The 4-year Experience of Nursing Activities Score Use in a Brazilian Cardiac Intensive Care Unit

Elias Rodrigues de Almeida Júnior
Post-graduate Program on Applied Immunology and Parasitology, Federal University of Uberlândia, Uberlandia, Brazil.
ORCID: http://orcid.org/0000-0003-3322-0694
Email: juniorelias_@hotmail.com

Daniel Braga de Oliveira
Nursing, Medicine Faculty, Federal University of Uberlândia, Uberlândia, Brazil.
ORCID: https://orcid.org/0000-0003-2547-1581
Email: danielbraga137@hotmail.com

Gabriela Rodrigues dos Santos
Nursing, Medicine Faculty, Federal University of Uberlândia, Uberlândia, Brazil.
ORCID: https://orcid.org/0000-0002-2220-2856
Email: gabrielasantos0947@gmail.com

Rosângela de Oliveira Felice
Clinical Hospital of Uberlândia, Federal University of Uberlândia, Uberlândia, Brazil.
ORCID: https://orcid.org/0000-0002-6010-7323
Email: rosangelafelice@gmail.com

Fabiola Alves Gomes
Professor at Medicine Faculty, Federal University of Uberlândia, Uberlândia, Brazil.
ORCID: https://orcid.org/0000-0002-3597-1566
Email: fabiola@ufu.br

Clesnan Mendes-Rodrigues (Corresponding author)
Professor at Medicine Faculty, Federal University of Uberlândia, Uberlândia, Brazil.
ORCID: https://orcid.org/0000-0002-8871-7422
Email: clesnan@ufu.br

Abstract

Background: *The assessment of nursing workload offers both support for patient care planning and service management. In an Intensive Care Unit (ICU) this workload is measured by the Nursing Activities Scores (NAS), although in specialized areas such as Cardiology, its use is still diminished.* ***Objective:*** *To describe NAS and the prevalence of its sub-items in a Brazilian Cardiac ICU. We also aimed to evaluate NAS*

oscillation since the opening of the unit, and according to the day of the week. ***Methods:*** *Daily NAS records collected from November 2014 to October 2018 were assessed, totaling 8600 assessments distributed over 49 months. The data were analyzed according to time, day of the week, number of records per day, and dichotomizing if NAS was higher or lower than 50 points.* ***Results:*** *NAS presented mean value of 52.91 points and a median of 53.40 points. The mean NAS values per month ranged from 45.00 to 59.10 points. The percentage of NAS assessments above 50 points ranged from 20.59 to 92.34% per month and proved to be a better indicator for assessing the variability of the monthly workload. When combined two by two, 66.01% of NAS combinations scored more than 100 points, suggesting the need for more than one nursing professional per day. When the data were stratified by year, 2018 had the lowest means compared to the others. When compared to the mean values in function of the day of the week, it was observed that Monday to Friday (with the highest mean on Wednesday, the predominant day for cardiac surgeries) showed higher values than weekends.* ***Conclusions:*** *Overall, NAS showed low values compared to other general or cardiac ICUs, it also presented temporal variability and our results showed risk of workload overload which can compromise patient care and safety. Such results reinforce the importance of the administrative and assistant aspects of the routine use of NAS in ICUs specially in specialized environments as Cardiac ICU.*

Keywords: Nursing; Workload; Intensive Care Unit; Cardiology; Quality Indicator; Patient Safety.

1. Introduction

The Nursing professionals daily work is composed of several assistant and administrative activities, among them are the dimensioning of Nursing staff, preparation of monthly schedules and daily assignment of team activities, and the organization of the service within the hospital units, among others (COFEN, 2017). To stablish work schedules, nurses have some instruments for estimating the Nursing workload being the number of hours that a patient demands from Nursing care in a day of hospitalization (or 24 hours) or in some cases a healthcare in a unit of time and a place (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003; COFEN, 2017).

Intensive Care Units (ICUs) usually present high patient-related complexity of nursing care. In many cases when the dimensioning of Nursing staff is based only on the current legislation the staff in these units may not meet the minimum nursing care needs of the inpatients (Brazil, 2010; Inoue & Matsuda, 2010; Borges et al., 2017). In this scenario, it is essential to measure Nursing workload in these units and debate the work schedules that are recommended and required by the ICUs Brazilian legislation (Brazil, 1998; Brazil, 2010). The currently most used instrument to measure nursing workload in ICU worldwide is Nursing Activities Score (NAS) (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003), validated and translated in Brazil by Queijo and Padilha (Queijo & Padilha, 2009).

The NAS presents the time in 24 hours spent by the nursing team on twenty-three healthcare procedures divided into seven categories. The individual score for each sub-item ranging from 1.2 points to 32 points depending on the activity; the sum of sub-items reaching a maximum of 176.8 total points for the workload. Each point of NAS equals to 14.4 minutes (0.24 hours) of assistance from the Nursing team. (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003). The filling of the items on NAS is performed based

on Nursing activities records performed in the last twenty-four hours of hospitalization, thus providing retrospective data on Nursing workload (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003; Ducci & Padilha, 2008). Although NAS is an instrument that retrospectively assesses workload, it has been used as a measure of workload prediction to be offered in the next 24 hours of assistance with good results (Ducci & Padilha, 2008).

Some studies have shown that NAS application made possible to adjust the number of nursing professionals, as well as to identify nursing shortage, in addition to understand the reality of workload, thus providing essential information to plan out nursing care schedules according to all patient's particularities (Padilha et al., 2010; Nogueira et al., 2013). In this regard, NAS is a helpful instrument both when used as an assistance tool and as an administrative tool, promoting effective management, being able to contribute to an appropriate dimensioning of the nursing team (Macedo et al., 2016).

NAS is widely used in general adult ICUs, but its use on specific settings such as cardiology is still incipient (Coelho, Queijo, Andolhe, Gonçalves, & Padilha, 2011; Reich, Vieira, Lima, & Rabelo-Silva, 2015; Mendes-Rodrigues et al., 2017-b). Some studies carried out with patients in the postoperative period of cardiac surgery have shown NAS ranging from 61.6 points to 96.8 points (Giakoumidakis et al., 2012; Coelho, Queijo, Andolhe, Gonçalves, & Padilha, 2011). Differences depending on the type of ICU on NAS within the same institution are also observed (Mendes-Rodrigues et al., 2017-b). Other studies have shown that cardiac patients in emergency units, in this case in a Chest Pain Unit, have a quite different care profile from other units with higher patient-dependence from the Nursing team (Mendes-Rodrigues et al., 2017-a). This difference between cardiology patients and others could also be present when comparing cardiac or general ICUs or other specialties.

Resolution n. 7, of February 24th, 2010 (Brazil, 2010) and the Consolidation Ordinance n. 3 GM/MS, of September 28th, 2017 (Brazil, 2017) establish that Brazilian ICUs require continuous and mandatory assessment of some indicators as the evaluation of hospital infection rates by Hospitals Infection Control Centers, as the calculation of severity scores or prognosis indexes (e.g. mortality risks), as calculation and presentation of risk of injuries or outcomes, the use of some severity of illness index or systems that help to identify critically ill patients at death risk. Specifically, for nursing, article twenty-three rules the use of the Nursing Care Classification System or a workload index that helps the quantitative and qualitative assessment of nursing human resources needed for patient care. In this case, the workload index currently used in ICUs is NAS. ICUs routinely collect this data from NAS, catalog them, and present them as a public indicator (Brazil, 2010), but often they do not analyze or apply these results in the institution's clinical and administrative practice. Consolidation Ordinance n. 3 GM/MS, of September 28th, 2017 also defines the minimum criteria for staff dimensioning for ICUs (Brazil, 2017).

The applicability of nursing workload estimation instruments has been increasingly emphasized, not only to assist in administrative practices, but also in care practices (Griffiths et al., 2020; Hoogendoorn et al., 2020), since when knowing better the clinical and care profile of their patients, nurses will have a better chance for dimensioning and adjusting their work schedules to make nursing care more efficient and effective. Recently, the interest in studying such instruments as NAS applied in cardiac ICUs has increased (Giakoumidakis et al., 2012; Coelho, Queijo, Andolhe, Gonçalves, & Padilha, 2011), especially since it represents a scarce subject in the scientific literature. In this regard, studying NAS as an administrative and

assistant tool in a Cardiac ICU has the potential to improve the lack of published data on the subject, provide a descriptive study of NAS, and support future studies on the subject. The results of this study can also provide indications of the applicability of quality indicators assessed for ICUs and specifically for Cardiac ICUs. Knowing the impact of nursing care on the quality of health services is essential, and aspects such as workload and staff dimensioning are important factors to explain these results, as what has been reported (Nogueira et al., 2017; Gomes et al., 2019).

Accordingly, the aim of this study is to describe the profile and prevalence of the sub-items of the NAS instrument in the Cardiac Intensive Care Unit of the Clinical Hospital of Uberlândia of the Federal University of Uberlândia based on a four-year experience of using NAS and evaluate its temporal variation since the opening of the unit, and according to years, months and the days of the week.

2. Methods

2.1 Study Design and Location

This is a retrospective, analytical, documentary (internal ICU documents) and longitudinal quantitative study of the experience report of NAS use performed at the Clinical Hospital of Uberlândia (Hospital de Clínicas de Uberlândia in Portuguese), Federal University of Uberlândia (Universidade Federal de Uberlândia in Portuguese), Minas Gerais state, Brazil. This is a teaching complex hospital with about 520 beds. Data were collected at the Cardiac ICU, which helps patients with a cardiovascular disease profile. The unit was opened in November 2014 and consisted of seven beds, with about 30 to 40 monthly admissions documented and mean length of stay between 10 to 15 days, according to indicators of the Statistical Service of the hospital. This Cardiac ICU is classified as type 3, with greater care complexity in Brazilian ICU classification (Brazil, 2017).

2.2 Sample Size and Data Collection

Since NAS is a mandatory daily assessment indicator for all patients admitted to the ICU, based on the unit's accreditation legislation (Brazil, 2010), all records were evaluated from the opening of the unit, November 2014 to October 2018. Besides this, the unit had only seven beds, which reduces the number of records, which based the decision to evaluate all data in the studied period. Assuming an alpha of 0.005 (Benjamin et al., 2018), an expected frequency of 50% for each sub-item of the NAS instrument, and a permissible error of 1%, there would be necessary 19698 assessments of NAS as the minimum sample size to determine the prevalence of a NAS subitem, due to the presence of rare subitems observation.

Data from four years of NAS evaluation were included, grouped into 49 months of evaluation (November 11th, 2014 to October 31st, 2018), consisting of 1482 evaluation days. In these 49 months, 8,600 daily NAS assessments were performed. For each evaluation day, the number of beds evaluated or not was counted. Data were evaluated according to the opening month (month 1: November 2014), day of the week, if it was a weekday or weekend and month and year of evaluation. Data for each NAS evaluation was also dichotomized into NAS higher or lower than 50 points, because Brazilian legislation indicates one nursing professional for every two patients in one shift (Brazil, 2010), which corresponds to a workload of maximum 50 points per patient or added up to two patients up to 100 points. For each assessment day,

where at least two patients were assessed for NAS, the assessments for the day were combined two by two and the sum of NAS of the two assessments was calculated, and each combination was dichotomized as higher or lower than 100 points, once combinations with more than 100 points could express nursing workload overload in a random assignment of patients for a nursing professional

When available, NAS subitems were registered and evaluated for prevalence. We used two bases, considering the patient-day basis (all 4174 available records, representing the prevalence of the sub-items in the records) or as patient basis (673 available records). In the last case, considering the presence of at least one record of sub-item per patient during hospitalization, which represents whether the patient had the record of this sub-item during hospitalization. The patient code registered not permits patient identification.

2.3 Ethical and Legal Aspects

This study did not include any clinical or sociodemographic data of patients in the unit, and neither patients nor their medical records were accessed. All data from NAS are routinely collected in the unit, catalogued and stored in electronic spreadsheets and do not allow identification of any patient. There is no possibility to associate identification of any patient with the collection of data. Since the data were secondary, they were collected from books, spreadsheets and administrative forms from the unit and do not involve approaching patients or their medical records, the study has no indication of submission to the Research Ethics Committee, as it does not involve direct approach to human beings or their hospital records. Some authors of this study are also professionals from the unit, who have unrestricted access to the collected data, and use these indicators in service management. NAS data in the patient base were obtained within the project approved by the Ethics Committee of Federal University of Uberlândia under the number CAAE 38877220.4.0000.5152. Independently, these data are pubic and routinely collected for service management according to regulations for the operation of ICU based on legal requirements (Brazil 2010).

2.4 Statistical Analysis

The data were presented with descriptive statistics according to the type of variable. A significance of 5% was adopted in all analyses. The normality of the data was tested with the Kolmogorov Smirnov Lilliefors test with the package nortest, and the Gamma distribution was tested with the package goft, MASS and fitdistrplus. The frequency of combinations of patients two to two with the criteria of more than 100 points in the NAS was compared to the expected proportion of 1:1 with the Chi-squared adherence test for equal expected proportions (0.5, 0.5). The adjustment of the data of the number of beds evaluated per day to the exponential function was tested with the package (nlseasy). Differences in NAS were analyzed with Generalized Linear Models (GLM) considering as fixed effects in each analysis the year, month since opening, day of the week, and working day dichotomized (weekend and weekday). These effects in GLM were analyzed with Gamma distributions with log link function (Crawley, 2007). The percentage of NAS with more than 50 points evaluated in function of the month of opening were analyzed with GLM adopting binomial distribution with logit link function. When pairwise comparisons were necessary in GLM, we used Tukey test in package (multicomp). All these analyses were conducted using R environment (R Core Team, 2020).

3. Results

Eight thousand and six hundred NAS measurements were included, divided into 49 months and 1482 days, of which only 3.64% of the days no patients were evaluated and in 48.65% of the days, all seven patients from Cardiac ICU were evaluated. Considering at least one patient assessed per day, 96.36% of the days had at least one NAS measurement. The relative frequency or the probability of the number of evaluated patients per day was well adjusted the exponential function with the estimates of the parameters $B_0 = 0.46535651$ ($p = 0.1684$); $B_1 = 0.65934234$ ($p = 0.00046$); (Figure 1). It was also possible to appraise that the number of patients evaluated per day increased over time, although it was not directly tested. Based on records, it was not possible to evaluate the percentage of not evaluation of NAS of patients on a patient-day basis since the real daily occupancy rate was not assessed for the study period.

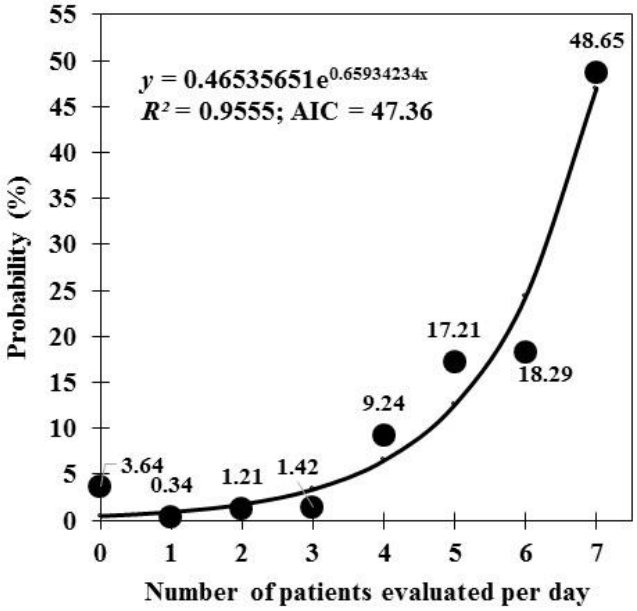

Figure 1 - Relative frequency from number of patients evaluated per day in a Brazilian Cardiac Intensive Care Unit for 1486 days of Nursing Activities Score (NAS) observations for four years (from November 2014 to October 2018).

NAS presented a mean value of 52.91 points (n = 8600, standard deviation = 9.29 points; standard error = 0.10 points, coefficient of variation = 17.56%) and a median of 53.40 points (minimum = 13.60 points; maximum = 140.80 points; interquartile range = 12.60 points). NAS did not adjust a Gaussian distribution (D = 0.081246, $p = 2.2 * 10^{-16}$), and it presented the following quartiles: Quartile 1 = 46.60 points; Quartile 2 = 53.40 points and Quartile 3 = 59.00 points, with an asymmetric distribution of data (Figure 2). The daily NAS evaluation data followed the Gamma distribution (V = -3, $p = 0.06$), with estimated shape parameter of 32.42502 and estimated scale parameter of 0.61290.

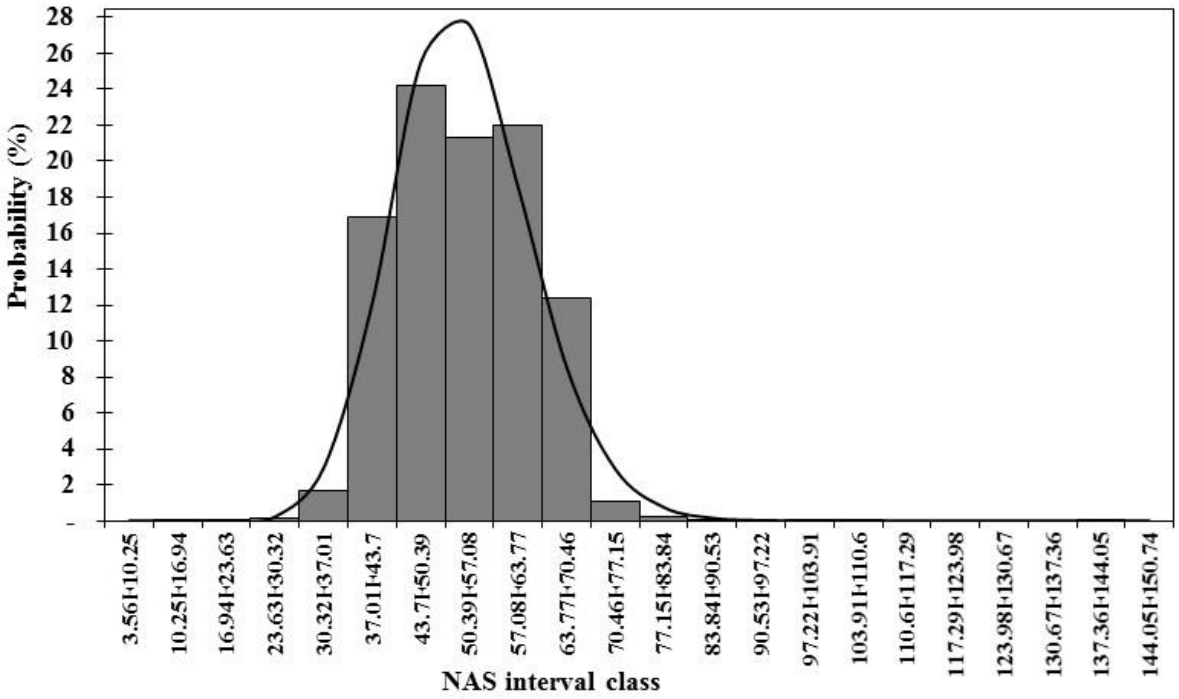

Figure 2 - Histogram and Gamma probability density function (mean = 52.91 points, variance = 23.29 points^2, shape parameter estimative = 32.42502, scale parameter estimative = 0.61290) for 8600 Nursing Activities Score (NAS) observations in a Brazilian Cardiac Intensive Care Unit for four years (from November 2014 to October 2018).

The 49 evaluated months showed mean values that differed from each other (X^2 = 1278.13, *d.f.* = 48, p <0.000001) (Figure 3). The mean NAS values per month ranged from 45.00 points (month 48) to 59.10 points (month 4). The median also differed between the evaluated months (X^2 = 820.32, *d.f.* = 48, p <0.000001) and the median values ranged from 43.60 points (month 42) to 60.75 points (month 40). Based on the adjusted Gamma distribution estimated for all NAS data assessed in this study, the probability of having a NAS assessment greater than 50 points is 60.24%. The percentage of patients above 50 points ranged from 20.59% (month 48) to 92.34% (month 4) (Figure 4) and proved to be a better indicator for assessing monthly workload variability in the unit. This can be observed by detecting the difference between the evaluated months (X^2 = 821.24, *d.f.* = 48, p <0.000001), and by the greater coefficient of variation 28.71% that may show better discrimination between the studied months, against 6.10% for the monthly mean NAS and 8.42% for the median of each month. When combining daily measurements of NAS two by two, workload exceeded 24 hours (> 100 points) in 66.01% of these combinations (14958 combinations in 22659) and was minor than 24 hours in 33.99% of the cases (7701 combinations in 22659). The observed values were different from 1: 1 ratio (X^2 = 2324, p <0.0001), showing a higher prevalence of random combination of patients with a workload greater than 24 hours a day.

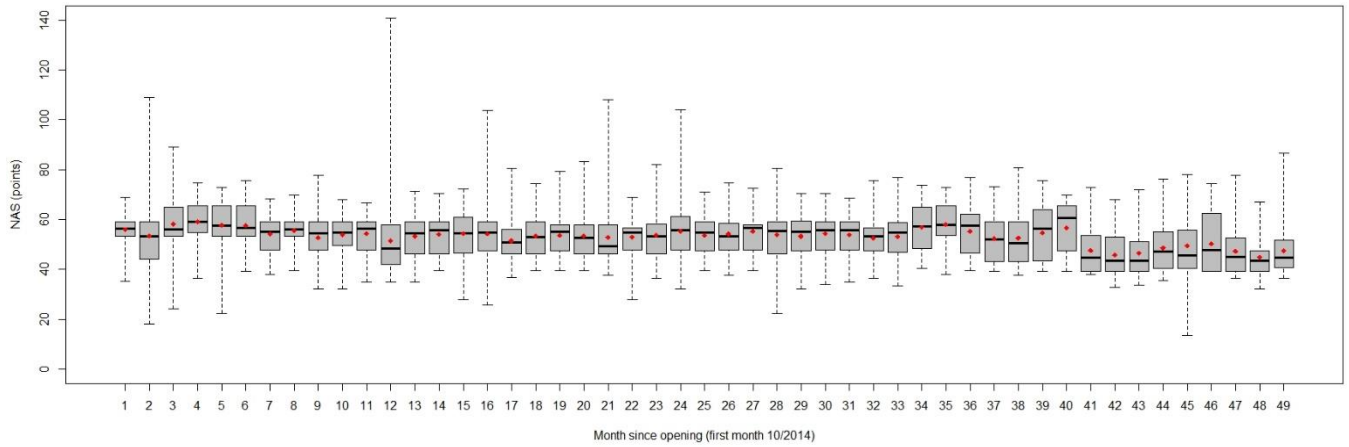

Figure 3 - Boxplots from Nursing Activities Score (NAS) measured during 49 months since opening from a Brazilian Cardiac Intensive Care Unit (from November 2014 to October 2018). Boxplot represented minimum and maximum (whiskers); first quartile, median and third quartile (box); and mean represented by a lozenge.

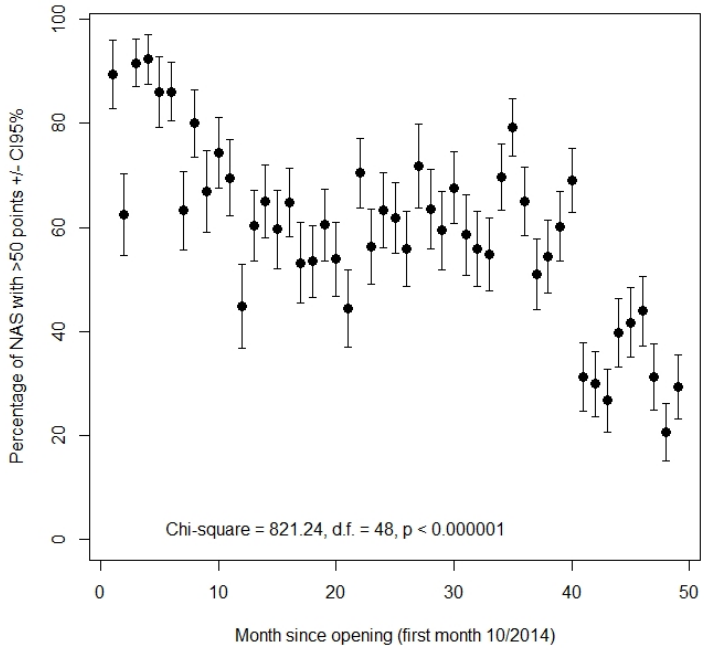

Figure 4 - Plots from Percentage of Nursing Activities Score (NAS) with >50 points ± 95% confidence interval (CI95%) measured during 49 months since opening from a Brazilian Cardiac Intensive Care Unit (from November 2014 to October 2018).

When data were stratified according to the year of sampling, we observed differences between them (X^2 = 1278.13, *d.f.* = 4, p = 0.00042), and when multiple comparisons were performed, year 2018 (mean = 48.51 points) presented the lowest means (Figure 5A) compared to the other years with means between 53 and 56 points. When comparing the mean values in function of the day of the week, a difference was observed between the days of the week (X^2 = 43.29, *d.f.* = 6, p <0.000001). Monday through Friday showed

mean values higher than weekends (Figure 5B). And when dichotomizing these days on weekdays and weekends, we also observed significant differences between the two strata, with mean values being higher during weekdays ($X^2 = 43.29$, $d.f. = 6$, $p < 0.000001$); weekends showed lower mean NAS values with mean of 52.15 points versus 53.21 points for the weekend (Figure 5C).

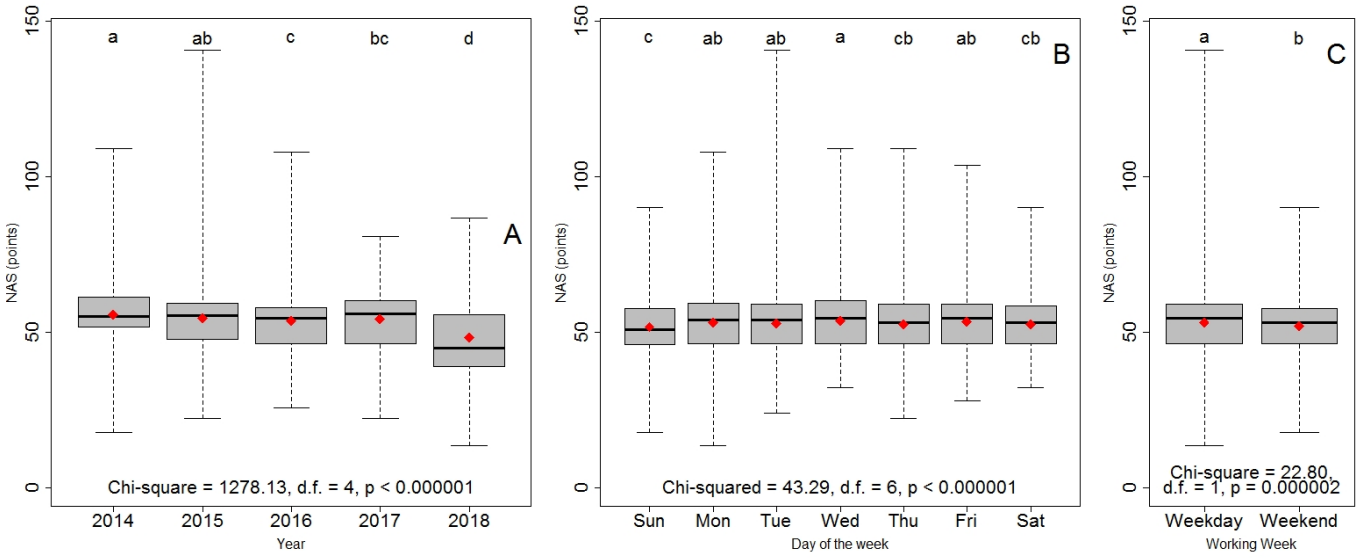

Figure 5 - Boxplots from Nursing Activities Score (NAS) measurements evaluated by year (A), day of the week (B) and working week (C) in a Brazilian Cardiac Intensive Care Unit. Means followed by different lowercase letters, in each boxplot, are different based in Tukey test ($p < 0.05$). Boxplot represented minimum and maximum (whiskers); first quartile, median and third quartile (box); and mean represented by a lozenge.

The most frequently observed NAS items were: 1a - hourly vital signs, regular registration and calculation of fluid balance (97.22%); 2 – laboratory investigations: biochemical and microbiological (100%); 3 - medication, except vasoactive drugs (99.95%); 4 - hygiene procedures (99.66%); 7a - support and care for family members and patients who require exclusive dedication for about an hour in any shift (99.93); 8 - performing routine administrative and managerial tasks (100%); and 17 - quantitative urinary output measurement (94.25%). Items that appeared with lower frequencies were: 1b - presence at bedside and continuous observation or active for 2 hours or more (2.71%); 1c - presence at bedside and active for 4 hours or more (0.07%); 4b - hygiene procedures that last more than 2 hours (0.34%); 6c - performing a procedure with 3 or more nurses at any frequency (0.14%); 13 - intravenous replacement of large fluid losses (1.51%); 14 - left atrium monitoring with or without cardiac output measurement (0.17%); 15 - cardiorespiratory resuscitation in the last 24 hours (1.22%); 18 - measurement of intracranial pressure (0.31%); 19 - treatment of complicated metabolic acidosis/alkalosis (1.22%); and 20 - intravenous hyperalimentation (0.67%). The items that did not receive score on any day were: 4c - hygiene procedures that last more than 4 hours; 7b - support and care for family members and patients who require exclusive dedication for 3 hours or more in any shift; 8b - performing administrative and managerial tasks requiring full dedication for about 2 hours in any shift; and 8c - performing administrative and managerial tasks requiring full dedication for about 4 hours or more in any shift (Table 1).

Table 1. Prevalence (%) for each item and subitem of the Nursing Activities Score from a Brazilian Cardiac Intensive Care Unit, based in patient-day or patient basis.

	Patient-day (4174)				Patient (n=673)			
Sub-items	n	%	LL	UL	n	%	LL	UL
1a	4058	97.22	96.72	97.72	669	99.41	98.82	99.99
1b	113	2.71	2.21	3.20	44	6.54	4.67	8.41
1c	3	0.07	0.00	0.15	1	0.15	0.00	0.44
2	4174	100.00	-	-	673	100.00	-	-
3	4172	99.95	99.89	100.00	673	100.00	-	-
4a	4160	99.66	99.49	99.84	672	99.85	99.56	100.00
4b	14	0.34	0.16	0.51	5	0.74	0.09	1.39
4c	0	0.00	-	-	0	0.00	-	-
5	589	14.11	13.06	15.17	220	32.69	29.15	36.23
6a	2162	51.80	50.28	53.31	598	88.86	86.48	91.23
6b	1993	47.75	46.23	49.26	349	51.86	48.08	55.63
6c	6	0.14	0.03	0.26	4	0.59	0.01	1.18
7a	4171	99.93	99.85	100.00	673	100.00	-	-
7b	0	0.00	-	-	0	0.00	-	-
8a	4174	100.00	-	-	673	100.00	-	-
8b	0	0.00	-	-	0	0.00	-	-
8c	0	0.00	-	-	0	0.00	-	-
9	2346	56.21	54.70	57.71	380	56.46	52.72	60.21
10	1174	28.13	26.76	29.49	199	29.57	26.12	33.02
11	3005	71.99	70.63	73.36	489	72.66	69.29	76.03
12	1603	38.40	36.93	39.88	384	57.06	53.32	60.80
13	63	1.51	1.14	1.88	40	5.94	4.16	7.73
14	7	0.17	0.04	0.29	5	0.74	0.09	1.39
15	51	1.22	0.89	1.56	34	5.05	3.40	6.71
16	872	20.89	19.66	22.12	78	11.59	9.17	14.01
17	3934	94.25	93.54	94.96	659	97.92	96.84	99.00
18	13	0.31	0.14	0.48	10	1.49	0.57	2.40
19	51	1.22	0.89	1.56	29	4.31	2.77	5.84
20	28	0.67	0.42	0.92	4	0.59	0.01	1.18
21	1173	28.10	26.74	29.47	101	15.01	12.31	17.71
22	2327	55.75	54.24	57.26	445	66.12	62.55	69.70
23	514	12.31	11.32	13.31	334	49.63	45.85	53.41

Legend: LL: lower limit of 95% confidence interval for percentage, UL: upper limit of 95% confidence interval for percentage, the LL or UL values not showed refers to items without variance.

4. Discussion

This study presents meaningful results, first revealing that the distribution of the NAS data is asymmetric with concentration to the left since the data's mean is lower than the median, which means that there is a greater concentration of values higher than the mean value of NAS. According to legal regulations criteria (Brazil, 2010; Brazil, 2017), the ICU need a nursing technician (or nurse) for every two patients per work shift and at least one assistant nurse for each eight beds or fraction in each shift. According to our analyzes, 50% of the evaluations were equal to or greater than 53.40 points, which already indicates nursing workload overload for this unit's nursing team based on staff dimensioning legal criteria. This scenario gets worse when our results indicate that 25% of the evaluations are above 59.00 points (quartile 3), highlighting greater nursing workload.

Batassini et al. (2019) showed that less than 10% of NAS measurements have a score below 50 points. The random allocation of two patients to a professional based on previous day can also offer risks to nursing care since in 66.01% of the simulated cases, the NAS of these two patients is greater than 100 points. Consequently, the nurses need to perform a careful assessment of the patient's degree of dependence before design the healthcare in work schedule. The NAS value on the current day or the previous day may be a good criterion for the distribution of work schedule, but this strategy needs to be tested for reliability of NAS's ability to be prospective based on the previous day's reading, although some studies have already shown its good ability to prospect workload. (Reich, Vieira, Lima, & Rabelo-Silva, 2015). All these findings may show a possible insufficient number of professionals in this unit, being that the contrasts of work schedule with the measured workload needed for an adequate work management.

The mean workload values of 52.91 points (12.7 hours of nursing care) observed in our study were lower than in various studies (Ortega, D'Innocenzo, Silva, & Bohomol, 2017; Toffoletto, Oliveira, Andolhe, Barbosa, & Padilha, 2018; Oliveira et al., 2015; Bruyneel et al., 2019; Lucchini et al., 2019). This mean was lower than other ICUs evaluated from the same institution, being this the general adult, neonatal II, neonatal III and pediatric ICUs (Mendes-Rodrigues et al., 2017-b).

The same is observed in comparisons with other general Brazilian ICUs, in a study performed in a university hospital from São Paulo, Brazil, the mean NAS was 66.5 points (Gonçalves, Garcia, Toffoleto, Telles, & Padilha, 2006), and in an adult ICU in the inner of the state of São Paulo, the mean NAS was 62.2 points (Panunto & Guirardello, 2012). Other studies reported a mean NAS value of 65.6 points, with a minimum of 32 points and a maximum of 114 points in a general ICU also in São Paulo. (Ortega, D'Innocenzo, Silva, & Bohomol, 2017) and a mean value of 73.7 points was found (Dias, 2006; Ducci, Zanei, & Whitaker, 2008), both in São Paulo hospitals.

When compared a more specialized scenarios or subpopulation we observed one higher mean NAS too in other ICUs. Mean NAS of 73.40 points was found in a trauma ICU in São Paulo, with a minimum of 35.00 points and a maximum of 123.00 points (Padilha et al., 2017). In another study, the mean NAS found was 74.27 points in patients' victims of adverse events hospitalized in nine ICUs in the city of Sao Paulo, and those who did not suffer adverse events had a mean NAS of 71.20 (Toffoletto, Oliveira, Andolhe, Barbosa, & Padilha, 2018).

In the international scenario we also found higher mean NAS, in a study performed in ICUs of 16

Belgian hospitals, mean NAS of 68.6 points was reported (Bruyneel et al., 2019). Another study executed in a Spanish ICU found mean NAS of 70.9 points (Zuazua-Rico, Mosteiro-Diaz, Maestro-Gonzalez, & Fernandez-Garrido, 2020). In a survey performed in a general ICU from an Italian university hospital mean NAS of 72.5 points was reported. And another study performed between 2015 and 2016 at five university hospitals from Rasht city in Iran, obtained mean NAS of 72.8 points (Moghadam et al., 2020).

Regarding direct comparisons with Cardiac ICUs, data are scarce, but our mean NAS is lower than other ICUs that treat some cardiologic aspects. Mean daily NAS of 74.6 points was reported in a study from a public teaching hospital in São Paulo, Brazil, in a specialized postoperative period of heart surgery ICU (Dias, 2006). And in the same city, mean NAS of 82.4 points was found in a study performed in a surgical ICU from a cardiac specialized institute (Oliveira et al., 2015). Another study performed in a cardiac ICU in an Italian university hospital found a mean NAS of 63.5 points. In all this cases, the mean NAS observed was higher than found by us.

All these findings show that both developed and developing countries can find NAS values higher than what was observed in our study, and even when comparing to general or cardiac ICUs, previously observed NAS values are higher than those reported by us, even when evaluating variation in months that had NAS values between 45.00 and 59.09 points. The NAS lower values could be justified by two hypotheses as differences between the units or the inaccurate use of the NAS instrument. In the beginning of NAS implementation in the unit, data were not routinely evaluated by the nurse team. It is fundamental to emphasize the need for future studies to evaluate nurse's capacity and efficiency to apply NAS daily, and to create strategies to avoid misuse and misinterpretation of NAS. Since this study is of administrative nature, it was not possible to associate NAS with the patients' profile, and the fact that most other similar studies were performed in Sao Paulo city in higher care complexity and larger ICUs than this unit in Uberlândia, could also explain why our mean NAS is lower. Another hypothesis is that NAS reflected the unit's evolution through the 49 months, a long period, with several phases of development and growth of the area covered by the Clinical Hospital of Uberlândia. Despite this, we observed a tendency to decrease the NAS values and the percentage of patients with NAS greater than 50 points over time, which does not corroborate the previous hypothesis. More studies are still needed to clarify the determinants of lower values of NAS in the studied ICU.

We observed the highest NAS values on Wednesdays, which for a long time was this units' cardiac surgeries day, which in the following years were scheduled for Mondays and Fridays, although this pattern was not constant, thus it does not allow direct associations. Also on Wednesday is the day in that the most severe patients were selected to surgery since in the middle of the week the medical team was able to better prepare patients for surgical procedures. They avoided operate more severely ill patients on Fridays due to the proximity to the weekend, and on Mondays, since they were unable to organize the logistics at the weekend to perform more complex surgeries. On other days of the week, the profile of patients seen in the unit was different, with patient healthcare related to before and after coronary angioplasty, pre- and post-operative of cardiac pacemaker implantation, care for postpartum women with heart disease, among others. With this resulted in patients demanding less attention from the nursing team, and consequently lower NAS means when compared to complex ICUs in metropolitan regions with often cardiac surgeries in all days. Although our study does not consider the patients' causes of ICU admission several studies associate diagnosis with workload (Gomes et al., 2019; Kraljic et al., 2017). Reich, Vieira, Lima, & Rabelo-Silva (2015) reported that hospitalized patients with heart failure and endovascular aneurysm have higher demands from the

nursing professionals. In clinical practice, certain more severe health conditions cause greater dependence on nursing care, thus generating greater workload (Reich, Vieira, Lima, & Rabelo-Silva, 2015). Sousa, Gonçalves, Toffoleto, Leão, & Padilha (2008) stated that the unique variable correlated with nursing workload with significant values was the cause of hospitalization, verifying that surgical patients need longer time of assistance when compared to inpatients with other clinical dysfunctions. Another study reported that surgical patients are 2.79 times more likely to require long times of assistance in the first 24 hours of hospitalization than patients undergoing clinical treatment (Inoue, Kuroda, & Matsuda, 2011). Apparently, our studied unit's patients' profile may be associated with low NAS values compared to other ICUs, but this hypothesis has yet to be tested.

Regarding nursing care needs, the items and sub-items most frequently observed were routine tasks, hourly vital signs, regular registration and calculation of fluid balance, biochemical and microbiological investigations, medication, quantitative urinary output measurement, hygiene procedures and support and care for family members and patients for about an hour. A study performed in a Cardiac Unit in the Southern region of Brazil brings results like ours (Reich, Vieira, Lima, & Rabelo-Silva, 2015), and other surveys in general and cardiac surgery ICUs confirm our results about the frequency of the items laboratory investigations, medications, quantitative urinary output measurement and support and care for family members (Conishi & Gaidzinski, 2007; Dias, 2006). The high frequency of these nursing activities illustrates the ICUs routine and considerably contributes to increase of workload, since they are customary and repetitive tasks, in addition to requiring knowledge and skills beyond technique (Reich, Vieira, Lima, & Rabelo-Silva, 2015).

4.1 Experience, strengths and limitations of the study

Since the opening of the Cardiac ICU at the Clinical Hospital of Uberlândia of the Federal University of Uberlândia, NAS collection has been done by the team of nurses from the unit, obeying legal requirements and supplying internal indicators. How NAS has been collected from the beginning of the unit's activities, it was possible to execute a broad study with many collections, which allowed us to obtain more accurate descriptions from NAS, as well as to draw a clear profile of workload and its many elements such as the time variation and variation depending on the day of the week. In addition, it allows construction of indicators that may have great applicability in the staff's work. Long-term studies of workload indicators are rare. We can mention Nogueira et al. (2017) that correlates the effect of hours of nursing care on the results of intensive care assistance for a period of 36 months, evaluating indicators such as phlebitis and pneumonia. However, long term studies like ours, in which NAS has been evaluated over time are scarce in the scientific literature (e.g. Castro et al. 2020).

Some limitations of our study must be considered. We can mention the fact that we do not include the assessment of the patients profiles, since with certain information such as history of illnesses and lifestyle habits, therapeutic interventions or surgeries performed, organ dysfunction, severity index (Simplified Acute Physiologic Score), length of stay , death, among others, we would have the opportunity to observe from other perspectives how the patient's profile collaborates with the fluctuation of the workload, as analyzed by Oliveira et al., (2015). Another limitation would be the validation of the data, since during NAS collection, divergent and sometimes inconsistent data were found, such as wrong sums, copy of previous day's collection and spelling errors, and even after deletion and correction of these values,

these errors could limit our study.

In the present study, in only 3.64% of the days there was no NAS collection, and in 51.35% of the days not all patients were evaluated, which may indicate a weakness in the workload assessment system in the unit in initial years, which reflects in the daily work planning and indicators. However, it was a limitation of the unit itself, since at the beginning of NAS implementation, not all professionals performed collections or were trained to perform the assessment, but this scenario started to change from the moment more training was implemented with the unit's nursing team, and over time the number of collections increased. Despite this, most studies with NAS have evaluated a limited number of NAS assessments in some scenarios (Mendes-Rodrigues et al., 2017-b; Camuci et al., 2014; Cyrino et al., 2017).

One of the main factors that can hinder adherence and proper application of NAS is the insufficient number of human resources (Ferreira, Machado, Vitor, Lira, & Martins, 2014). As a routine, NAS is applied in the studied unit at night, and analyzing work schedules available in the online and public scales system at the Clinical Hospital of Uberlândia, on most nights the Cardiac ICU had only one nurse responsible for assistant and administrative activities. Another hypothesis is the communication failure (predominantly in nursing notes and shift change) among professionals, which could lead to the loss of information and a mistaken analysis of the NAS. The obvious workload overload of this professionals could be combined with lack of preparation and insufficient knowledge to correctly apply the NAS instrument, resulting not only in failure to efficiently perform their tasks, but also in failure to use NAS, causing a cascade of irregularities.

4.2 Recommendations

The Nursing Activities Score is a valuable instrument used in ICU as an administrative tool to assess the required amount of care for a patient in the next work shift, and to estimate workload more effectively and even improve financial resources (Inoue & Matsuda, 2010). The application of this instrument aims to avoid inaccurate dimensioning, which if used correctly can improve nursing assistance quality, as well as assist in the allocation of human resources, monitoring of productivity and financial processes, thus stipulating minimum criteria for the organization of an adequate nursing staff and nursing technicians to meet demands of the service (Morais et al., 2011). The impact of use and application of workload instruments is still incipient (Griffiths et al., 2020).

Accordingly, the importance of assessing workload and dimensioning the nursing team is unquestionable, since adequate quantity and quality of human resources is fundamental for patients' integral care (Panunto & Guirardello, 2012) and safety. Correspondingly, our work should encourage other researchers to expand the study of NAS in Cardiac ICUs and in other specialized units to improve investigations of which factor could affect nursing workload and impact adequate work conditions for nursing professionals, as well as safety and quality of life for professionals and patients.

5. Conclusion

In conclusion, although the mean value found here for NAS in this Cardiac ICU is relatively lower than what has been found in other general or cardiac ICUs, it has temporal variability and as it is above 50

points it may indirectly represent workload overload, which can compromise patient care. The temporal variability and the high frequency of high NAS values (higher 50 points) demonstrates the need for continuous monitoring of nursing workload indicators and continuous assessment of the dimensioning of the nursing team for the unit, allowing better planning of integral care, reducing risks and promoting greater patient safety and quality of life for both professionals and patients.

6. Acknowledgements

We would like to thank the "Unidade Coronariana - UCO" team at the "Universidade Federal de Uberlândia" for support during the study and for the release of the administrative data. We also thank the "Conselho Nacional de Desenvolvimento Científico e Tecnológico" (CNPq) (PIBIC/PIBITI CNPq) and "Universidade Federal de Uberlândia" for the scientific initiation scholarship to the first author

7. References

Batassini, É., Silveira, J. T. da, Cardoso, P. C., Castro, D. E., Hochegger, T., Vieira, D. F. V. B., & Azzolin, K. de O. (2019). Nursing Activities Score: Qual periodicidade ideal para avaliação da carga de trabalho? Acta Paulista de Enfermagem, 32(2), 162–168. https://doi.org/10.1590/1982-0194201900023

Benjamin, D. J., Berger, J. O., Johannesson, M., Nosek, B. A., Wagenmakers, E.-J., Berk, R., … Johnson, V. E. (2018). Redefine statistical significance. Nature Human Behaviour, 2(1), 6–10. https://doi.org/10.1038/s41562-017-0189-z

Borges, F., Bohrer, C. D., Bugs, T. V., Nicola, A. L., Tonini, N. S., & De Oliveira, J. L. C. (2017). Dimensionamento de pessoal de enfermagem na uti-adulto de hospital universitário público. Cogitare Enfermagem, 22(2). https://doi.org/10.5380/ce.v22i2.50306

Brasil. Ministério da Saúde (1998). Portaria n. 3.432, de 12 de agosto de 1998. Estabelece Critérios de Classificação para as Unidades de Tratamento Intensivo [Internet]: http://bvsms.saude.gov.br/bvs/saudelegis/gm/1998/prt3432_12_08_1998.html

Brasil. Agência Nacional de Vigilância Sanitária. (2010) Resolução da Diretoria Colegiada nº 7, de 24 de fevereiro de 2010. Dispõe sobre os requisitos mínimos para funcionamento de unidades de terapia intensiva e dá outras providências. Diário Oficial da União

Brasil. Ministério da Saúde. Portaria de Consolidação nº 3, de 28 de setembro de 2017. [Internet]: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2017/prc0003_03_10_2017_comp.html16.BR

Bruyneel, A., Tack, J., Droguet, M., Maes, J., Wittebole, X., Miranda, D. R., & Pierdomenico, L. D. (2019). Measuring the nursing workload in intensive care with the Nursing Activities Score (NAS): A prospective study in 16 hospitals in Belgium. Journal of Critical Care, 54, 205–211.

https://doi.org/10.1016/j.jcrc.2019.08.032

Camuci, M. B. et al. (2014). Nursing Activities Score: nursing work load in a burns Intensive Care Unit. Revista Latino-americana de Enfermagem, 22(2), 325-331. https://doi.org/10.1590/0104-1169.3193.2419

Castro, M. C. N., Almeida, P. M. V., Dell'Acqua, M. C. Q., Spiri, W. C., Cyrino, C. M. S., Jensen, R. (2020) Avaliação temporal da carga de trabalho de enfermagem em UTI. Revista Científica de Enfermagem, 10(32), 3-10. https://doi.org/10.24276/rrecien2020.10.32.3-10

Coelho, F. U. de A., Queijo, A. F., Andolhe, R., Gonçalves, L. A., & Padilha, K. G. (2011). Carga de trabalho de enfermagem em unidade de terapia intensiva de cardiologia e fatores clínicos associados. Texto & Contexto - Enfermagem, 20(4), 735–741. https://doi.org/10.1590/S0104-07072011000400012

Conishi, R, Gaidzinski, R. R. (2007). Nursing Activities Score (NAS) como instrumento para medir carga de trabalho de enfermagem em UTI adulto. Revista da Escola de Enfermagem da USP, 41(3), 346-354. https://doi.org/10.1590/S0080-62342007000300002

Conselho Federal de Enfermagem (2017) Resolução COFEN Nº 543/2017, de 18 de abril de 2017. Atualiza e estabelece parâmetros para o Dimensionamento do Quadro de Profissionais de Enfermagem nos serviços/locais em que são realizadas atividades de enfermagem. [Internet]: http://www.cofen.gov.br/resolucao-cofen-5432017_51440.html.

Crawley M. J. (2007) Generalized linear models in the R book, John Wiley, Chichester.

Cyrino, C. M. S., Dell'Acqua, M. C. Q., Castro, M. C. N. e, Oliveira, E. M. de, Deodato, S., & Almeida, P. M. V. de. (2017). Nursing activities score by assistance sites in intensive care units. Escola Anna Nery, 22(1), e20170145. https://doi.org/10.1590/2177-9465-ean-2017-0145

Dias, M. C. C. B. (2006). Aplicação do Nursing Activities Score – NAS.: como instrumento de medida de carga de trabalho de enfermagem em UTI Cirúrgica Cardiológica. [Master degree dissertation], Escola de Enfermagem da Universidade de São Paulo, 115pp.

Ducci, A. J., & Padilha, K. G. (2008). Nursing Activities Score: Estudo comparativo da aplicação retrospectiva e prospectiva em unidade de terapia intensiva. Acta Paulista de Enfermagem, 21(4), 581–587. https://doi.org/10.1590/S0103-21002008000400008

Ducci, A. J., Zanei, S. S. V., & Whitaker, I. Y. (2008). Carga de trabalho de enfermagem para quantificar proporção profissional de enfermagem/paciente em UTI cardiológica. Revista da Escola de Enfermagem da USP, 42(4), 673–680. https://doi.org/10.1590/S0080-62342008000400009

Ferreira, P. C., Machado, R. C., Vitor, A. F., Lira, A. L. B. de C., & Martins, Q. C. S. (2014). Nursing measure in intensive care unit: Evidence about the Nursing Activities Score. Revista da Rede de Enfermagem do Nordeste, 15(5), 888-897. https://doi.org/10.15253/2175-6783.2014000500019

Giakoumidakis, K. et al. (2012) Risk factors for increased in-hospital mortality: a cohort study among cardiac surgery patients. European Journal of Cardiovascular Nursing, 11(1), 23-33. https://doi.org/10.1016/j.ejcnurse.2010.09.005

Gomes, F. A., Röder, D. V. D. de B., Cunha, T. M., Felice, R. D. O., Mendonça, G. S., & Mendes-Rodrigues, C. (2019). The nursing workload assessed through the Nursing Activities Score as a predictor for the occurrence of ventilator-associated pneumonia in an adult intensive care unit. Journal of Nursing Education and Practice, 9(9), 104. https://doi.org/10.5430/jnep.v9n9p104

Gonçalves, L. A., Garcia, P. C., Toffoleto, M. C., Telles, S. C. R., & Padilha, K. G. (2006). Necessidades de cuidados de enfermagem em Terapia Intensiva: Evolução diária dos pacientes segundo o Nursing Activities Score (NAS). Revista Brasileira de Enfermagem, 59(1), 56–60. https://doi.org/10.1590/S0034-71672006000100011

Griffiths, P., Saville, C., Ball, J., Jones, J., Pattison, N., & Monks, T. (2020). Nursing workload, nurse staffing methodologies and tools: A systematic scoping review and discussion. International Journal of Nursing Studies, 103, 103487. https://doi.org/10.1016/j.ijnurstu.2019.103487

Hoogendoorn, M. E., Margadant, C. C., Brinkman, S., Haringman, J. J., Spijkstra, J. J., & de Keizer, N. F. (2020). Workload scoring systems in the Intensive Care and their ability to quantify the need for nursing time: A systematic literature review. International Journal of Nursing Studies, 101, 103408. https://doi.org/10.1016/j.ijnurstu.2019.103408

Inoue, K. C., & Matsuda, L. M. (2010). Dimensionamento de pessoal de enfermagem em Unidade de Terapia Intensiva para adultos. Acta Paulista de Enfermagem, 23(3), 379–384. https://doi.org/10.1590/S0103-21002010000300011

Inoue, K. C., Kuroda, C. M., & Matsuda, L. M. (2011). Nursing Activities Scores (NAS): Carga de trabalho de enfermagem em UTI e fatores associados. Ciência, Cuidado e Saúde, 10(1), 134–140. https://doi.org/10.4025/cienccuidsaude.v10i1.14915

Kraljic, S., Zuvic, M., Desa, K., Blagaic, A., Sotosek, V., Antoncic, D., & Likic, R. (2017). Evaluation of nurses' workload in intensive care unit of a tertiary care university hospital in relation to the patients' severity of illness: A prospective study. International Journal of Nursing Studies, 76, 100–105. https://doi.org/10.1016/j.ijnurstu.2017.09.004

Lucchini, A., Elli, S., De Felippis, C., Greco, C., Mulas, A., Ricucci, P., … Foti, G. (2019). The evaluation of nursing workload within an Italian ECMO Centre: A retrospective observational study. Intensive and Critical Care Nursing, 55, 102749. https://doi.org/10.1016/j.iccn.2019.07.008

Macedo, A. P. M. de C., Mendes, C. M. F. S., Candeias, A. L. S., Sousa, M. P. R., Hoffmeister, L. V., & Lage, M. I. G. S. (2016). Validação do Nursing Activities Score em unidades de cuidados intensivos portuguesas. Revista Brasileira de Enfermagem, 69(5), 881–887. https://doi.org/10.1590/0034-7167-2016-0147

Mendes-Rodrigues, C., Antunes, A. V., Mendonça, G. S., Braga, I. A., Gomes, F. A. (2017-a). Perfil de uma unidade de dor torácica em hospital universitário quanto ao tipo de cuidado. Revista da Sociedade de Cardiologia do Estado de São Paulo, 27(4), 163–167. https://doi.org/10.29381/0103-8559/20172704S163-7

Mendes-Rodrigues, C., Costa, K. E. S., Antunes, A. V., Gomes, F. A., Rezende, G. J., & Silva, D. V. (2017-b). Carga de trabalho e dimensionamento de pessoal de enfermagem em unidades de terapia intensiva. Revista Brasileira Ciências da Saúde, 15 (33), 5-13. https://doi.org/10.13037/ras.vol15n53.4159

Miranda, D. R., Nap, R., de Rijk, A., Schaufeli, W., & Iapichino, G. (2003). Nursing Activities Score: Critical Care Medicine, 31(2), 374–382. https://doi.org/10.1097/01.CCM.0000045567.78801.CC

Moghadam, K. N., Chehrzad, M. M., Masouleh, S. R., Mardani, A., Maleki, M., Akhlaghi, E., & Harding, C. (2020). Nursing workload in intensive care units and the influence of patient and nurse characteristics. Nursing in Critical Care, nicc.12548. https://doi.org/10.1111/nicc.12548

Morais, F. R. C. et al. (2011) Resgatando o cuidado de enfermagem como prática de manutenção da vida: concepções de Collière. Revista Enfermagem UERJ, 19(2), 305-310.

Nogueira, L. de S., Koike, K. M., Sardinha, D. S., Padilha, K. G., & Sousa, R. M. C. de. (2013). Nursing workload in public and private intensive care units. Revista Brasileira de Terapia Intensiva, 25(3), 225–232. https://doi.org/10.5935/0103-507X.20130039

Nogueira, T. do A., Menegueti, M. G., Perdoná, G. da S. C., Auxiliadora-Martins, M., Fugulin, F. M. T., & Laus, A. M. (2017). Effect of nursing care hours on the outcomes of Intensive Care assistance. PLOS ONE, 12(11), e0188241. https://doi.org/10.1371/journal.pone.0188241

Oliveira, L. B. de, Rodrigues, A. R. B., Püschel, V. A. de A., Silva, F. A. da, Conceição, S. L. da, Béda, L. B., … Secoli, S. R. (2015). Avaliação da carga de trabalho no pós-operatório de cirurgia cardíaca segundo o Nursing Activities Score. Revista da Escola de Enfermagem da USP, 49(spe), 80–86. https://doi.org/10.1590/S0080-623420150000700012

Ortega, D. B., D'Innocenzo, M., Silva, L. M. G. da, & Bohomol, E. (2017). Análise de eventos adversos em pacientes internados em unidade de terapia intensiva. Acta Paulista de Enfermagem, 30(2), 168–173. https://doi.org/10.1590/1982-0194201700026

Padilha, K. G., Barbosa, R. L., Andolhe, R., Oliveira, E. M. de, Ducci, A. J., Bregalda, R. S., & Secco, L. M. D. (2017). Carga de trabalho de enfermagem, estresse/burnout, satisfação e incidentes em unidade de terapia intensiva de trauma. Texto & Contexto - Enfermagem, 26(3). e1720016 https://doi.org/10.1590/0104-07072017001720016

Padilha, K. G., de Sousa, R. M. C., Garcia, P. C., Bento, S. T., Finardi, E. M., & Hatarashi, R. H. K. (2010). Nursing workload and staff allocation in an intensive care unit: A pilot study according to Nursing Activities Score (NAS). Intensive and Critical Care Nursing, 26(2), 108–113. https://doi.org/10.1016/j.iccn.2009.12.002

Panunto, M. R., & Guirardello, E. de B. (2012). Carga de trabalho de enfermagem em Unidade de Terapia Intensiva de um hospital de ensino. Acta Paulista de Enfermagem, 25(1), 96–101. https://doi.org/10.1590/S0103-21002012000100017

Queijo, A. F., & Padilha, K. G. (2009). Nursing Activities Score (NAS): Cross-cultural adaptation and validation to Portuguese language. Revista da Escola de Enfermagem da USP, 43(spe), 1018–1025. https://doi.org/10.1590/S0080-62342009000500004

R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/

Reich, R., Vieira, D. F. V. B., Lima, L. B. de, & Rabelo-Silva, E. R. (2015). Nursing workload in a coronary unit according to the Nursing Activities Score. Revista Gaúcha de Enfermagem, 36(3), 28–35. https://doi.org/10.1590/1983-1447.2015.03.51367

Sousa, C. R. de, Gonçalves, L. A., Toffoleto, M. C., Leão, K., & Padilha, K. G. (2008). Predictors of nursing workload in elderly patients admitted to intensive care units. Revista Latino-Americana de Enfermagem, 16(2), 218–223. https://doi.org/10.1590/S0104-11692008000200008

Toffoletto, M. C., Oliveira, E. M. de, Andolhe, R., Barbosa, R. L., & Padilha, K. G. (2018). Comparação entre gravidade do paciente e carga de trabalho de enfermagem antes e após a ocorrência de eventos adversos em idosos em cuidados críticos. Texto & Contexto - Enfermagem, 27(1). e3780016 https://doi.org/10.1590/0104-070720180003780016

Zuazua-Rico, D., Mosteiro-Diaz, M. P., Maestro-Gonzalez, A., & Fernandez-Garrido, J. (2020). Nursing

workload, knowledge about pain, and their relation to pain records. Pain Management Nursing, 21(6), 510–515. https://doi.org/10.1016/j.pmn.2020.03.009