Original Article

Care for the pronated patient: an analysis of care indicators and workload

Cuidados prestados ao paciente pronado: uma análise dos indicadores assistenciais e carga de trabalho

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ABSTRACT

Objective: to analyze care indicators and workload, associating them with the quality of care provided to prone patients. **Methods:** a retrospective study with a convenience sample, including patients undergoing prolonged mechanical ventilation, diagnosed with COVID-19, invasive ventilation, and prone positioning. Demographic variables, information on comorbidities, ventilatory and hemodynamic status, workload using the Nursing Activities Score, quality of care indicators, diet therapy, and outcomes were collected. **Results:** 71 patients were evaluated; 55 (77.5%) were men, with a mean age of 65.5 years; 44 (62%) had cardiovascular diseases and 46 (62%) with metabolic diseases; 69 (97.2%) had severe hypoxemia and 52 (73.2%) used vasoactive drugs. The average Nursing Activities Score was 92.2 points; 67 (94.4%) did not reach the calorie/protein target, 47 (66.2%) developed ventilator-associated pneumonia, and 38 (53.5%) pressure injuries; 17 (23.9%) died. **Conclusion:** there was no statistical correlation between the worsening of care indicators and the increase in workload, although this was high at all the times studied. **Contributions to practice:** the high workload was related to adverse outcomes, demonstrating a relationship with the severity of the patients studied.

Descriptors: COVID-19; Respiratory Distress Syndrome; Prone Position; Workload; Quality of Health Care.

RESUMO

Objetivo: analisar os indicadores assistenciais e a carga de trabalho, associando-os com a qualidade da assistência prestada aos pacientes pronados. **Métodos:** estudo retrospectivo com amostra de conveniência, incluindo pacientes submetidos à ventilação mecânica prolongada, com diagnóstico da COVID-19, ventilação invasiva e posicionamento em prona. Foram coletadas variáveis demográficas, informações sobre comorbidades, estado ventilatório e hemodinâmico, carga de trabalho por meio do *Nursing Activities Score*, indicadores de qualidade assistencial, dietoterapia e desfechos. **Resultados:** foram avaliados 71 pacientes, 55 (77,5%) homens, com idade média de 65,5 anos; 44 (62%) com doenças cardiovasculares e 46 (62%) com doenças metabólicas; 69 (97,2%) apresentaram hipoxemia grave e 52 (73,2%) usaram drogas vasoativas. A média do *Nursing Activities Score* foi de 92,2 pontos; 67 (94,4%) não atingiram a meta calórica/proteica, 47 (66,2%) desenvolveram pneumonia associada à ventilação e 38 (53,5%) lesão por pressão; 17 (23,9%) faleceram. **Conclusão:** não houve correlação estatística entre a piora dos indicadores assistenciais e o aumento da carga de trabalho, embora esta tenha sido elevada em todos os momentos estudados. **Contribuições para a prática:** a alta carga de trabalho se relacionou aos desfechos negativos, demonstrando relação com a gravidade dos pacientes estudados.

Descritores: COVID-19; Síndrome do Desconforto Respiratório; Decúbito Ventral; Carga de Trabalho; Qualidade da Assistência à Saúde.

Introduction

A series of atypical respiratory infections reported in Wuhan, China, in December 2019 was identified as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes COVID-19. The World Health Organization quickly declared this pathogen, the agent responsible for viral pneumonia, a public health emergency[1].

The virus spreads from person to person via respiratory droplets or aerosols in contact with the host's mucous surfaces, leading to a respiratory condition classified as asymptomatic, mild, mixed, or severe. In critical cases, it can be considered a form of severe acute respiratory syndrome (SARS), commonly accompanied by complications such as circulatory shock, sepsis, disseminated intravascular coagulation, acute kidney, liver, and multiple organ dysfunction syndrome, justified by the disseminated pro-inflammatory response and the high number of chemokines released from the infection[1].

SARS is an acute, diffuse respiratory failure of inflammatory origin. It leads to increased pulmonary vascularization and permeability, edema, and loss of aerated lung tissue, resulting in hypoxemia. It is also associated with high morbidity, and its clinical markers are, in addition to hypoxemia, the presence of bilateral radiographic opacities associated with increased physiological dead space and decreased lung compliance[2].

Invasive mechanical ventilation is the mainstay of SARS treatment. Strategies should be adopted to mitigate the lung damage induced by it, and, to this end, protective strategies are recommended, with a tidal volume of 4 to 8 ml/kg of predicted weight and plateau pressure ≤ 30 cmH2O. The initial tidal volume should be set at 6 ml/kg of body weight and managed in case of a double trigger or a decrease in inspiratory airway pressure below the positive end-expiratory pressure (PEEP)[3].

Based on this theoretical concept, prone ventilation is recommended for patients with SARS since when adopted for periods ≥ 16 hours in patients with a PaO2/FiO2 ratio ≤ 150 mmHg, it is associated with a reduction and prevention of ventilator-induced lung damage, reducing mortality from 41% to 23.6% over 90 days[4].

The main indications for adopting the prone position in SARI are the need to improve oxygenation and reduce mortality, while the only absolute contraindication is an unstable vertebral fracture. Relative contraindications include hemodynamic instability, unstable pelvic or long bone fractures, open abdominal wounds, and increased intracranial pressure[4]. Although it has been used safely for decades, there has been a sudden increase in the use of this position thanks to the advent of the COVID-19 pandemic and the consequent increase in associated complications[5].

These complications include brachial plexus paralysis, an increase in the number of bloodstream infections, increased intra-abdominal pressure, compartment syndrome, cardiovascular impairment, thrombosis and stroke, liver dysfunction, eye damage, oropharyngeal edema, displacement of the ventilation device, gas embolism, and an increase in the incidence of pressure injuries, with an increase in the potential for ischemic lesions and malnutrition in critically ill patients[4-6].

In this context, nurses are among the most essential professionals, as they are responsible for providing direct care to critically ill pronated patients. They seek to reduce the risks associated with care, understand the severity and complexity of the clinical condition, and understand how hemodynamic and ventilatory responses require nursing care, increasing the workload of professionals in the field.

From this perspective, the nursing workload is presented as "the amount of time and care dedicated (directly and indirectly) to the patient, workplace and professional development" based on five attributes: the amount of time spent on nursing care; the level of knowledge, skills, and behavior required to meet health needs; the intensity of care provided directly to

the patient; the physical, mental and emotional effort applied to care; and the ability to modify the care plan based on changes in patient complexity[7].

The need to assess workload is not new. A series of instruments aimed at measuring it have been developed from a broad perspective, encompassing the Intensive Care Unit (ICU), but not restricted to it. The development of instruments designed for this reality resulted in the idealization of the Nursing Activities Score (NAS), an instrument adapted and validated for the Brazilian reality, covering around 80.8% of nursing activities. This is considered to be a stable and consistent measuring instrument for assessing nurses' workload[8].

At the same time, aspects related to work overload can be detrimental to the care provided, significantly increasing the number of complications and adverse outcomes. This reflects on patient insecurity and affects the results of quality indicators, such as management tools that guide excellence in care and monitor aspects related to care realities. Addressing this issue is crucial to ensure the efficiency and effectiveness of organizational processes and results[9].

There is still little evidence that COVID-19 and its therapeutic consequences - such as the adoption of the prone position, the use of extracorporeal membrane oxygenation (ECMO), and prolonged mechanical ventilation - have any impact on nursing workload. In addition, given the effects of overload on the quality of care, there is a need for studies that compare and correlate workload with the results of quality indicators, making it possible to identify points for improvement and, consequently, to draw up more effective care plans aimed at patient safety.

This study aimed to analyze care indicators and workload, associating them with the quality of care provided to prone patients.

Methods

This is a retrospective study conducted in the 50-bed general ICU of a tertiary and philanthrop-ic hospital in a municipality in the state of São Paulo, Brazil, based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.

The convenience sample consisted of patients undergoing prolonged mechanical ventilation from January to December 2020. The inclusion criteria were age ≥ 18 years, medical diagnosis of SARS, use of invasive mechanical ventilation, and prone positioning. Those aged < 18 years, with an ICU stay of less than 24 hours, on non-invasive mechanical ventilation or using other non-invasive forms of oxygen therapy, as well as patients instructed to pronate spontaneously, were excluded.

The following variables were observed: age, gender (male and female), comorbidities, ventilatory status, hemodynamic status, nursing workload, care indicators (such as development of skin lesions, primary bloodstream infection associated with central catheter, urinary tract infection associated with bladder catheter, ventilator-associated pneumonia, and diet therapy within the calorie/protein target), and outcomes (ICU discharge, hospital discharge or death).

To analyze the patients' ventilatory status, the presence of opacities on the chest X-ray was considered. Hypoxemia was classified as mild (200 mmHg ≤ PaO_2/FiO_2 ≤ 300 mmHg), moderate (100 mmHg ≤ PaO_2/FiO_2 ≤ 200 mmHg) or severe (PaO_2/FiO_2 ≤ 100 mmHg) based on the new global definition of SARI[2]. Hemodynamic status was assessed based on the need for chemical/mechanical circulatory support through extracorporeal membrane oxygenation.

Workload was quantified using the Nursing Activities Score (NAS), an instrument divided into seven broad categories with twenty-three items, whose weights range from a minimum of 1.2 to a maximum of 32.0. The total calculation represents the sum of the values assigned to each item, resulting in a score expressed as a percentage, which means the nursing time spent providing direct care to each patient in the last 24 hours. Its maximum value is 176.8%, where

each point is equivalent to 14.4 minutes of nursing care. Therefore, if the total score is ≥ 100, the patient has required the care of more than one nursing professional per shift in the last 24 hours[8].

NAS scores ≥ 71.1% were considered indicative of high workloads. This choice aligns with a study in a Brazilian University Hospital, which assessed the workload described by the NAS in 437 patients admitted to a 17-bed clinical-surgical ICU, aged between 18 and 100. Although the institution described and the one evaluated in this study has a different profile, the exact definition was used due to the tertiary and highly complex nature of both services and the lack of in-depth analyses of this type of workload in large private institutions[10].

Skin lesions developed in risk areas after the maneuver characterized as pressure lesions, dermatitis associated with humidity, and lesions related to medical adhesives.

Healthcare-related infections were defined according to the diagnostic criteria established by the National Health Surveillance Agency (ANVISA), allowing for standardization and representativeness of the institutional reality[11].

Regarding diet therapy within the calorie/protein target, patients using enteral devices such as nasoenteric tube, gastrostomy tube jejunostomy, or gastrojejunostomy were considered, provided they had received an infusion of at least 80% of the individualized target defined by a multi-professional team, disregarding cases of parenteral nutritional intake[12].

Data was collected electronically between September and November 2022. To this end, a list of patients admitted to the hospital on prolonged mechanical ventilation during the research period was provided by the EpiMed Solutions® platform. The inclusion and exclusion criteria were applied from this list, and the final sample was drawn.

Socio-demographic variables, comorbidities, hemodynamic and ventilatory support variables, care indicators (observed up to 24 hours after discharge from the ICU), and outcomes were collected from electronic medical records. To calculate the workload, the researchers reproduced the NAS variables in software with a function based on a conditional logic structure: if the valid argument "1" was entered, the program automatically added up the stipulated weights and returned the result; if the false argument "0" was entered, the program returned a null value. NAS was calculated retrospectively at three moments: before (N1), during (N2), and after prone positioning (N3), considering as a reference the time recorded in the medical records when the maneuver was performed and the 24 hours before and after.

Patients who underwent more than one cycle in this position were not reintroduced into the sample, and the critical values for NAS and hemodynamic variables were calculated to avoid statistical bias.

The continuous quantitative variables were described after assessing their adherence to normal distribution using the Shapiro-Wilk test. The mean and standard deviation were used for variables with a normal distribution, while the median and interquartile range were calculated for non-normal variables. The considered significance level for the statistical treatment was 5% ($p \leq 0.05$).

The relationships between quantitative variables, workload, and outcomes were verified using the unpaired Student's t-test or the non-parametric Mann-Whitney test. Pearson's chi-square and Fisher's exact tests were used for qualitative or categorical variables. SPSS V22 and Microsoft Excel software were used for the statistical analyses.

A waiver of the Informed Consent Form was requested considering the retrospective nature of the research, whose data collection was based on the institution's electronic medical records and information systems. To guarantee the confidentiality of patient information, data had to be collected without nominal identification or sensitive information that could lead to the identification of study patients.

The study's ethical foundation is firmly established by its compliance with Resolution 466/2012 of the National Health Council. This was further rein-

forced by the approval of the institution's Research Ethics Committee under opinion no. 5.638.018/2021 and Certificate of Submission for Ethical Appraisal: 62035322.4.0000.5461. Additionally, the coordinators responsible for the areas involved in the study also sought authorization, ensuring full ethical compliance.

Results

The medical records of 318 patients undergoing prolonged mechanical ventilation at the institution were assessed. Only seventy-one met the inclusion criteria adopted, of which 55 (77.5%) were male and 16 (22.5%) females. The mean age was 65.5 years (62.6 ± 68.3, standard deviation 12.1), and cardiovascular and metabolic diseases were the most common comorbidities.

Among cardiovascular diseases, systemic arterial hypertension and coronary artery disease were the most common, with 38 (86.3%) and 10 (22.7%) patients affected, respectively. As for metabolic diseases, diabetes mellitus (DM), dyslipidemia, and obesity were the most common, affecting 24 (52.1%), 15 (32.6%), and 20 (43.4%) patients, respectively.

Regarding ventilatory status, 69 (97.2%) patients had a PaO_2/FiO_2 ratio $\leq$ 150, indicating severe hypoxemia, PEEP levels $\geq$ 5 cmH2O, and the presence of opacities on the chest X-ray. One patient did not undergo imaging due to hemodynamic instability and ECMO cannulation before the maneuver.

The overall average NAS was 92.2 (89.4 ± 95), indicating a high workload for the nursing team. Table 1 shows the variation in NAS in the different periods evaluated; while the average for N1 was 86.7 (83.5 ± 89.8), N2 had an average of 98.8 (96.1 ± 101.5), and N3 90.8 (87.4 ± 94.3), indicating a difference between N1 and N2 of 12.1 points, indicating the high demand required by prone patients. The difference between N2 and N3 reached 8 points, suggesting that even higher averages were obtained after switching to the supine position, depending on the criticality of the SARS patient.

Table 1 – Nursing Activities Score distribution based on prone position (n=71). São Paulo, SP, Brazil, 2024

Nursing Activities Score	Average	Median	Standard Deviation
N1*	86.7	84.3	13.2
N2†	98.8	96.4	11.5
N3‡	90.8	90.5	14.6

*Calculated 24 hours before the prone maneuver was performed; †Calculated 24 hours from the prone maneuver was performed; ‡Calculated 24 hours after the prone maneuver was performed

When evaluating hemodynamic status, chemical and mechanical circulatory support were used. Only two patients (2.8%) used ECMO in the venovenous modality during the observed period, indicating a greater need for ventilatory support than circulatory support.

The use of chemical circulatory support using vasoactive drugs was necessary in 52 patients, with noradrenaline being the most used in doses of 0.3 to 0.01 mcg/kg/min, with an average of 0.1 mcg/kg/min (0.08 ± 0.16). Vasopressin was needed in seven patients, at doses of 0.08 to 0.01 IU/min, with an average dose of 0.04 IU/min (0.02 ± 0.06), and dobutamine was needed in only five, at doses of between 10 and 4 mcg/kg/min, with an average of 6.76 mcg/kg/min (3.45 ± 10).

In terms of quality of care, the worst results were found in the indicators of diet therapy on target, development of ventilator-associated pneumonia, and pressure injury, with respective frequencies of 94.4%, 66.2%, and 53.5%, which may indicate weaknesses in care and insecurity for the teams in adopting preventive measures. Ventilatory instability and the need to optimize ventilatory mechanics, with the adoption of decubitus positions with the headboard at 0º, are risk factors for worsening these indicators.

The development of urinary tract infections and primary bloodstream infections were the least

common, with a frequency of 38% and 36.6%, respectively. Among the outcomes studied, fifty-nine patients (83.1%) were discharged from the ICU, and 54 (76.1%) were discharged from the hospital. Despite the increased workload in patients with the dysfunctions above, no statistically significant relationship was found between the high demand for care and the onset of these complications.

However, the high workload in the sample was related to the adverse outcomes studied, with a variation of 12.6 points between the average NAS of discharged individuals and those who died in the hospital, as shown in Table 2.

Table 2 – Associations between average workload, indicators, and observed outcomes (n=71). São Paulo, SP, Brazil, 2024

Observed variable	Average in the Nursing Activities Score		p-value
	Yes	No	
Development of pressure injury	92.9	91.4	0.756*
Development of a bloodstream infection	94.2	91	0.492†
Development of urinary tract infection	92.8	91.8	0.986†
Development of ventilator-associated pneumonia	93.4	89.9	0.174†
Diet therapy on target Outcomes	87.5	92.5	0.417*
Intensive care unit death	99.9	90.6	0.005*
Hospital death	101.8	89.2	0.000*

*Paired T-test; †Mann-Whitney test

Regarding the severity of hypoxemia and mortality, it was found that among patients with a PaO2/FiO2 ratio > 150, only 12 (17.39%) had a negative outcome (p=0.100). Of those with more than two indications for prone, 9 (13.85%) had a negative result (p=0.056). Therefore, the severity of hypoxemia was not statistically correlated with adverse outcomes in the sample studied.

Discussion

The demographic findings of the sample studied correspond to those found in an epidemiological study that characterized the first five months of hospital admissions with a positive diagnosis for COVID-19 in Brazil. This study, which included a sample of 254,288 individuals, showed a national average age of 60, 56% of whom were male. When the regional cut-off was made, the Southeast region, responsible for reporting 61% of cases, mirrored the national scenario[13].

The results are in line with the risk factors for the severity of COVID-19, with high age and male gender being predictors of hospital admission and mortality[14]. The increase in the prevalence of chronic degenerative diseases associated with the aging process means that the elderly are more immune to different etiologies.

In line with the literature[13], all the patients had more than one associated comorbidity. Cardiovascular and metabolic diseases were the most common in the sample studied due to the increased vascular resistance, inflammatory response, and hypercoagulation caused by the syndromes, which increased the risk of hospitalization for these patients[15].

Among the ventilatory variables studied, moderate to severe hypoxemia was found based on the PaO2/FiO2 ratios of 200 to 150 obtained in the sample, with the need for PEEPs ≥ 5 cmH2O to overcome areas of alveolar collapse and images suggestive of pulmonary edema, demonstrating that all the patients observed developed SARS. However, it should be noted that this study did not prove the 45% increase in mortality in moderate to severe cases[2].

However, the high mortality rate described is explained by the diffuse alveolar damage in SARS due to epithelial necrosis related to neutrophil infiltration and subsequent endothelial damage. These events result in ventilation-perfusion mismatch and right-to-left intrapulmonary ventilation, worsening dead space ventilation and reducing lung compliance. Furthermore, after the initial insult, a fibroproliferative phase forms pulmonary fibrosis, which worsens compliance and pulmonary insufficiency, delaying recovery[16].

Most of the patients studied did not reach the

proposed dietary goal despite recommendations to start enteral nutrition within 24-48 hours of ICU admission, with progression according to tolerability up to a calorie goal of 15-20 kcal/kg/day (representing 70-80% of energy needs) and a protein goal of 1.2-2 g/kg/day in critically ill patients[12].

The prone position does not impede enteral nutrition and is not associated with increased gastrointestinal or pulmonary complications. Studies have shown that infusion in devices with post-prone positioning is safe and recommend positioning the hospital bed in reverse Trendelenburg (10-25º angulation) to reduce the risk of aspiration of gastric contents, facial edema, and intra-abdominal hypertension[6,17].

The main complication described was an increase in gastric residual volume, indicating a probable reduction in motility associated with hypoperfusion of abdominal organs, given the pathophysiological process of the disease and the patient's hemodynamic aspects. However, the continuous infusion of the diet allows a significant amount of volume to be administered without impact. Another preventative measure is the administration of prokinetic agents during positioning, allowing patients to be adequately supplied[6,17].

A comprehensive examination of 994 prone maneuvers revealed that 29.7% of patients developed a pressure injury, and 28.2% had ventilator-associated pneumonia. These figures differ from those found in the current study, which identified frequencies of 53.5% and 66.2%, respectively, higher than those suggested. This discrepancy can be explained by the publication date and the population analyzed in the articles reviewed, of which 63.4% were related to SARS not caused by COVID-19[18].

However, it is known that the semi-fowler's position can reduce the development of ventilator-associated pneumonia by up to 71.4%, hospitalization time (68.9%), and time on mechanical ventilation (67.6%) compared to the prone position. Although the prone position effectively reduces mortality and length of stay in the ICU, it is not statistically associated

with an increase or decrease in its occurrence[19].

Skin lesions developed in thirty-eight patients studied (53.5%), a high standard according to the literature. However, in addition to pressure injuries (defined as losses in the partial or total thickness of the skin /underlying tissue, usually over bony prominences or medical devices due to pressure and shear), lesions related to medical adhesives (characterized by erythema that persists for more than 30 minutes after removal of the adhesive) and moisture-associated dermatitis (a spectrum of lesions typified by inflammation and erosion of the epidermis, resulting from prolonged exposure to sources of moisture such as urine, feces, sweat, wound exudate and ostomy effluent)[18,20-22].

In COVID-19 patients, severe hypoxemia, microvascular lesions, and hypercoagulation explain the elevated risk of developing pressure injuries. Hypoxemia reduces peripheral perfusion of the skin, promoting the appearance of ischemic lesions, while microvascular lesions and hypercoagulation increase the fragility of the skin barrier, favoring their development[20-22].

However, the institution routinely adopted a series of measures to minimize the incidence of pressure ulcers attributed to the prone position, such as the use of a viscoelastic mattress, cushions on the face, shoulders, chest, lower limbs, and pelvis, adhesive foam dressings with polyurethane to absorb moisture and redistribute pressure in areas at risk; and tilting the bed to redistribute overall pressure.

The workload obtained in the study was considered high in all the periods evaluated, with a significant increase during prone positioning, which can be viewed as a critical period for nursing care, without correlating with an increase in the incidence of the indicators studied.

Our study on the influence of nursing workload on adverse events in adult ICU patients revealed that increased workload is a risk factor for healthcare-related infections, pressure injuries, falls, and medication errors. However, it is not all doom and gloom. We

found that high NAS scores can protect against adverse events when work scales are adjusted based on the identified demand[23].

Assessments of workload in COVID-19 patients using NAS showed that the score was significantly higher for these patients compared to the control group. Factors that directly impacted the increase in workload included age ≤ 65 years, use of continuous renal replacement therapy, and patient death[24].

This study found a true association between high workload and hospital and ICU mortality (p=0.005 and p=0.000, respectively). The NAS values obtained were ≥ 90 points, indicating that each patient demanded more than 90% of a nursing professional's time. These results reflect the seriousness of the cases and the need for human resources, indicating patients' vulnerability to adverse events since high workload predicts outcome.

Study limitations

This research contains weaknesses related to the study design, which calls for further study to generate robust evidence directly affecting patient safety. Therefore, for future studies, we suggest a detailed analysis of the most prevalent NAS items, identifying key points of patient demand in comparison with nursing sizing, and adopting a control group to obtain more significant results and guarantee the reproducibility of the study.

Contributions to practice

The demographic characterization of the patients, mostly elderly and male, with multiple comorbidities, reinforces the need for rigorous surveillance and specific preventive interventions for these risk groups. In addition, the high incidence of pressure injuries in patients in the prone position, associated with hypoxemia and microvascular fragility, highlights the importance of preventive measures, such as using viscoelastic mattresses and adhesive foam dressings,

to minimize damage. The analysis also highlights the importance of enteral nutrition in prone patients, demonstrating that the position does not prevent safe feeding when post-pyloric positioning recommendations and prokinetic measures are followed.

In addition, the research highlights the impact of nursing workload, particularly during critical periods such as prone positioning. Although increased workload was not directly correlated with a higher incidence of adverse events, its association with mortality emphasizes the need for adequate allocation of human resources and institutional support in ICUs. These data corroborate the relevance of strategic planning and the efficient distribution of resources, ensuring that the nursing team can provide high-quality care even in situations of high demand, contributing to better clinical outcomes and patient safety.

Conclusion

Male gender, age ≥ 60 years, and the presence of cardiovascular and metabolic diseases were identified as risks for severe forms of the disease and the need for hospitalization. All the patients had severe hypoxemia and often required ultra-protective mechanical ventilation with associated hemodynamic support.

Despite the benefits of pronation, this method can lead to complications, requiring specific preparation by the team to minimize adverse events. The nursing workload was consistently high during all the periods evaluated, reflecting the severity of the cases. However, this workload did not correlate negatively with care indicators, possibly due to the protective effect of a 1:1 work ratio. At the same time, workload was associated with adverse outcomes, highlighting the severity of cases and the natural evolution of COVID-19.

Authors' contributions

Conception and design, analysis and interpretation of data, manuscript drafting and relevant criti-

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References

1. Parasher A. COVID-19: Current understanding of its pathophysiology, clinical presentation and treatment. Postgrad Med J. 2021;97(1147):312-20. doi: https://dx.doi.org/10.1136/postgrad-medj-2020-138577

2. Matthay MA, Arabi Y, Arroliga AC, Bernard G, Bersten AD, Brochard LJ, et al. A new global definition of acute respiratory distress syndrome. Am J Respir Crit Care Med. 2024;209(1):37-47. doi: https://doi.org/10.1164/rccm.202303-0558WS

3. Tasaka S, Ohshimo S, Takeuchi M, Yasuda H, Ichikado K, Tsushima K, et al. ARDS Clinical Practice Guideline 2021. J Intensive Care. 2022;10(1):32. doi: https://doi.org/10.1186/s40560-022-00615-6

4. Guérin C, Albert RK, Beitler J, Gattinoni L, Jaber S, Marini JJ, et al. Prone position in ARDS patients: why, when, how and for whom. Intensive Care Med. 2020;46(12):2385-96. doi: http://doi.org/10.1007/s00134-020-06306-w

5. Douglas IS, Rosenthal CA, Swanson DD, Hiller T, Oakes J, Bach J, et al. Safety and outcomes of prolonged usual care prone position mechanical ventilation to treat acute coronavirus disease 2019 hypoxemic respiratory failure. Crit Care Med. 2021;49(3):490-502. doi: https://doi.org/10.1097/CCM.0000000000004818

6. Bruni A, Garofalo E, Grande L, Auletta G, Cubello D, Greco M, et al. Nursing issues in enteral nutrition during prone position in critically ill patients: A systematic review of the literature. Intensive Crit Care Nurs. 2020;60:102899. doi: https://doi.org/10.1016/j.iccn.2020.102899

7. Alghamdi MG. Nursing workload: a concept analysis. J Nurs Manag. 2016;24(4):449-57. doi: https://doi.org/10.1111/jonm.12354

8. Queijo AF, Padilha KG. Nursing Activities Score (NAS): cross-cultural adaptation and validation to Portuguese language. Rev Esc Enferm USP. 2009;43(spe):1018-25. doi: https://dx.doi.org/10.1590/S0080-62342009000500004

9. Margadant C, Wortel S, Hoogendoorn M, Bosman R, Spijkstra JJ, Brinkman S, et al. The Nursing Activities Score per nurse ratio is associated with in-hospital mortality, whereas the patients per nurse ratio is not. Crit Care Med. 2020;48(1):3-9. doi: https://dx.doi.org/10.1097/CCM.0000000000004005

10. Altafin JAM, Grion CMC, Tanita MT, Festti J, Cardoso LTQ, Veiga CFF et al. Nursing Activities Score and workload in the intensive care unit of a university hospital. Rev Bras Ter Intensiv. 2014;26(3):292-8. doi: https://doi.org/10.5935/0103-507X.20140041

11. Agência Nacional de Vigilância Sanitária. Critérios Diagnósticos de Infecções Relacionadas à Assistência à Saúde. Brasília: Anvisa; 2017.

12. Castro MG, Ribeiro PC, Matos LBN, Abreu HB, Assis T, Barreto PA, et al. BRASPEN Guideline for Nutritional Therapy in the Critically Ill Patient. BRASPEN J. 2023;38(Supl):2-46. doi: https://doi.org/10.37111/braspenj.diretrizDOENTEGRAVE

13. Ranzani OT, Bastos LSL, Gelli JGM, Marchesi JF, Baião F, Hamacher S, et al. Characterisation of the first 250000 hospital admissions for COVID-19 in Brazil: a retrospective analysis of Nationwide data. Lancet Respir Med. 2021;9(4):407-18. doi: http://doi.org/10.1016/S2213-2600(20)30560-9

14. Marin BG, Aghagoli G, Lavine K, Yang L, Siff EJ, Chiang SS, et al. Predictors of COVID-19 severity: a literature review. Rev Med Virol. 2020;31(1):1-10. doi: https://doi.org/10.1002/rmv.2146

15. Steenblock C, Schwarz PEH, Ludwig B, Linkermann A, Zimmet P, Kulebyakin K, et al. COVID-19 and metabolic disease: mechanisms and clinical management. Lancet Diabetes Endocrinol. 2021;9(11):786-98. doi: http://doi.org/10.1016/S2213-8587(21)00244-8

16. Welker C, Huang J, Gil IJN, Ramakrishna H. 2021 acute respiratory distress syndrome update, with coronavirus disease 2019 focus. J Cardiothorac Vasc Anesth. 2022;36(4):1188-95. doi: https://doi.org/10.1053/j.jvca.2021.02.053

17. Al-Dorzi HM, Arabi YM. Enteral nutrition safety with advanced treatments: extracorporeal membrane oxygenation, prone positioning, and infusion of neuromuscular blockers. Nutr Clin Pract. 2021;36(1):88-97. doi: https://doi.org/10.1002/ncp.10621

18. González-Seguel F, Pinto-Concha JJ, Aranis N, Leppe J. Adverse events of prone positioning in mechanically ventilated adults with ARDS. Respir Care. 2021;66(12):1898-911. doi: http://doi.org/10.4187/respcare.09194

19. Pozuelo-Carrascosa DP, Cobo-Cuenca AI, Carmona-Torres JM, Laredo-Aguilera JA, Santacruz-Salas E, Fernandez-Rodriguez R. Body position for preventing ventilatorassociated pneumonia for critically ill patients: a systematic review and network metaanalysis. J Intensive Care. 2022;10(1):9. doi: https://doi.org/10.1186/s40560-022-00600-z

20. Moore Z, Patton D, Avsar P, McEvoy NL, Curley G, Budri A, et al. Prevention of pressure ulcers among individuals cared for in the prone position: lessons for the COVID-19 emergency. J Wound Care. 2020;29(6):312-20. doi: https://dx.doi.org/10.12968/jowc.2020.29.6.312

21. Ximenes RRC, Chaves EMC, Girão ALA, Gonçalves MHRB, Ferreira SL, Carvalho REFL. Knowledge of nursing staff before and after training on incontinenceassociated dermatitis. Rev Esc Enferm USP. 2024;58:e20230272 doi: https://dx.doi.org/10.1590/1980-220X-REEUSP-2023-0272en

22. O'Flynn SK, Mohamud L, Copson D. Medical adhesive-related skin injury. Br J Nurs. 2020;29(6):20-6. doi: https://doi.org/12968/bjon.2020.29.6.S20

23. Ross P, Howard B, Ilic D, Watterson J, Hodgson CL. Nursing workload and patient-focused outcomes in intensive care: A systematic review. Nurs Health Sci. 2023;25(4):497-515. doi: https://doi.org/10.1111/nhs.13052

24. 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;62:102967. doi: https://doi.org/10.1016/j.iccn.2020.102967