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ORIGINAL ARTICLE

Nursing activities score (NAS): A proposal for practical application in intensive care units

Leilane Andrade Gonçalves[1], **Katia Grillo Padilha***, **Regina M. Cardoso Sousa**[1]

School of Nursing, University of São Paulo, Av. Dr. Eneas de Carvalho Aguiar 419, CEP 05403-000, São Paulo SP, Brazil

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Summary For over 30 years in an attempt to demonstrate the cost-benefit ratio of the intensive care unit (ICU) a variety of tools have been developed to measure not only the severity of illness of the patient but also to capture the true cost of nursing workload. In this context, the nursing activities score (NAS) was developed as a result of modifications to the therapeutic interventions scoring system-28 (TISS-28). The NAS is a tool to measure nursing workload ICU and it has been shown to be twice as effective in measuring how nurses spend their time caring for critically ill patients than the TISS-28. This paper discuss the introduction of the NAS into everyday use in an intensive care unit in Brazil and highlights the challenges of standardisation of operational definitions, training requirements and accurate completion of the documentation when using such a tool. The rationale and steps undertaken to achieve this are outlined and the benefits of such a process are highlighted.

Introduction

For over 30 years in an attempt to demonstrate the cost-benefit ratio of the intensive care unit (ICU) a variety of tools have been developed to measure not only the severity of illness of the patient but also capture the true cost of nursing workload (Carayon and Gürses, 2005; Guccione et al., 2004; Jakob and Rothen, 1997). In this context, many tools for assessing nursing workload were developed as shown in Table 1 Among these tools are several models of the therapeutic interventions scoring system (TISS), of which the nursing activities score (NAS) is the latest version (Miranda et al., 2003).

Proposed by Miranda et al. (2003), NAS was validated in a study of 99 ICUs in 15 countries. It is a modified version of TISS-28 with an additional five new items, i.e. monitoring and titration, hygiene procedures, mobilisation and positioning of the patient, support and care of relatives/patients, and administrative and management tasks plus 14

* Corresponding author. Tel.: +55 11 3061 7544; fax: +55 11 3061 7546.
E-mail address: kgpadilh@usp.br (K.G. Padilha).
[1] Tel.: +55 11 3066 7544; fax: +55 11 3066 7546.

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Table 1 Tools to measuring nursing workload: type, definition, reference and further information

Tool	Definition	Year of development	References
PRN	Project of research of nursing	1981	EROS, 1981
OMEGA	Omega scoring system	1986	CESRLF, 1986
TOSS	Time oriented score system	1991	GIRTI, 1991
SOPRA	System of patient related activity	1999	ICNARC, 1999
TISS-28	Therapeutic intervention scoring system-28 (TISS-28)	1996	Miranda et al., 1996
NEMS	Nine equivalents of nursing manpower score	1997	Miranda et al., 1997
NAS	Nursing activities score	2003	Miranda et al., 2003

sub-items. The NAS weightings measure the time consumed by nurses' activities at the patient level and represent the calculated percentage of nursing staff's time (one 24-h period) dedicated to the performance of the activities included in the instrument. The sum of the weights of the individual items scored reflects the amount of time spent by nursing staff in an ICU on performing activities during a particular day. Results indicate that NAS explains 81% of the nursing time, whereas TISS-28 explains only 43% (Miranda et al., 2003). Thus, this new instrument has become not only more wide-ranging but also is reduced to a total of 23 items, which in theory makes its application easier.

In Brazil, after the translation to Portuguese (Queijo and Padilha, 2004) some problems were observed in its application by intensive care nurses. The main difficulties were related to the lack of clear operational explanation about some items as well as a lack of nursing recordings carried out in the ICU, especially as it relates to items 1, 4, 6, 7 and 8. Besides, unlike the 8-h shifts considered and recommended for NAS, most ICU Brazilian nurses works in 6- or 12-h shifts (morning shift: from 7 am to 1 pm; evening shift: from 1 pm to 7 pm, and night shift: from 7 pm to 7 am) (Miranda et al., 2003). These problems have motivated the authors to develop a proposal for a practical application of NAS with a view to providing some guidelines for the items and thus ensure systematic data collection by all nurses in the same ICU.

Considering NAS as a useful tool to measure nursing workload in the ICU and the possibility that many nurses may face the same difficulties, the suggested steps for implementing this proposal are outlined below, along with operational definitions of some NAS items.

Operation manual

Although NAS has its own specific instructions for use (Miranda et al., 2004), this study aimed to complement the operation manual regarding items 1, 4, 6, 7 and 8, which require additional information. Such instructions are found in Table 2 .

Contributions to accomplish such items were consensually reached by a group of judges including the nurses who have participated in the NAS adaptation to the Brazilian culture (Queijo and Padilha, 2004) and also in the TISS-28 operational guidelines (Padilha et al., 2005).

Procedures

1st step

Standardisation of a realistic time period spent on nursing care

Except for item 6, which requires frequency and the number of professionals involved in mobilisation and positioning, information about the time spent on activities is vital to all other items (1, 4, 7 and 8).

In order to establish a realistic standard time period for the ICU, a form was developed so that the total time spent for each item could be recorded according to the following criteria (Table 3).

- *Normal*: time considered as a ''routine'' to carry out an activity.
- *More than Normal*: time considered longer than the ''routine'' to carry out an activity.
- *Much more than Normal*: time considered much longer than the ''routine'' to carry out an activity.

For example item 1, monitoring and titration, for such criteria as an example: (1a) (Normal), generally accepted as the baseline of monitoring in the ICU. (1b) (More than normal), the patient cannot be left alone, and the nurse needs to stay continuously next to the bed for observation and eventual action; in some occasions although strict continuous presence may not be required, the patient's condition requires much higher dedication of the nursing activity for a longer period of time, as during the preparation of fluids and/or medication

Table 2 NAS manual

1. Monitoring and titration
   1a. Hourly vital signs, regular registration and calculation of fluid balance (4.5%)
   It is applied to patients who DO NOT need frequent treatment changes and who either require routine monitoring and control or ''Normal'' according to the time predicted by the Unit, in 24 h.
   1b. Presence at bedside and continuous observation or active for 2 h or more in any shift, for reasons of safety, severity or therapy, such as: non-invasive mechanical ventilation, weaning procedures, restlessness, mental disorientation, prone position, donation procedures, preparation and administration of fluids and/or medication, assisting specific procedures (12.1%)
   It is applied to patients who, due to safety reasons, severity or therapy, had their monitoring intensified ''more than Normal'' according to the time predicted by the Unit, for at least one 24-h shift.
   1c. Present at bedside and active for 4 h or more in any shift for reasons of safety, severity or therapy, such as those examples above (1b) (19.6%)
   It is applied to patients who, for security reasons, severity or therapy, had their monitoring intensified ''much more than normal'' according to the time predicted by the Unit, for at least one 24-h shift.

4. Hygiene procedure
   4a. Hygiene procedures such as: dressing of wounds and intravascular catheters, changing lines, washing patient, incontinence, vomiting, burns, leaking wounds, complex surgical dressing with irrigation, special procedures (e.g. barrier nursing, cross-infection related, room cleaning following infections, staff hygiene), etc. (4.1%)
   It is applied to the patient who underwent any hygiene procedure as described above, with frequency ''Normal'' according to the time predicted by the Unit, for at least one 24-h shift.
   4b. The performance of hygiene procedures took more than 2 h in any shift (16.5%)
   It is applied to patients who underwent any hygiene procedures according to 4a, in a frequency ''more than Normal'' according to the time predicted by the Unit, for at least one 24-h shift.
   4c. The performance of hygiene procedures took more than 2 h in any shift (20.0%)
   It is applied to patients who underwent any hygiene procedures according to 4a, in a frequency ''much more than Normal'' according to the time predicted by the Unit, for at least one 24-h shift.

6. Mobilisation and positioning, including procedures such as: turning the patient; mobilisation of the patient; moving from bed to chai; team lifting (e.g. immobile patient, traction, prone position)
   6a. Performing procedure(s) up to 3 times per 24 h (5.5%)
   It is applied to patient undergoing mobilisation and positioning procedures as described, up to three times in 24 h.
   6b. Performing procedure(s) more frequently than 3 times per 24 h, or with 2 nurses—any frequency (12.4%)
   It is applied to patient undergoing the mobilisation and positioning procedures described in item 6, which had been carried out more than three times in 24 h or by two professionals from the nursing team in at least a shift in 24 h.
   6c. Performing procedure(s) with 3 or more nurses — any frequency (17.0%)
   It is applied to the patient undergoing the mobilisation and positioning procedures as described in item 6 that had been carried out by three or more members of the nursing team at any frequency in at least one shift in 24 h.

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 whilst present at bedside and observing patient)
   7a. Support and care of either relatives or patient requiring full dedication for about 1 h in any shift such as: to explain clinical conditions, dealing with pain and distress, difficult family circumstances (4.0%)
   It is applied to the patient and family who have received emotional support with exclusive dedication, lasting as ''Normal'' according to the hours established by the Unit, in at least, one shift for 24 h.
   7b. Support and care of either relatives or patient requiring full dedication for 3 h or more in any shift such as:: death, demanding circumstances (e.g.: large number of relatives, language problems, hostile relatives) (32.0%)
   It is applied to the patient and family who have received emotional support with exclusive dedication lasting ''more than Normal'' according to the time predicted by the Unit in at least one shift for 24 h.

8. Administrative and managerial tasks
   8a. Performing routine tasks such as: processing of clinical data, ordering examinations, professional exchange of information (e.g. wards round) (4.2%)

Table 2 (*Continued*)

It includes any administrative and managerial task related to patient that takes the ''Normal'' time according to the one established by the Unit.
8b. Performing administrative and managerial tasks requiring full dedication for about 2 h in any shift such as: research activities, protocols in use, admission and discharge (23.2%)
It includes any administrative and managerial task related to patient that takes ''more than Normal'', according to the time predicted by the Unit.
8c. Performing administrative and managerial tasks requiring full dedication for about 4 h or more in any shift such as: death and organ donation procedures, co-ordination with other disciplines (30.0%)
It includes any administrative and managerial task related to patient that takes ''much more than Normal'', according to the time predicted by the Unit

Table 3 Estimate nursing time spent in the ICU

Aiming to adjust the time spent on nursing care according to this ICU reality, we would like your help to quantify, in hours and minutes, the nursing procedures described below, based on your experience in this Unit, on a shift of 6 and 12 hours.	
In order to estimate the time spent in certain activity, take into consideration the whole time spent to perform it, no matter it is continuous or not.	**Shift:** Morning ( ) Evening ( ) Night ( )
1. Monitoring and Titration **Presence at bedside and continuous observation** in order to assure safety, severity, or therapies such as non-invasive mechanical ventilation, weaning, restlessness, mental confusion, prone position, preparation and administration of either fluids or medication, assistance in specific procedures.	Normal:_____ More than Normal: _____ Much more than Normal: _____
4. Hygiene Procedures Wound dressings and intravascular catheters, changing lines, patient hygiene in specific situations (incontinence, vomit, burning, dealing wounds, complex surgical dressings with irrigation and special procedures such as isolation).	Normal:_____ More than Normal: _____ Much more than Normal: _____
7. Family and patient support and care – "support and emotional care"	Normal:_____ More than Normal: _____ Much more than Normal: _____
8. Administrative and Managerial tasks	Normal:_____ More than Normal: _____ Much more than Normal: _____
Date:	

Table 4 Hypothetical model of average time spent on nursing care, per shift in an adult ICU. São Paulo, Brazil, 2003

Items	Shifts	Normal	More than normal	Much more than normal
Monitoring and titration	6 h 12 h	≤2 h ≤4 h	>2 h < 4 h >4 h < 8 h	≥4 h ≥8 h
Hygiene procedures	6 h 12 h	≤1 h ≤3 h	>1 h < 3 h >3 h < 6 h	≥3 h ≥6 h
Family and patient support and care	6 h 12 h	≤30 min ≤2 h	>30 min >2 h	
Administrative and managerial tasks	6 h 12 h	≤1 h e 30 min ≤2 h	>1 h e 30 min, ≤3 h >2 h ≤5 h	>3 h >5 h

during a clinical condition of shock. (1c) (Much more than normal), continuous presence and increased activity may be necessary, such as assuring the patient's comfort during, and the patient's commitment to, a non-invasive mechanical ventilation mode or ''keeping'' the patient in bed during a period of restlessness or mental disorientation.

All ICU nurses were then asked to complete the form (Table 3) to record both the shift worked (6 or 12 h) and the estimated time spent on carrying out the activities described in the sub-items. Upon filling out the forms, nurses were clearly informed that, irrespective of whether the activity was continuous or not, what needed to be recorded was the total amount of time during the shift spent on performing any part of that particular activity.

Based on the data provided by the nursing staff, it was then possible to calculate the average time for each of the four categories (1, 4, 7 and 8) with respect to both 6- and 12-h shifts (Table 4).

This average time was used in training ICU nurses (step 3 or 4) in order to standardise the comprehension of ''normal'', ''more than normal'', and ''much more than normal'' concepts.

2nd step

Designing NAS complementary tool

Most of NAS information was available in the patients' daily control form. However, as mentioned before, NAS required complementary information to fulfil items 1, 4, 6, 7 and 8. Such complementary information was nevertheless often not available in the nursing forms.

In order to obtain such information, a form named NAS Complementary Information (Table 5) was developed. This form was filled out on a daily basis by nurses working on morning, evening and night shifts. It was necessary to gather such information on each shift, since the highest NAS score for items 1, 4, 6, 7 and 8 was to be considered within every 24 h.

3rd step

Nursing staff training

This was considered quite important to ensure that a uniform approach was used by all staff completing the NAS forms. A series of meetings were arranged with the nursing staff after each shift. This allowed patients to continue being attended by the staff of the following shift with no cut off on assistance. Two meetings of approximately 1 h were arranged for each group. All ICU staff participated in the training program.

As one used the operational manual (Table 2), each item was explained so that it became understandable, meaningful, and consequently more accurate.

Once this procedure was completed, the NAS Complementary form (Table 5) was submitted to the nurses on several shifts along with instructions to fill it out. Questions asked by nurses were then answered and their doubts were cleared in the meetings. Also, an ICU nursing research staff member was available to clear doubts until the tool was effectively implemented on the Unit's daily activities. This process took approximately 1 month.

It is important to point out that nurses at this ICU were already applying TISS-28 and had also participated in the multicentre study that resulted in the NAS tool. This field of study is linked with a university institution where research is assigned an important role and therefore is supported by chief staff members. Moreover, ICU nurses were particularly motivated towards this theme, since they found their workload rather excessive in the Unit and considered that NAS application might contribute to setting adequate nursing staff requirements.

Table 5 Complementary NAS

Name:		Identification Number:								
Complementary-NAS	*Frequency*	*Date*								
	Monitoring and Titration									
	Normal									
M	*More than Normal*									
	Much more than Normal									
	Normal									
E	*More than Normal*									
	Much more than Normal									
	Normal									
N	*More than Normal*									
	Much more than Normal									
	Hygiene Procedures									
	Normal									
M	*More than Normal*									
	Much more than Normal									
	Normal									
E	*More than Normal*									
	Much more than Normal									
	Normal									
N	*More than Normal*									
	Much more than Normal									
	Mobilization and Posi1tioning (frequency)									
	1x									
M	*2x*									
	> or = 3x									
	1x									
E	*2x*									
	> or = 3x									
	1x									
N	*2x*									
	> or = 3x									
	Mobilization and Positioni1ng (personal)									
	1									
M	*2*									
	> or = 3									
	1									
E	*2*									
	> or = 3									
	1									
N	*2*									
	> or = 3									
	Family and Patient Support and care									
	Normal									
M	*More than Normal*									
	Normal									
E	*More than Normal*									
	As expected									
N	*More than expected*									
	Administative and Managerial Tasks									
	Normal									
M	*More than Normal*									
	Much more than Normal									
	Normal									
E	*More than Normal*									
	Much more than Normal									
	Normal									
N	*More than Normal*									
	Much more than Normal									

4th step

Daily NAS score

Based on the information from NAS-COMPLEMENTARY (Table 5) and control sheets in the last 24 h, the total NAS of each patient was calculated once a day at 8 am. As regards the admission day, the activities carried out from the ICU admission time until 8 am., were considered, irrespective of whether they reached 24 h or not. On the discharge day, the intervention scores carried out from 8 am to discharge time were considered. In ICUs, the NAS score within such periods was important because admissions and discharges require extra nursing workload and occur quite frequently due to a low LOS average in these Units.

As the NAS and complementary tool were applied on a daily basis, information was registered by the nurse responsible for the patient. A former study of validation for this tool in the Brazilian culture showed a high agreement between two observers

(99.8%) and an average Kappa index of 0.99 (Queijo and Padilha, 2004).

Reflections on the process

Many difficulties are faced as nursing workload measuring tools are implemented in Brazil as well as in other countries. The basic difficulty lies in the fact that such tools are usually designed within a different cultural framework and thus require adaptation into the local language. Other factors such as the need for additional information to be gathered for proper use of tools, limited staff available in the Units, and excessive workload may also cause professionals to become unmotivated and not apply the tools in practice.

As far as the NAS is particularly concerned, there was a need for standardising the time spent by the nursing staff on items 1, 4, 7 and 8, since the times proposed by the original NAS were set for longer or shorter shifts (i.e. 8 h) as compared to shifts performed in Brazil (i.e. 6 and 12 h long). By applying the originally proposed NAS to 6-h shifts, one might underestimate the nursing workload required for items 1, 4, 7 and 8. On the other hand, such workload might be overestimated if one applied it to 12-h shifts. For instance, the performance of hygiene procedures that take >2 h (item 4b) in an 8-h shift is more than normal. This time span, which is equivalent to 1/4 of an 8-h shift, would amount for 1/3 and 1/6 of a 6- and 12-h shift, respectively.

However, this proposal arose from the belief that it is possible to overcome these barriers if there is motivation and effective participation of all ICU nurses for collecting data. So, it is possible to gather actual data in order to express the reality of a particular Unit and thus provide for adequate staff members.

Implementing this tool in a Brazilian ICU showed that NAS use was feasible and provided relevant information on nursing workload features. This process is currently being developed with short-term positive assessments. Result have shown an adequate adjustment of the number of nursing staff to eventually enhance the professionals' satisfaction. However, long-term assessments are necessary in order to analyse ICU assistance quality and cost.

In conclusion, we would like to point out that although the introduction of this proposal was feasible in a university hospital ICU, the follow-up of the process both in this context and in others will ensure the necessary assessments and the enhancement of this proposal.

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