Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

Severity and nursing workload in patients critically ill with COVID-19

Gravidade e carga de trabalho de enfermagem em pacientes críticos com COVID-19

Gravedad y carga de trabajo de enfermería en pacientes en estado crítico con COVID-19

Silmara Meneguin[I]; Mariele Gobo de Oliveira[I]; Brenda Xavier Campos[I]; Monique Antônia Coelho[I]

[I]Universidade Estadual Paulista "Júlio de Mesquita Filho", Botucatu, Brazil

ABSTRACT

Objective: to investigate the correlation between nursing workload and severity index in patients with COVID-19 in an Adult Intensive Care Unit. **Method:** this retrospective, cross-sectional study was conducted between February and October 2020, with data from 93 patients with COVID-19. Severity analysis was performed according to the Acute Physiology Age and Chronic Health Evaluation method and workload, by the Nursing Activities Score. **Results:** patients were predominantly elderly, male, with one or more comorbidities, and hospitalized for more than seven days. The average Nursing Activities Score at admission was 74.2 and the severity index was 24.47, with 66.6% lethality. Significant correlation was found between workload and patient severity (0.5132; p <0.0001). **Conclusion:** nursing workload correlated moderately with severity of patients with COVID-19. The study findings can help in scaling nursing staffs and preventing adverse events.

Descriptors: COVID-19; Intensive Care Units; Nursing Team; Workload; Severity of Illness Index.

RESUMO

Objetivo: investigar a correlação da carga de trabalho de enfermagem e índice de gravidade em pacientes com COVID-19, em Unidade de Terapia Intensiva Adulto. **Método**: estudo transversal, retrospectivo, realizado entre fevereiro e outubro de 2020, com dados de 93 pacientes com COVID-19. A análise da gravidade foi realizada segundo o *Acute Physiology Age and Chronic Health Evaluation* e a carga de trabalho pelo *Nursing Activities Score*. **Resultados**: prevaleceram idosos, sexo masculino, com uma ou mais comorbidades, com internação superior a sete dias. A média do *Nursing Activities Score* admissional foi de 74,2 pontos e o índice de gravidade de 24,47, com letalidade de 66,6%. Identificada correlação significante entre carga de trabalho e gravidade do paciente (0,5132; p<0,0001). **Conclusão:** carga de trabalho de enfermagem correlacionou-se moderadamente com a gravidade dos pacientes com COVID-19. Os resultados deste estudo podem auxiliar no dimensionado de enfermagem e prevenção de eventos adversos.

Descritores: COVID-19; Unidades de Terapia Intensiva; Equipe de Enfermagem; Carga de Trabalho; Índice de Gravidade de Doença.

RESUMEN

Objetivo: investigar la correlación de la carga de trabajo de enfermería y el índice de gravedad en pacientes con COVID-19, en una Unidad de Cuidados Intensivos de Adultos. **Método:** estudio transversal, retrospectivo, realizado entre febrero y octubre de 2020, con datos de 93 pacientes con COVID-19. El análisis de la severidad se realizó de acuerdo con la *Acute Physiology Age and Chronic Health Evaluation* y la carga de trabajo de acuerdo con el *Nursing Activities Score*. **Resultados:** predominó el adulto mayor, del sexo masculino, con una o más comorbilidades, hospitalizado desde hace más de siete días. El Nursing Activities Score medio al ingreso fue de 74,2 puntos y el índice de gravedad de 24,47, con una letalidad del 66,6%. Se identificó una correlación significativa entre la carga de trabajo y la gravedad del paciente (0,5132; p<0,0001). **Conclusión:** la carga de trabajo de enfermería se correlacionó moderadamente con la gravedad de los pacientes con COVID-19. Los resultados de este estudio pueden auxiliar en el dimensionamiento de la enfermería y la prevención de eventos adversos.

Descriptores: COVID-19; Unidades de Cuidados Intensivos; Grupo de Enfermería; Carga de Trabajo; Índice de Severidad de la Enfermedad.

INTRODUCTION

The Coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in December 2019 and rapidly became a severe public health problem[1]. However, the development of vaccines with an increasingly broad spectrum at the end of 2020 has provided adequate immune protection against the virus, despite mutations in the SARS-CoV-2 genome and the emergence of new variants that contributed to a decrease in the vaccines' effectiveness[2].

Additionally, data provided by the Centers for Disease Control and Prevention (CDC) show that vaccines are not equally distributed worldwide, and developing countries cannot always follow the recommended immunization scheme[3,4]. Nevertheless, mortality rates decreased worldwide; 6,572,800 people died up to October 2022. Brazil stands out in this context, with 688,157 deaths and an average of 2,000 cases/month after vaccination[5].

Corresponding author: Silmara Meneguin. E-mail: E-mail: s.meneguin@unesp.br
Editor in chief: Cristiane Helena Gallasch; Associate Editor: Magda Guimarães de Araujo Faria

Received: Jul 22nd 2022 – Accepted: Dec 21st 2022

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

This highly contagious disease is characterized by flu-like symptoms, coughing, and fever, which can progress to pneumonia and, in the most severe cases, dyspnea accompanied by respiratory failure and death [6].

Estimated mortality among those in Intensive Care Units (ICU) and requiring invasive mechanical ventilation (IMV)[7] ranges between 8.1% and 97%, considering that approximately two-thirds of the patients are affected by Severe Acute Respiratory Syndrome (SARS), which is characterized by the acute onset of hypoxemic respiratory failure with bilateral infiltrates[8]. A study during the pandemic addressing 250,000 hospital admissions due to COVID-19 in Brazil verified a high mortality rate (55%) in ICU patients and even a higher rate among those using invasive mechanical ventilation (80%)[9].

As a result, the care routine of ICU nursing professionals suddenly changed during the pandemic. In addition to the risk of imminent contamination, workers had to adapt to the care provided to severely ill patients and a great demand for other therapeutic activities. Thus, the nursing workload has become an important indicator to reasonably and appropriately determine staff dimensioning to promote safe and quality nursing care.

In this context, workload measurement instruments have been of interest in the nursing field as using these tools allows improving strategies used to dimension the staff according to work demand.

The Nursing Activities Score (NAS) is one of the most important instruments to measure nursing workload. It is based on the time spent on nursing activities considering the care provided. The instrument[10] was adapted and validated in Brazil in 2009[11] and has been used to assess the workload of ICU nurses. A point is assigned to each item, and the number of points represents the score assigned to a patient. This score corresponds to this patient's direct and indirect care needs in the last 24 hours. Each score corresponds to 14.4 minutes spent delivering care[10].

However, the nursing team's working time is influenced by several factors, including the severity of a patient and prognosis, which can be measured by instruments such as the Acute Physiology, Age and Chronic Health Evaluation – II (APACHE – II)[12,13].

The APACHE prognostic scoring system was developed in 1981 at the University of Washington and uses basic physiological principles to stratify adult patients according to the level of severity. This system was based on the hypothesis that the severity of an acute illness and, therefore, the risk of death can be measured by quantifying the extent of disturbances in certain physiological parameters[12]. Estimating the prognosis using a disease severity score is important within ICUs, as it also allows allocating resources and comparing the performance between units, even if it changes over time[14].

The NAS was developed to measure nursing workload regardless of a patient's disease severity. However, its correlation with a severity score was deemed necessary given the complexity of COVID-19. In addition, it is known that the ICU is a place organized to provide care to critically ill patients who demand continuous monitoring and multiple modalities of physiological support to sustain life during a period of acute failure of the organ system, which imposes a heavy workload on the health staff, especially to nursing workers[15].

Thus, this study is expected to contribute to improved care planning for critical patients affected by the coronavirus and staff dimensioning.

Given the previous discussion, this study's objective was to investigate the correlation between nursing workload and the severity index of COVID-19 patients in an ICU.

METHOD

This cross-sectional, retrospective study, with a quantitative approach, was conducted in the adult ICU of a tertiary-level public hospital in the interior of São Paulo, from February to October 2020, due to the onset of the COVID-19 pandemic.

The ICU addressed here is a referral unit, providing care to patients from the regulatory vacancy center, serving several surrounding cities and patients referred by the Emergency Room, Surgical Center, and Inpatient Units. This unit has 41 beds, 16 intended to care for patients suspected or infected with SARS-CoV-2. The remaining beds are intended for patients with other diagnoses.

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

The non-probabilistic convenience sample consisted of all patients 18 years old or older, with a confirmed diagnosis of COVID-19, who remained hospitalized in the ICU for ≥ 24 hours during the study period. Patients with other medical diagnoses were excluded from the study.

Initially, a survey was conducted at the institutional Center for Medical Informatics (CIMED) via the patients' electronic medical records to identify the sample, the nursing workload measured with NAS, and the severity and mortality index using the APACHE II; the first 24 hours after admission to the ICU was considered as reference.

Data were collected using a two-part instrument. The first part addressed sociodemographic and clinical data, and the second included NAS and APACHE – II.

NAS was designed to measure nursing workload. It is based on the time spent on nursing activities. The instrument comprises 23 therapeutic interventions, subdivided into seven major categories: basic activities (monitoring and control, hygiene procedures, mobilization and positioning, support and care for family members and patients, administrative and managerial tasks), ventilatory support, cardiovascular support, renal support, neurological support, metabolic support, and specific interventions. Items 1, 4, 6, 7, and 8 present self-excluding alternatives, according to the variability of the patient's demand[10].

The final score ranges from 1.4% and 177% and represents the time a nursing worker spent in the last 24 hours providing care to a patient. Scores above 100% indicate the need for at least two nursing workers to provide care to a given patient/day[10,11].

The NAS instrument is computerized in the Hospital Information System (SIH) ICU, where data were collected. The team of clinical nurses fills it out once a day, at night, after assessing patients at the bedside; the computerized system automatically generates the scores.

APACHE–II is widely used in intensive care to measure a patient's severity and the likelihood of dying. Its main objective is to quantitatively describe the level of organic dysfunction among severely ill patients. It expresses a score based on clinical and laboratory alterations or type of interventions, considering physiological variables: rectal temperature, average blood pressure, or arterial and diastolic blood pressure, heart rate, respiratory rate, oxygenation through gasometric parameters, arterial PH, serum potassium and creatinine, hematocrit and white cells and the Glasgow coma scale[14,16] .

The physician in charge fills in the scale in the Hospital Information System upon patient admission, generating a score and estimated mortality.

Initially, all variables were descriptively analyzed. Then, the correlation between workload and APACHE-II and respective significance tests was estimated using Pearson's correlation coefficient, which assumes values from -1 to +1. Finally, the following reference values were adopted to analyze the correlations' magnitude: values between 0 and 0.3 were considered negligible; between 0.31 and 0.5 weak; between 0.51 and 0.7 moderate; between 0.71 and 0.9 strong; and very strong when >0.917. The analyses were performed using the IBM SPSS program, version 22, with a significance level of 5%.

This study complied with ethical guidelines guiding research involving human subjects, according to Resolution No.466/12, Brazilian Health Council, and obtained approval of the study protocol from the Institutional Research Ethics Committee.

RESULTS

Based on the inclusion criteria, 93 patients diagnosed with COVID-19 in the study period were selected. Table 1 presents the participants' sociodemographic and clinical characteristics.

Most patients were men (73.11%), aged 60.18 years old on average (±13.85), with one or more associated comorbidities; systemic arterial hypertension 69 (66.99%), diabetes mellitus 48 (46.61%), and obesity 41 (39.81%) were the most prevalent. The average stay in the ICU was 13 days. As for the clinical outcome, 62 (66.66%) patients died.

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

TABLE 1: Distribution of the COVID-19 patients' sociodemographic and clinical profiles. Botucatu, SP, Brazil, 2020.

Variables	μ(SD)	n (%)
Age (years)	60.18(±13.8)	
Length of hospitalization in the ICU (days)	13.7(±10.7)	
Sex		
Male		68(66.02)
Female		25(33.98)
Comorbidities		
Systemic Arterial Hypertension		69(66.99)
Diabetes Mellitus		48(46.61)
Obesity		41(39.81)
Smoking		33(32.04)
Origin		
Urgency and Emergency		50(53.76)
Hospitalization Ward		42(45.16)
Other ICU		1(1.08)
Outcome		
Discharge		31(33.33)
Death		62(66.66)
Nursing Activities Score	74.2(±22.12)	
APACHE II	24.47(±6.45)	

Notes: μ: mean; SD: standard deviation; ICU= Intensive Care Unit; APACHE: Acute Physiology and Chronic Health Evaluation II.

Regarding the nursing workload, the mean total NAS was 74.2% (± 22.12), ranging from 38% to 127.8%. Considering that each point in the NAS is equivalent to 14.4 minutes of nursing care, an average of approximately 17.80 nursing hours was obtained per patient/day.

According to the NAS (Table 2), the nursing actions performed in the first 24 hours in the ICU with the highest scores were: Laboratory investigations (96.73%), Treatment to improve pulmonary function (95. 65%), and Support and care for family members and patients (90.21%).

The mean severity index assessed by the APACHE-II score was 24.47 points, showing that 40% of patients were at risk of death on admission. The analysis in Table 3 shows the results obtained in the correlation between NAS and APACHE – II.

Regarding the correlation between the scores obtained in the NAS and APACHE-II, a moderate and statistically significant correlation was found between the instruments (r: 0.5132; p< 0.0001), showing that the APACHE-II predictor score of mortality and severity was positively associated with nursing workload, that is, the greater a patient's severity, the greater the nursing workload spent on this patient in the ICU.

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

TABLE 2: Frequency of items rated in the Nursing Activities Score on the patients' first day in the adult ICU. Botucatu, SP, Brazil, 2020.

Interventions	n	%
1. Monitoring and controls		
1a. Hourly vital signs, water balance calculation, and recording.	20	21.73
1b. Bedside presence and observation or continuous activity for 2 hours or more in any shift to ensure safety, due to the disease severity or therapeutic reasons.	67	72.82
1c. Bedside presence and observation or continuous activity for 4 hours or more in any shift	4	4.34
2. Laboratory investigations	89	96.73
3. Medication	77	83.69
4. Hygiene procedures		
4 a. Carrying out hygiene procedures, such as dressing wounds and intravascular catheters, changing bed linen, patient body hygiene in specific situations (e.g., incontinence, vomiting, burns, wounds with secretion, complex surgical dressings with irrigation), special procedures (i.e., isolation), etc.	43	46.73
4 b. Carrying out hygiene procedures that last more than 2 hours in any shift.	45	48.91
4 c. Carrying out hygiene procedures that last more than 4 hours in any shift.	1	1.08
5. Drain care.	28	30.43
6. Mobilization and positioning.		
6a. Carrying out a procedure(s) up to 3 times over 24 hours.	28	30.43
6b. Carrying out procedures more than 3 times in 24 hours or requiring 2 nurses, regardless of the frequency.	62	67.39
6c. Carrying out a procedure(s) with 3 or more nurses, regardless of the frequency.	1	1.08
7. Support and care for family members and patients.		
7a. Support and care for family members and patients demanding exclusive dedication for about one hour in any shift, such as explaining clinical conditions, dealing with pain and anguish, or dealing with difficult family circumstances.	83	90.21
7b. Support and care for family members and patients demanding exclusive dedication for 3 hours or more in any shift, such as death, challenging circumstances (i.e., a large number of family members, language problems, or hostile family members).	8	8.69
8. Administrative and managerial tasks.		
8a. Carrying out routine tasks, such as processing clinical data, requesting exams, and exchanging professional information (i.e., shift change, clinical visits).	62	67.39
8b. Carrying out administrative and managerial tasks that demand integral dedication for about 2 hours in any shift, such as research activities, application of protocols, application of protocols, admission and discharge procedures.	27	29.34
8c. Carrying out administrative and managerial tasks that require integral dedication for about 4 hours or more in any shift, such as death and organ donation procedures, and coordination with other disciplines.	2	2.17
9. Respiratory support.	82	89.13
10. Care for artificial airways.	65	70.65
11. Treatment to improve lung function.	88	95.65
12. Vasoactive medication.	62	67.39
13. Intravenous replacement of significant fluid losses.	13	14.13
14. Left atrium monitoring.	1	1.08
15. Cardiopulmonary resuscitation in the last 24 hours.	0	0
16. Hemofiltration techniques.	5	5.43
17. Quantitative measurement of urinary output.	77	83.69
18. Intracranial pressure measurement.	1	1.08
19. Treatment of complicated metabolic acidosis and alkalosis.	3	3.26
20. Intravenous hyperalimentation.	1	1.08
21. Enteral nutrition.	59	64.13
22. Unit's specific interventions.	25	27.17
23. Specific interventions outside the unit.	17	18.47

Legend: ICU – Intensive Care Unit

TABLE 3: Correlations between the mean Nursing Activities Score and Acute Physiology and Chronic Health Evaluation II. Botucatu, SP, Brazil, 2020.

	r*	p
NAS and APACHE II	0,5132	< 0,0001

Legend: *r: Pearson's Coefficient of Correlation. NAS: Nursing Activities Score; APACHE II: Acute Physiology and Chronic Health Evaluation II.

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

DISCUSSION

The total NAS score in this study was 74.2%, equivalent to 17.80 nursing hours per patient in 24 hours. NAS scores above 50% show a high nursing workload, i.e., a professional can provide comprehensive care to only one patient per work shift, especially in situations where the score exceeds 70%[18]. A high workload was also found in a Brazilian study addressing critically ill COVID-19 patients, with a NAS score of 86%[19].

Although comparisons were impossible because this study does not present the NAS scores prior to the pandemic, the potential explanation for these high scores may be directly linked to the high demand for therapeutic activities as most patients were severely ill and susceptible to hemodynamic instability, demanding the nursing team to spend more time with their care[20]. In this context, an Italian study compared the NAS in a general ICU before and during the pandemic and identified a 33% increase in the average score (from 63 to 84 points) related to the severity of patients at the time of admission and procedures such as the prone maneuver, renal replacement therapy, ECMO and invasive mechanical ventilation[21].

The categories with the highest scores were: laboratory investigations, treatment to improve lung function, and support and care for family members and patients. Similar results are reported by a study comparing patients diagnosed with COVID-19 with pneumonia. The highest scores concerned hygienic procedures, mobilization and positioning, support and care for family members and patients, and respiratory care. The support and care provided to family members are explained by the mortality rates in ICUs and restricted visitation during the pandemic, while the score concerning respiratory care is explained by the higher number of patients using mechanical ventilation in a COVID ICU[22].

Another interesting piece of information in this investigation concerns the fact that the number of deaths was higher than predicted by the mean APACHE-II score obtained at admission. Perhaps these results are explained by the patients' worsened conditions, which became more severe during their stay in the ICU. Therefore, it is essential to know the score's applicability and the high mortality risk in this context for strategic measures to be incorporated into the work process[23].

The moderate correlations found between the scores obtained in the NAS and APACHE-II strengthen the concept of the severity of illness associated with the nursing workload. A study conducted in Colombia before the pandemic found a similar result, with an association between high workload and more than a three-day hospitalization, high APACHE-II score, patients coming from the surgical center, and a diagnosis of trauma[24]. A study addressing COVID-19 patients in intensive care units in Belgium also found an association between more prolonged nursing activities and high APACHE-II scores ($p = 0.006$) and death ($p = 0.002$)[25]. Thus, the literature shows that COVID-19 patients admitted to an ICU require significantly more nursing time and an average ratio of almost 1:1[21,22,25].

The characteristics of this study's sample are similar to those addressed by other studies, with a male prevalence among hospitalizations due to COVID-19. These results are corroborated by Chinese (62%)[26] and American (60.3%)[27] studies, with an even higher percentage of men in Lombardy (82%)[28]. One study performed by researchers from Taiwan found that the most severe cases of COVID-19 are more likely to occur among elderly individuals with comorbidities, as shown by the study addressing 109 COVID-19 patients admitted to the Central Hospital of Wuhan[29], China. The sample's profile was older men with coexisting diseases, such as diabetes mellitus (20.8%), cardiovascular disease (11.3%), and chronic kidney disease (15.1%).

In this study, considering that the same individual may have one or more comorbidities in addition to the diagnosis that led to hospitalization, systemic arterial hypertension, diabetes mellitus, and obesity were the most prevalent; results that are similar to other studies[30,31]. Additionally, epidemiological data indicate that comorbidities such as hypertension, respiratory, cardiovascular, metabolic, and immunological diseases, and advanced age are predictors of the severity of COVID-19 and mortality[32,33].

The overall average stay in the ICU was 13 days. A systematic review addressing the length of hospitalization of COVID-19 patients in an ICU reports a median of 8 (5–13) days in China and 7 (4–11) days among studies conducted in other countries[34]. However, a study conducted in France with 433 COVID-19 patients classified into diabetic and non-diabetic found an association between diabetes and ICU admission and more extended hospital stay. This group presented a median of 14 days of hospitalization. Such divergences may be explained by different admission and discharge criteria[35].

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

As for the patients' origin, most were referred to the ICU by the urgency and emergency service, which corroborates the findings of a Brazilian study addressing a population without COVID-19, in which 59.8% of the admissions originated in the Emergency Room[36]. Note that the facility where the study was performed is a referral center for the care of COVID-19 patients and serves the Regional Health Department VI, facilitating cooperation with other municipalities, covering approximately 68 municipalities divided into five health regions.

Although studies addressing workload related to COVID-19 patients are still incipient, it is a topic that has aroused increasing interest. Nursing workload has been the subject of discussion in health organizations worldwide due to its implications for the quality of patient care, besides challenging the health system in a pandemic context. Such studies also contribute to personnel dimensioning as they allow assessing the time spent with care delivery according to the classification of patients in different categories of care, supporting the planning of costs and care[15].

However, the profile of COVID-19 patients admitted to an ICU is likely correlated with high severity scores, as well as low survival rates. This correlation is based on the assumption that newly admitted patients need a high level of care and monitoring, especially in the first 24 hours due to their clinical conditions coupled with the use of complex therapeutic equipment, throughout their stay in the unit, which reflects a need to reinforce human resources, directly interfering with the nursing workload[37].

Study Limitations

This study's limitations concern the fact that it addressed a single facility and that the results could not be compared with a control group in this ICU. Additionally, the few studies on nursing workload among COVID-19 patients at the beginning of the pandemic hindered comparing results, showing the need for future studies in the field. Thus, we suggest studies are developed in the future.

CONCLUSION

The nursing workload was moderately correlated with the severity of COVID-19 patients during the pandemic, requiring 17.80 nursing hours/patient/day in the first 24 hours of hospitalization. The high nursing workload was mainly due to laboratory investigation activities, treatment to improve lung function, and support/care provided to family members and patients.

This study brings important contributions to nursing professionals working in intensive care units as it supports the implementation of strategies intended to improve nursing care planning, staffing, and the prevention of adverse events.

REFERENCES

1. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? The Lancet. 2020 [cited 2020 Apr 06]; 395(10231):1225-8. DOI: https://doi.org/10.1016/S0140-6736(20)30627-9.
2. Deming ME, Lyke KE. A 'mix and match' approach to SARS-CoV-2 vaccination. Nat Med. 2021 [cited 2022 Sep 02]; 27(9):1510-1. DOI: https://doi.org/10.1038/s41591-021-01463-x.
3. CDC [Internet]. Global COVID-19 Vaccinations. 2022 [cited 2022 Sep 02]. Available from: https://COVID.cdc.gov/COVID-data-tracker/#global-vaccinations.
4. Zibadi S, Samieefar N, Sodeifian F, Mosavari N, Rezaei N. COVID-19 Vaccination: what challenges are we going to face. Acta Biomed. 2021 [cited 2022 Sep 02]; 92(4):e2021379. DOI: https://doi.org/10.23750/abm.v92i4.11759.
5. World Health Organization [Internet]. WHO Coronavirus (COVID-19). 2022 [cited 2020 Apr 06]. Available from: https://COVID19.who.int/.
6. Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz JV, Dorman T, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2017 [cited 2020 Apr 06]; 37:270-6. DOI: https://doi.org/10.1016/j.jcrc.2016.07.015.
7. Ramos FJS, Atallah FC, Souza MA, Ferreira EM, Machado FR, Freitas FGR. Determinants of death in critically ill COVID-19 patients during the first wave of COVID-19: a multicenter study in Brazil. J Bras Pneumol. 2022 [cited 2020 Apr 06]; 48(5):e20220083. DOI: https://doi.org/10.36416%2F1806-3756%2Fe20220083.
8. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus–Infected Pneumonia in Wuhan, China. JAMA. 2020 [cited 2021 Mar 10]; 323(11):1061-9. DOI: https://doi.org/10.1001%2Fjama.2020.1585.

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

9. Ranzani OT, Bastos LSL, Gelli JGM, Marchesi JF, Baião F, Hamacher S, et al. Characterisation of the first 250 000 hospital admissions for COVID-19 in Brazil: a retrospective analysis of nationwide data. Lancet Respir Med. 2021 [cited 2022 Nov 07]; 9(4):407-18. DOI: https://doi.org/10.1016/S2213-2600(20)30560-9.
10. Miranda DR, Nap R, de Rijk A, Schaufeli W, Iapichino G. Nursing activities score. Crit Care Med. 2003 [cited 2022 Nov 07]; 31(2):374-82. DOI: https://doi.org/10.1097/01.ccm.0000045567.78801.cc.
11. Queijo AF, Padilha KG. Nursing Activities Score (NAS): cross-cultural adaptation and validation to Portuguese language. Rev Esc Enferm USP. 2009 [cited 2022 Nov 07]; 43(spe):1001-8. Available from: https://www.scielo.br/j/reeusp/a/T88JNv3WgwFwSpN5zWSrnLH/?format=pdf&lang=en.
12. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med. 1985 [cited 2020 Apr 10]; 13(10):818-29. Available from: https://pubmed.ncbi.nlm.nih.gov/3928249/.
13. Becker RB, Zimmerman JE. ICU scoring systems allow prediction of patient outcomes and comparison of ICU performance. Crit Care Clin. 1996 [cited 2021 Mar 10];12(3):503-14. DOI: https://doi.org/10.1016/s0749-0704(05)70258-x.
14. Zimmerman JE, Kramer AA, McNair DS, Malila FM. Acute Physiology and Chronic Health Evaluation (APACHE) IV: Hospital mortality assessment for today's critically ill patients. Crit Care Med. 2006 [cited 2021 Mar 10]; 34(5):1297-310. DOI: https://doi.org/10.1097/01.ccm.0000215112.84523.f0.
15. Gonçalves LA, Andolhe R, Oliveira EM, Faro ACM, Gallotti RMD, Padilha KG. Nursing allocation and adverse events/incidents in intensive care units. Rev Esc Enferm USP. 2012 [cited 2022 Nov 07]; 46(spe):71-7. DOI: https://doi.org/10.1590/S0080-62342012000700011.
16. Dias AT, Matta PO, Nunes WA. Severity Indexes in an Adult Intensive Care Unit: Clinical Evaluation and Nursing work. Rev Bras Ter Intensiva. 2006 [cited 2020 Apr 10]; 18(3). Available from: https://www.scielo.br/j/rbti/a/Pks8t789bJgv3YNzsszC6Bn/?format=pdf&lang=pt.
17. Mukaka MM. Statistics corner: A guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012 [cited 2022 Nov 07]; 24(3):69-71. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3576830/.
18. Lucchini A, de Felippis C, Elli S, Schifano L, Rolla F, Pegoraro F, et al. Nursing Activities Score (NAS): 5 Years of experience in the intensive care units of an Italian University hospital. Intensive Crit Care Nurs. 2014 [cited 2022 Nov 07]; 30(3):152-8. DOI: https://doi.org/10.1016/j.iccn.2013.10.004.
19. Buffon MR, Severo IM, Barcellos R de A, Azzolin K de O, Lucena A de F. Critically ill COVID-19 patients: a sociodemographic and clinical profile and associations between variables and workload. Rev Bras Enferm. 2022 [cited 2022 Nov 07]; 75(suppl 1):E20210119. DOI: https://doi.org/10.1590/0034-7167-2021-0119.
20. Padilha KG, Stafseth S, Solms D, Hoogendoom M, Monge FJC, Gaomaa OH, et al. Nursing Activities Score: an updated guideline for its application in the Intensive Care Unit. Rev Esc Enferm USP. 2015 [cited 2022 Nov 07]; 49(spe):131-7. DOI: https://doi.org/10.1590/s0080-623420150000700019.
21. Lucchini A, Giani M, Elli S, Villa S, Rona R, Foti G. Nursing Activities Score is increased in COVID-19 patients. Intensive Crit Care Nurs. 2020 [cited 2021 Mar 10]; 59:102876. DOI: https://doi.org/10.1016%2Fj.iccn.2020.102876.
22. Hoogendoorn ME, Brinkman S, Bosman RJ, Haringman J, de Keizer NF, Spijkstra JJ. The impact of COVID-19 on nursing workload and planning of nursing staff on the Intensive Care: a prospective descriptive multicenter study. Int J Nurs Stud. 2021 [cited 2021 Sep 05]; 121:104005. DOI: https://doi.org/10.1016/j.ijnurstu.2021.104005.
23. Vieira AM, Parente EA, Oliveira LDS, Queiroz AL, Bezerra ISAM, Rocha HAL. Características de óbitos dos pacientes internados em uma unidade de terapia intensiva de hospital terciário. J. Health Biol. Sci. 2018 [cited 2021 Mar 20]; 7(1):26. DOI: http://dx.doi.org/10.12662/2317-3076jhbs.v7i1.1999.p26-31.2019.
24. Rivera DIC, Torres CC, Romero LAL. Factors associated with nursing workload in three intensive care units. Rev Esc Enferm USP. 2021 [cited 2022 Nov 07]; 55:e20200272. DOI: https://doi.org/10.1590/1980-220X-REEUSP-2020-0272.
25. Bruyneel A, Gallani MC, Tack J, d'Hondt A, Canipel S, Franck S, et al. Impact of COVID-19 on nursing time in intensive care units in Belgium. Intensive Crit Care Nurs. 2021 [cited 2021 Mar 20]; 62:102967. DOI: https://doi.org/10.1016/j.iccn.2020.102967.
26. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. The Lancet. 2020 [cited 2020 Apr 10]; 395(10229):1054-62. DOI: https://doi.org/10.1016/S0140-6736(20)30566-3.
27. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, et al. Presenting Characteristics, Comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York city area. JAMA. 2020 [cited 2020 Apr 10]; 323(20):2052. DOI: https://doi.org/10.1001/jama.2020.6775.
28. Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A, et al. Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy region, Italy. JAMA. 2020 [cited 2020 Apr 11]; 323(16):1574. DOI: https://doi.org/10.1001/jama.2020.5394.
29. Liu Y, Sun W, Li J, Chen L, Wang Y, Zhang L, et al. Clinical features and progression of acute respiratory distress syndrome in coronavirus disease 2019. medRxiv. 2020 [cited 2021 Mar 21]. Preprint available from: https://www.medrxiv.org/content/10.1101/2020.02.17.20024166v3.
30. Barros GM, Mazullo Filho JBR, Mendes Júnior AC. Considerações sobre a relação entre a hipertensão e o prognóstico da COVID-19. J. Health Biol. Sci. 2020 [cited 2021 Mar 21];8(1):1-3. DOI: http://dx.doi.org/10.12662/2317-3076jhbs.v8i1.3250.p1-3.2020.
31. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020. China CDC Wkly. 2020 [cited 2021 Mar 21];2(8):113-22. DOI: https://weekly.chinacdc.cn/en/article/doi/10.46234/ccdcw2020.032.

DOI: http://dx.doi.org/10.12957/reuerj.2022.69318

32. Lloyd-Sherlock P, Ebrahim S, Geffen L, McKee M. Bearing the brunt of COVID-19: older people in low- and middle-income countries. BMJ. 2020 [cited 2020 May 03]; 368:m1052. DOI: https://doi.org/10.1136/bmj.m1052.
33. Bhattacharyya A, Seth A, Srivast N, Imeokparia M, Rai S. Coronavirus (COVID-19): a systematic review and meta-analysis to evaluate the significance of demographics and comorbidities. Res Sq. 2021 [cited 2021 Feb 02]; rs.3.rs-144684. DOI: https://doi.org/10.21203/rs.3.rs-144684/v1.
34. Rees EM, Nightingale ES, Jafari Y, Waterlow NR, Clifford S, Pearson CAB, et al. COVID-19 length of hospital stay: a systematic review and data synthesis. BMC Med. 2020 [cited 2022 Nov 06]; 18(1):270. DOI: https://doi.org/10.1186%2Fs12916-020-01726-3.
35. Al-Salameh A, Lanoix J, Bennis Y, Andrejak C, Brochot E, Deschasse G, et al. Characteristics and outcomes of COVID-19 in hospitalized patients with and without diabetes. Diabetes Metab Res Rev. 2021 [cited 2022 Nov 06]; 37(3):e3388. DOI: https://doi.org/10.1002/dmrr.3388.
36. Santos T, Nogueira L, Silva G, Padilha K, Moita Neto J. Carga de trabalho de enfermagem em terapia intensiva mediante a aplicação do Nursing Activities Score. Rev ACRED. 2015 [cited 2022 Nov 06]; 5(9):1-20. Available form: https://dialnet.unirioja.es/servlet/articulo?codigo=5626612.
37. Santos DDS, Marques CR de G, Santos IAG, Neta MSC, Almeida HOC, Santos ES. Associação do Nursing Activities Score com desfechos de pacientes críticos. Rev Enferm UFPE on line. 2021 [cited 2021 Mar 10]; 15(2). Available from: https://periodicos.ufpe.br/revistas/revistaenfermagem/article/view/245761.