

**ASSOCIATION BETWEEN NURSING WORKLOAD AND THE PATIENT PROGNOSIS IN INTENSE CARE UNIT**

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**ABSTRACT**

*This is a prospective, cross-sectional descriptive study using a quantitative approach. The study was conducted at two general ICUs of a Teaching Hospital, which attend patients from both the Unified Health System and the Supplementary Health Services. The aims of the present study are to identify the patients' prognosis using SAPS III and to verify the nursing staff workload through NAS relating all data gathered. Data were collected using the medical charts inserted into the Epimed Solution System from August to September 2013. NAS allowed us to*

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*assess the nursing staff workload, demonstrating an inadequate personnel downsizing in both ICUs. SAPS III is important in predicting the mortality of critically ill patients. These tools support the ICU nurse in the patient-care planning. Tools showed lower nursing workload in relation to patients with poor prognosis, who showed high SAPS III and death. NAS demonstrated to be inversely proportional to SAPS III.*

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**Keywords:** *Workload, Nursing, Prognosis, Intensive Care Unit*

## 1. INTRODUCTION

Since its appearance in the 50s, the Intensive Care Unit (ICU) has been through many technological transformations, which also provided the adherence to greater therapeutic and structural resources, as well as to a groundbreaking technology, which has contributed to a current profile change of the inpatients admitted to these units. These facilities come to be more complex in relation to other sectors inside the institution, demanding highly qualified professionals who must have scientific and technical skills and the ability to provide an adequate nursing care for the required care. (LEITE, 2010).

Considering the technological changes and the characteristics of patients requiring ICU admission, it is important to be aware of the mortality and morbidity risks. In order to do that, we must quantify the physiological disorders through instruments that refine prognostic indications on critical patients, such as the *Simplified Acute Physiology Score* (SAPS). From the estimated mortality, SAPS aimed to correct errors and improve the ICUs' performance. (JUNIOR E MALBOUISSON et al., 2010).

SAPS III contributes in a relevant way to the ICUs, because it quantifies the acute and physiological disorders at the time of the patient admission (LE GRALL et al., 1984; LE GRALL, LEMESHOW, 1993; COOK et al., 2001). It is also possible, through these instruments to define the patient acuity on his/her arrival to the unit (OLIVEIRA, 2009). Therefore, there is a capacity to estimate mortality aiming at correcting errors and qualifying nursing staff at the ICU. (COOK et al., 2001).

The profile of patients attended at the ICU interferes directly with the nursing staff workload, which also affects the life quality of these professionals. It also jeopardizes the assistance delivered and the hospital costs arising from the staff. The evaluations of nursing workload are a theme/subject discussed throughout the world, since an undersized team could determine a decrease in the quality of health care. (LEITE 2010; FEITOSA, LEITE, SILVA, 2012; SANTOS et al., 2012; QUEIJO E PADILHA 2009).

The *Nursing Activities Score* (NAS) is an instrument developed by Miranda and collaborators (MIRANDA, 2003), which aims to quantify the nursing workload (CONISHI E GAIDZINSKI, 2007; MIRANDA, 2003; LIMA, 2008). It was translated and validated to the Brazilian reality (QUEIJO E PADILHA, 2009). It is divided into 7 categories and accounts with 23 items, which are pre-filled from the nursing activity records performed in the last 24 hours (LEITE, 2010). Studies have shown the importance of the nursing workload. This term is being incorporated to the staff dimensioning studies in order to measure the labor demand required by this team. (LEITE, 2010; INOUE, KURODA, MATSUDA, 2011; CONISHI E GAIDZINSKI, 2007).

A poor quality of nursing care leads to a higher hospital costs and increases the length of hospital stay jeopardizes the clients in relation to their rights of access, and to a risk-free assistance. It also compromises the institution legally by the staff deficiency and nursing staff workload. On the other hand, a super dimensioned nursing staff can result in high hospital costs. (FEITOSA, LEITE, SILVA, 2012; SANTOS, MATSUDA, PADILHA, 2012; QUEIJO E PADILHA 2009).

Regarding to ICU, the workload problems can gain other dimensional levels, when we considered the high-cost assistance and physical wear, which professionals are submitted to. It is important to highlight that these professionals are among those with greater psychobiological requirements throughout the work process to which they are subjected to, which result in a wear of their vital capabilities. (ESTEVEES, 2009).

Come to sight the importance of the utilization of instruments that allow the evaluation of the nursing staff workload, as well as the further accomplishment of the quantitative personnel downsizing suitable to provide health care according to the patient's profile. (LEITE, 2010; INOUE E MATSUDA, 2011; ESTEVEES, 2009; DIAS 2006). This study aimed to identify the ICU prognosis using SAPS III, which verifies the nursing staff workload through NAS and related data.

## 2. METHODS

A descriptive, prospective and cross-sectional study with a quantitative approach, carried out in two ICUs (ICU A and ICU) at the Hospital de Base de São José do Rio Preto - São Paulo. The ICU A has 20 beds for patients of all specialties except cardiology, because the hospital has a specific cardiology facility. The ICU A has 10 surgery beds and 10 clinical beds. The Brazilian Unified Health System (better known by the acronym SUS) assists the patients. The ICU B has 23 hospitalization beds including all specialties, except cardiology. Patients are assisted by their supplementary health (joint ventures or private companies).

The sample was composed of 77 patients admitted to the ICU A. These patients were evaluated on a daily basis. We performed 725 NAS applications. The sample in ICU B was composed of 107 patients. We performed 1,687 NAS applications. We excluded from the study patients with a length of hospital stay lower than 24 hours and those in the immediate post-operative period of liver transplant, or pancreas/kidney transplant according to the institutional protocol, which states that these procedures require an exclusive nurse and nursing technician, until their clinical outcome.

The researchers working in these units collected all the data in the end of each working shift (morning, afternoon, and evening). Data was collected using a prospective and retrospective methodology, as well as daily after-hours care and systematic revisions of the computerized records for application of NAS instrument. The Epimed Solution System in the ICU was used to collect the SAPS III data. This system provides access to information relative to patients' physiological disorders and prognosis that are being followed-up in these units for a consecutive 30-day period from August to September 2013.

NAS is divided into 7 categories and comprised of 23 items (CONISHI E GAIDZINSKI, 2007). They are as follows: 1- Monitoring and titration; 2- Laboratory: biochemical and microbiological investigations 3- Medication vasoactive drugs excluded; 4- Hygiene procedures; 5- Care of drains all: except gastric tube; 6- Mobilization and positioning; 7- Support and Care of relatives and patient; 8- Administrative and Managerial tasks; 9- Respiratory support; 10- Care of Artificial airways; 11- Treatment for improving lung function; 12- Vasoactive medication; 13- Intravenous replacement of large fluid losses; 14- Left atrium monitoring; 15- Cardiopulmonary resuscitation after arrest; 16- Hemofiltration techniques; 17- Quantitative urine output measurements; 18- Neurologic support; 19- Treatment of metabolic acidosis/alkalosis; 20- Intravenous hyper alimentation; 21- Enteral feeding; 22- Specific interventions in ICU; 23- Specific interventions outside the ICU (QUEIJO E PADILHA, 2009; BOCHEMBUZIO, 2007).

The total of NAS is achieved by the sum of values applied to each one of the 23 items. The result is attained in percentage and can range from 0 and 178.8%. Each NAS is equivalent to 14.4 minutes. The obtained result represents the time devoted by the nursing team to the direct care of the critically ill patient during 24 hours. If the total score was 100 points, this means that the patient needs 100% the nursing staff time for 24 hours. (LEITE, 2010; LIMA, TSUKAMOTO, FUGULIN, 2008). The instrument contributes as a parameter of prediction of the nursing personnel relative to the direct working time devoted to the care of the patient.

SAPS III covers 20 different easy mensuration variables at the admission. The instrument includes 3 parts that compose the SAPS III index, which represents the level of disease commitment and evaluation of health status prior to the hospital admission, designate as a pre-morbid condition. These variables are as follows: **Demographic variables** (age, prior health status; comorbidities; previous admission unit hospitalization; length of hospital stay and therapeutic use before admission to the ICU); **causes of ICU admission** (if the hospitalization had been planned or not, need for surgery, possible infection), and **physiological variables** (temperature, systolic blood pressure; heart rate and respiratory rate; oxygenation; arterial pH; sodium; potassium; bilirubin; hematocrit, leukocytes; platelets and Glasgow's coma scale) (JUNIOR et al., 2010).

Each variable has a value related to a physiological disorder severity. The lowest value granted by the score is 16 points and the highest one is 217 points. Recently, SAPS III has been validated in a Brazilian cohort of cancer patients with excellent results. (SOARES E SALLUH, 2006). The index was calibrated with a value of 1.3 for South America, meaning that the relationship between the observed and expected mortality is 1.3 (JUNIOR ET AL, 2010).

Data was stored in spreadsheets, using Microsoft Excel® version 2010 – Windows® 2010. We used the Pearson's correlation test and the Student's *t* test to perform the statistical analyses. The results were presented as percentile, mean and standard deviation, and variance. Data was organized into tables. The current Project was approved by the Ethic Research Committee of the Faculdade de Medicina de São José do Rio Preto (FAMERP), São Paulo, under the protocol CAAE 18559213.1.0000.5415.

### 3. RESULTS

In the ICU A, 42 out of the 77 patients were male (55%) and 35 female (45%). The mean age of the patients was 59 years (SD ± 18.08%). Most of the patients (n=28; 49.4%) were from the surgery center, followed by the emergency medical service (40.2%). Surgical hospitalizations were the mostly frequent ones (50.9%).

Among surgical hospitalizations, 26% were considered urgency hospitalizations, while 13% were considered elective hospitalizations. Most of the patients (71.4%) were discharged from the ICU to other units of the same hospital; mortality rate was 28.6% with 22 deaths. As for the length of hospital stay, the average was 14 days.

In ICU B, 55 out of 107 patients were female (51.4%) and 52 male (48.6%). The mean age of the patients was 68 years (DP± 17.04%). The mean length of hospital stay was 9 days. Regarding clinical aspects, 32 (24.6%) patients came from the surgery center, one (0.9%) from home care, 8 (7.5%) from other hospitals, 29 (27.1%) from emergency medical service, and 31 (29.0%) from inpatient care units/general wards. Of the 107 patients in ICU B, 75.7% of the patients were discharged from the unit, 23.4% deceased, and only one (0.09%) did not present a clinical outcome. The patient was still hospitalized at the end of the NAS application.

Regarding patients' diagnosis at admission in the ICU A and B, we grouped and described the main diseases on Table 1.

#### *Inserir Tabela 1*

ICU A, of the 725 NAS applications, we obtained an average of 45.4%. Patients who died have presented a higher percentage of NAS application (60.50%). In ICU B, of the 1,687 NAS applications, the sample average score was 63.5%. (Table 2)

#### *Inserir Tabela 2*

In relation to the severity of clinical conditions evaluated by SAPS III, the average score was 60.8 points; mortality risk was 48.9% in the first 24 hours after hospitalization. (Table 3)

#### *Inserir Tabela 3*

In the ICU B, the NAS application average was 45.71 points, and the mortality risk was 23.33%. (Table 4)

#### *Inserir Tabela 4*

### 4. DISCUSSION

Studies have shown that the profile of ICU inpatients in Brazil is mostly composed of males aged, 60 years and over. The elderly population is predominantly composed of aged, 80 and over. (CONISHI E GAIDZINSKI, 2007; LIMA, TSUKAMOTO E FUGULIN, 2008; PIERIN et al., 1991). Similarly, an international study carried out by NUNES (2000), shows that 48% of ICU inpatients were aged 65 and over (range 19 to 90 years). This result corresponds to the patients' profile studied in both ICUs (A and B), except for gender in ICU B, in which the prevalence was female.

Studies carried out in three Brazilian states involving 10 ICUs showed that 35.7% of the patients came from surgery centers, 28.2% from emergency medical services, 19.3% from general wards, and 10.6% from other hospitals. (LEITE, SILVA, PADILHA, 2012). This result was similar to the results found throughout the study regarding ICUs A and B.

The Brazilian ICU Census (AMIB, 2004) defines the length of ICU stay between one to six days. However, we found in the present study that the length of stay in ICUs A and B is longer (14 and 9 days, respectively). However, we stress that the length of ICU stay depends on various factors, such as the nature of the underlying disease and the therapeutic requirements arising from the complications. (GONÇALVES et al., 2006).

A study carried out by GONÇALVES et al. (2006) showed that ICU inpatients presented as a medical diagnosis at the moment of their admission infection, neurological and respiratory diseases, which is similar to the results found in ICU A and B, which showed a predominance of neurological and respiratory diseases.

Regarding the average of the total NAS, in ICU A, it was 44.4 points, while in ICU B, it was 63.3 points. Brazilian studies showed a variation between 61.9 and 73.7 points (LEITE, SILVA, PADILHA 2012; MARQUES, ZEITOUN, LARA, FERNANDES, 2013). This demonstrates a lower NAS in ICU A, which is similar to that presented Brazilian studies for ICU B. Student's *t* test showed that the difference observed is very relevant between NAS values in ICU A and B. A *P* value = 0.0021 were considered statistically significant.

The Federal Nursing Council (COFEN), in Resolution #293/04, states that the time of nursing care for intensive care in 24 hours is 17.9 hours per patient. Each NAS point is equivalent to 14.4 minutes (LEITE, 2010; LIMA, TSUKAMOTO, FUGULIN, 2008). The results of this study represent the time devoted by the nursing team to the direct care of the critically ill patient during 24 hours. Comparing the average of NAS score in both ICUs, we verified that in ICU A, the NAS score of 90.8 was equivalent to 21.8 hours of nursing care; in ICU B, the NAS score of 126.3 was equal to 30.3 hours, which is far beyond that recommended by COFEN. Generally, in the units studied, just one person from the nursing staff is responsible for 2 patients per bed. Therefore, we found a discrepancy in the quantitative nursing personnel, once COFEN states that the time of nursing care for intensive care in 24 hours is 17.9 hours per patient. We also found in ICUs A and B a high workload relative to that recommended by COFEN, showing a shortage of personnel to carry out nursing care according to the patient's profile.

This finding corroborates studies showing that critically ill patients require long-term nursing care both at the admission and throughout their stay due to organic instabilities presented by the patients in these units (GONÇALVES et al., 2006; BALSANELLI, ZANEI, WHITAKER, 2006).

Using NAS instrument allowed the evaluation of the time spent on therapy devoted to the critically ill ICU inpatient, showing that NAS applicability helps the nurse to adequate the nursing staff, thus, facilitating working conditions in order to provide a safe and quality nursing care, both for the patient and the nursing staff.

The results that have been achieved by applying NAS instrument reveal the need for care and hence pointed to a high workload of nursing staff. This data associated to other arguments provides subsidies to request health personnel to promote the nursing care required by the patients and pursued by the health professionals. The study confirmed the indication of NAS as an instrument to handle human resources in the adjustment of the nursing team.

SAPS III proved to be a useful instrument in predicting prognosis of the studied patients. It is used to check patients who require a further greater care. To state this, we considered the relationship observed by the study between nursing team's lower workload and the patients whose clinical outcome was death. The SAPS III average score in the first 24 hours of ICU admission for patients whose clinical outcome in ICU A was death was 66.79, with the overall average was 48.9. ICU B presented a SAPS III average score of 41.69, with an overall average of 23.33. Student's *t* test showed that the difference observed is very relevant between SAPS III values in ICU A and B. A *P* value = 0.0001 were considered statistically significant.

A study involving 952 patients admitted to the ICU showed an excellent discernment between SAPS II and SAPS III. The study revealed that the adjustments applied to Latin America presented a good discrimination between the expected and observed mortality. Because SAPS III index is easy to apply and to calculate, we recommend its routine utilization in ICU according to the relevance to stratification of surgical patients who are more likely to die (JUNIOR et al., 2010).

The patients showed a level of severity, which is similar to other Brazilian studies, in which there are variations in the SAPS III average score, ranging from 25.81 and 44.9 points. The use of Pearson correlation coefficient showed that there's a correlation between NAS and SAPS III in ICU B ( $P=0.0105$ ). There were no significant statistic values in ICU A. No correlation was observed between NAS and SAPS III in both ICUs. This evidence highlighted the difference between the profile of patients and quantitative nursing personnel.

## 5. CONCLUSION

The NAS instrument showed an increased workload compared to that one recommended by COFEN. NAS also showed a shortage of health personnel to carry out nursing care according to the patient's profile in both ICUs (longer than 17.9 hours). SAPS III showed an increased mortality risk in ICU A than in ICU B. The association between both instruments indicates a lower nursing workload relative to patients with bad prognosis, who presented increased SAPS III and death. NAS proved to be proportionally opposite to SAPS III.

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## TABLES

**Table 1. Percentage distribution from the sample according to the patient's admission diagnosis at ICUs A and B. São José do Rio Preto, 2014**

Diagnostics	UCI A		UCI B	
	N	%	N	%
Cardiovascular Diseases	05	06,5	10	09,3
Endocrine Diseases	02	02,6	01	00,9
Gastrointestinal Diseases	09	11,7	13	12,1
Gynecological/Obstetric Diseases	01	01,3	01	00,9
Neurological Diseases	24	31,1	30	28,0
Orthopedic Diseases	03	03,9	04	03,7
Kidney Diseases	03	03,9	10	09,3
Respiratory Diseases	19	24,7	21	19,6
Neoplasms	00	00	04	03,7
Others*	11	14,3	13	12,1
<b>Grand Total</b>	<b>77</b>	<b>100,0</b>	<b>107</b>	<b>100,0</b>

**Table 2. NAS of the patients admitted to ICUs A and B. São José do Rio Preto, 2014**

NAS	ICU A (%)	ICU B (%)
Minimal	40,5	32,2
Maximum	74,2	96,2
Medium	45,4	63,3

**Table 3. SAPS III score and adapted Equation percentage for Latin America, according to the sample of 77 patients from ICU A. São José do Rio Preto, 2014**

<b>SAPS III</b>	<b>Score</b>
Minimum	17,00
Medium	60,80
Maximum	103,00
<b>Mortality</b>	<b>%</b>
Minimum	0,47
Medium	48,90
Maximum	97,50

**Table 4. SAPS III score and adapted Equation percentage for Latin America, according to the sample of 107 patients from ICU B. São José do Rio Preto, 2014**

<b>SAPS III</b>	<b>Score</b>
Minimum	18,00
Medium	45,71
Maximum	93,00
<b>Mortality</b>	<b>%</b>
Minimum	0,52
Medium	23,33
Maximum	97,33