95% CI, 11.79 – 12.55) with a mean daily admissions and dismissals of 1.17. In unit H2, the mean daily-admitted patient number was 8.09 (95% CI, 7.81 – 8.36) with a mean daily admissions and dismissals of approximately 0.5 (Table 1).

Table 1 – Patients characteristics admitted in both units and workload during the study

	H1		H2		Chi	
	n	%	n	%	squared	p
Reason of admission					42.797	< .001
Cardiologic	34	52.3	3	8.1		
Medical	30	42.2	15	40.5		
Postsurgical	1	1.5	13	35.1		
Polytraumatized	0	0.0	6	16.2		
Sex (men)	23	62.2	37	56.9	0.267	.605
Mortality	7	10.8	5	13.5	0.171	.679
	M	IC 95%	M	IC 95%	T	p
Age	65.08	60.84 – 69.32	61.84	56.44 – 67.24	0.937	.351
ICU stay length	12.79	5.09 – 20.49	13.17	9.60 – 16.73	0.071	.944
Daily patients	12.17	11.79 – 12.55	8.09	7.81 – 8.36		
Admissions	1.17	0.89 – 1.45	0.49	0.32 – 0.66		
Dismissals	1.17	0.93 – 1.41	0.38	0.18 – 0.58		
NAS global	633.97	608.61 – 659.33	467.37	447.49 – 487.23		
NAS nurse	53.66	51.81 – 55.52	55.81	54.08 – 57.54	9.426	< .001
NAS patient	122.82	117.68 – 127.96	93.39	89.77 – 97.01	1.702	.092

Workload in both units

Table 1 shows global workload, nursing workload and workload per patient data for each unit. No significant differences were found in the daily mean workload per patient between the two units (t (92) = 1.702; p = 0.092). However, in both units, there were statistically significant differences related to nursing workload. H1 showed higher differences with 122.82 NAS points for each nurse, whereas in H2 there were 93.39 NAS points (t (92) = 9.426; p < 0.001; d = 1.95).

Items usage analysis

The following items, included in the score, were analyzed in both units: monitoring tasks (item 1), hygiene procedures (item 4), mobilization (item 6), support and attendance to patient companions (item 7), administrative tasks (item 8) and left atrium monitoring (item 14) (Table 2 shows these items, with the different patient classification options and the assigned weight of the available options). Statistically significant differences were found between the units for the completion of these items (Chart 1 and Table 2).

In the case of monitoring tasks (x^2 = 194.641; p < .001), in unit H1, there were more registries related to basic monitoring and monitoring tasks with more than a four-hour duration, whereas in the H2 unit, there was a significantly higher number of registries pertaining to two-hour duration monitoring tasks.

In the hygiene task item (x^2 = 210.120; p < .001), there were more registries in unit H1 corresponding to procedures performed once a day and more than three times a day. In unit H2, there were more registries with the option of performing these tasks three times per day. Concerning mobilization and positioning (x^2 = 10.741; p = .005), the H1 unit recorded more registries in the performance of such tasks more than three times per day and the involvement of three or more nurses (without noting the frequency), whereas in H2, the greater number of registries was recorded in cases of performing such tasks up to three times per day.

In the H1 unit, a larger number of registries were described as routine communication attendance to patient relatives (x^2 = 238.201; p < .001), whereas in the H2 unit, more registries were recorded as minimum one-hour dedication to relatives in attendance.

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Concerning management and administrative tasks ($x^2 = 29.772$; $p < .001$), in H1 there were more than two hours of dedication (including patients admission and dismissal tasks). In H2, there were more registries of routine administration tasks.

Chart 1 - Details of items with completion differences between both units.

Problematic items
Item 1 - Monitoring and titration 1a - Hourly vital signs, regular registration, and calculation of fluid balance (4.5) 1b - Present at bedside and continuous observation or active for 2 hrs or more in any shift, for reasons of safety, severity, or therapy such as noninvasive mechanical ventilation, restlessness, mental disorientation, prone position, donation procedures, and preparation and administration of fluids or medication (12.1) 1c - Present at bedside and active for 4 hrs or more in any shift for reasons of safety, severity, or therapy such as those examples above (19.6)
Item 4 - Hygiene procedures 4a - Performing hygiene procedures such as dressing of wounds and intravascular catheters, changing linen, washing patient, incontinence, vomiting, burns, leaking wounds, complex surgical dressing with irrigation, and special procedures (e.g. barrier nursing, cross-infection related, room cleaning following infections, staff hygiene) (4.1) 4b - The performance of hygiene procedures took > 2 hrs in any shift (16.5) 4c - The performance of hygiene procedures took > 4 hrs in any shift (20.0)
Item 6 - Mobilization and positioninga; including procedures such as turning the patient, mobilization of the patient, moving from bed to chair and team lifting (e.g., immobile patient, traction, prone position) 6a - Performing procedure(s) up to three times per 24 hrs (5.5) 6b - Performing procedure(s) more frequently than 3 times per 24 hrs, or with two nurses, any frequency (12.4) 6c - Performing procedure with three or more nurses, any frequency (17.0)
Item 7 -Support and care of relatives and patient, including procedures such as telephone calls, interviews, counseling; often, the support and care of either relatives or patient allow staff to continue with other nursing activities (e.g., communication with patients during hygiene procedures, communication with relatives while present at bedside, and observing patient) 7a - Support and care of either relatives or patient requiring full dedication for about 1 hr in any shift such as to explain clinical condition, dealing with pain and distress, difficult family circumstances (4.0) 7b - Support and care of either relatives or patient requiring full dedication for 3 hrs or more in any shift such as death, demanding circumstances (e.g., large number of relatives, language problems, hostile relatives) (32.0)
Item 8 - Administrative and managerial tasks 8a - Performing routine tasks such as processing of clinical data, ordering examinations, professional exchange of information (e.g., ward rounds) (4.2) 8b - Performing administrative and managerial tasks requiring full dedication for about 2 hrs in any shift such as research activities, protocols in use, admission and discharge procedures (23.2) 8c - Performing administrative and managerial tasks requiring full dedication for about 4 hrs or more of the time in any shift such as death and organ donation procedures, coordination with other disciplines (30.0)
Item 14 - Left atrium monitoring: pulmonary artery catheter with or without cardiac output measurement (1.7)

Table 2 - NAS item usage analysis in both ICUs during the study

		H1		H2		Chi	
		n	%	n	%	square	p
Monitoring	a	497	85.1	157	44.0		
	b	49	8.4	163	45.7	194.641	< .001
	c	38	6.5	37	10.4		
Laboratory		580	99.3	339	95.0		
Drugs		584	100.0	356	99.7		
Hygiene	a	534	91.4	219	61.3		
	b	11	1.9	130	36.4	210.210	< .001
	c	39	6.7	8	2.2		
Drains		111	19.0	182	51.0		
Mobilization	a	215	36.8	173	48.5		
	b	336	57.5	174	48.7	10.741	.005
	c	33	5.7	10	2.8		
Relatives	a	575	98.5	216	60.5	238.201	< .001
	b	1	0.2	18	5.0		
Administrative	a	530	90.8	355	99.5	29.776	< .001
	b	54	9.2	2	0.5		

Continue...

...Continuation

	H1		H2		Chi	
	n	%	n	%	square	p
Ventilatory support	571	97.8	308	86.3		
Airway care	384	65.8	178	49.9		
Ventilation treatment	414	70.9	270	75.6		
Vasoactive medications	81	13.9	114	31.9		
Fluid replacement	2	0.3	2	0.6		
Left atrium monitoring	28	4.8	8	2.2	3.927	.032
CPR	1	0.2	1	0.3		
Renal replacement therapy	49	8.4	49	13.7		
Diuresis	504	86.3	356	99.7		
Intracranial pressure	0	0.0	53	14.8		
Metabolic	7	1.2	13	3.6		
Total parenteral nutrition	47	8.0	65	18.2		
Enteral nutrition	281	48.1	169	47.3		
ICU interventions	38	6.5	20	5.6		
Extra ICU interventions	32	5.5	33	9.2		

Concerning the left atrium monitoring item (x^2 = 3.927; p = 0.048), unit H1 recorded positive points in more patients than did unit H2.

DISCUSSION

In intensive care units, adequate nursing personnel allocation is essential to guarantee the healthcare quality required for admitted patients, to increase their security during their stay and, at the same time, to reduce the appearance of side effects. Nursing workload evaluation tools are fundamental to accurately evaluate the workload and adjust the resources to provide what the patients need.

There are several available evaluation systems that have been evolving over the years. Initially, these tools assessed nursing activities related to medical treatment applied to patients. Recently, they have evolved into tools for the assessment of the real nursing assistance workload rather than only inter-dependent or collaborative nursing activities. The NAS in particular is a reliable tool for assessing nursing workload in intensive care units. It is used in many countries and institutions and the publications applying this score for the analysis of workload continuously grow[2,21-26].

However, despite the score's accuracy when assessing nursing workload, there are items that presented certain difficulties at the time of their evaluation. Gonçalves et al. (29) identified difficulties in the application of certain items when the tool was validated in Portuguese. They noted the necessity to elaborate additional instructions for certain items. However, no relative references were found concerning these difficulties in any other country. In our work, we applied this score to Spanish ICUs. We found significant differences in the completion of items 1, 4, 6, 7, 8 and 14. These differences were not justified by patient characteristics. It is possible that these differences exist because of the different ways the items were assessed in each of the participating units. This is a major problem because the existence of differences is based on biased perceptions that could reduce score efficacy not only for personnel allocations but also for comparison establishment between different units. To date, no study exists that performs these comparisons between different units. NAS guidelines assume that registrations are identical between different ICUs and nursing personnel. The aim of the present work is to demonstrate that this cannot be a default situation. It has been shown that different professionals in different units register differently the score's various items.

A review of the most controversial items is necessary. Moreover, the development of more detailed and complete instructions to guarantee homogeneity in registration between different units is also recommended. It is fundamental to establish a consensus concerning what activities and situations should be registered in each of these items. In that way, accurate personnel needs and results comparisons between different institutions and countries could be established.

This study has limitations. First, this study was developed in two medical ICUs. Therefore, there are no data concerning post-surgical patients. This group of patients has been highlighted in other studies because of the increased workload required during their first days of stay in the unit. Moreover, special characteristics of the Spanish healthcare system (ICU workload organization, professionals working at the unit, etc.) should be considered because they might have a significant effect on results. Study patient recruitment was not randomized. All patients admitted in the units during the study were included during a limited time. In future studies, it would be interesting to include an additional variable indicating the severity of the patients' conditions (SAPS II, APACHE II, etc.). This could allow a comparison with other studies performed on the same subject.

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CONCLUSION

The NAS is a standardized tool for the assessment of workload in intensive care units worldwide. It has an undoubted utility for the establishment of nursing necessities in an ICU. However, as previously mentioned in several works, there are difficulties in the completion of some of its items. For that reason, it is necessary to continue to explore the difficulties derived from its use and analyze the most controversial items to standardize its completion, facilitate its use and enable the possibility of comparing results between different intensive care units.

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