

O período de hospitalização e o uso de ventilação mecânica em pacientes com COVID-19 aumentam a ocorrência de incidentes não infecciosos: um estudo observacional retrospectivo

The period of hospitalization and use of mechanical ventilation in patients with COVID-19 increases the occurrence of non-infectious incidents: a retrospective observational study

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ABSTRACT

Introduction: The occurrence of incidents within the hospital impacts the patient's prognosis, while the work of the interdisciplinary team is essential for mitigating care-related incidents. **Objective:** To investigate reports of non-infectious incidents monitored by physiotherapists in patients diagnosed with COVID-19 and their relationships with length of hospital stay and use of mechanical ventilation. **Methods:** This is an observational and retrospective study with a convenience sample composed of patients with COVID-19 admitted to a Brazilian public hospital from March 2020 to December 2021. The following data were compiled to characterize the sample: age, sex, chronic non-communicable diseases, description of severity using the Related Diagnostics Group (RDG) methodology, expected length of hospital stay, length of hospital stay, occurrence of the non-infectious incident, exposure to mechanical ventilation (MV) and hospital outcome (discharge/transfer/death). The Chi-squared, Fisher's Exact, and Monte Carlo tests were used to analyze the correlation among categorical variables. The significance level considered was $p < 0.05$. **Results:** A total of 90 medical records were included in the study (65.6±14.7 years, 55.6% male). The occurrence of non-infectious incidents was significant regarding the length of stay in the intensive care unit ($p < 0.007$), time on MV ($p < 0.020$), and death outcome 70.6% ($p < 0.001$). **Conclusion:** The increased length of hospital stay associated with the use of MV in patients with COVID-19 contributes to a greater occurrence of non-infectious incidents in this population.

Keywords: COVID-19; Patient safety; Length of hospitalization; Mechanical ventilation.

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RESUMO

Introdução: A ocorrência de incidentes no âmbito hospitalar impacta o prognóstico do paciente e a atuação da equipe interdisciplinar é fundamental para a mitigação de incidentes relacionados à assistência.

Objetivo: Investigar as notificações de incidentes não infecciosos monitorados por fisioterapeutas em pacientes diagnosticados com COVID-19 e a sua relação com o tempo de internação hospitalar e uso de ventilação mecânica. **Métodos:** Trata-se de um estudo observacional e retrospectivo com uma amostra, alocado por conveniência, composta por pacientes com COVID-19 internados em um hospital público brasileiro no período de março de 2020 a dezembro de 2021. Foram compilados os seguintes dados para caracterização da amostra: idade, sexo, doenças crônicas não transmissíveis, descrição da gravidade pela metodologia *Related Diagnostics Group* (RDG), tempo de internação hospitalar previsto, tempo de internação hospitalar realizada, ocorrência do incidente não infeccioso, exposição à ventilação mecânica (VM) e desfecho hospitalar (alta/transferência/óbito). Para análise de correlação entre as variáveis categóricas foram utilizados os testes Qui-quadrado, Fisher e Monte Carlo. O nível de significância considerado foi $p < 0,05$.

Resultados: Foram incluídos 90 prontuários no estudo ($65,6 \pm 14,7$ anos, 55,6% do sexo masculino). A ocorrência de incidentes não infecciosos foi significativa no tempo de internação na unidade de terapia intensiva ($p < 0,007$), tempo de VM ($p < 0,020$) e desfecho de óbito 70,6% ($p < 0,001$). **Conclusão:** O aumento do tempo de internação hospitalar associado ao uso de VM em pacientes com COVID-19 contribui para uma maior ocorrência de incidentes não infecciosos nessa população.

Palavras-chave: COVID-19; Segurança do paciente; Tempo de Internação; Ventilação mecânica.

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INTRODUCTION

Coronavirus disease 19 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was classified as the third outbreak due to this virus. The first outbreak was caused by SARS-CoV (2003) and the second by the Middle East Respiratory Syndrome-Coronavirus (MERS-CoV) in 2012 in the Middle East¹. The first case of COVID-19 was registered in Brazil in February 2020, and then a pandemic situation was declared by the World Health Organization (WHO) in March of the same year due to the high transmission of the disease². Current data from September 2023 reveal the occurrence of almost seven million deaths worldwide caused by COVID-19 contamination, with around 700.000 deaths occurring in Brazil³.

The patient's age group and their burden of morbidities are related to the increase in unfavorable outcomes, such as longer hospital stays, increased demand for treatments in the Intensive Care Unit (ICU), use of Mechanical Ventilation

(MV), and an increased death rate². People who were diagnosed with chronic non-communicable diseases, which are slow-developing and long-lasting health conditions, are more likely to have severe symptoms when infected with the COVID-19 virus. Cardiovascular and cerebrovascular diseases, as well as diabetes, are the most relevant. The most severe cases of COVID-19 affect adults over 60 and those with the aforementioned chronic illnesses⁴.

In addition to these factors, the occurrence of incidents in the hospital impacts the patient's prognosis⁵. The International Patient Safety Classification, defined by the WHO, considers an incident as an "event or circumstance that may result in unnecessary harm to the patient" being classified as reportable circumstances, near miss, incident without harm and, incident with harm/adverse event⁶. Therefore, the work of the interdisciplinary team is essential for mitigating care-related incidents⁷, with the physiotherapist being responsible for ensuring functionality and positively contributing to clinical outcomes^{8,9}.

Detecting potential incidents can contribute to optimizing strategies that promotes care quality and patient safety during hospital stays¹⁰. Although there are studies that relate the participation of physiotherapists in reporting incidents during their work^{10,11}, the description of these incidents, according to the classification defined by the WHO and their action in a preventive manner, still needs to be discovered in the literature. Incident reports in the hospital environment during COVID-19 began to be limited to infectious adverse events¹². In this perspective, the objective of the present study was to investigate reports of non-infectious incidents monitored by physiotherapists in patients diagnosed with COVID-19 and their relationship with the length of hospital stay and use of MV.

METHODS

STUDY DESIGN

This was a retrospective observational study that followed the recommendations of the STrengthening the reporting of OBServational studies in Epidemiology (STROBE)¹³. It was conducted in a public hospital in a Brazilian metropolitan capital, from March 2020 to December 2021.

SAMPLE

The eligibility criteria were: medical records of patients diagnosed with COVID-19, aged ≥ 18 years, with chronic non-communicable diseases, with a hospital stay of ≥ 24 hours, exposed or not to non-infectious incidents. Eligible patients were recruited through convenience sampling, considering the entire population of the previously stipulated period.

Medical records with incomplete or incomprehensible information, patients with neurodegenerative diseases and, who did not receive physiotherapeutic care during the hospitalization period were excluded.

DATA COLLECTION AND STUDY VARIABLES

The variables were collected through electronic medical records and data provided by the Hospital Infection Control Service (SCIH), which provided a list of patients who were diagnosed with COVID-19. The diagnosis was made through the rapid nasal SWAB test from the hospital's clinical analysis laboratory hospital and confirmed by the Reverse transcription polymerase chain reaction (RT-PCR) test performed by the Ezequiel Dias Foundation (FUNED). The Patient Safety Center (NSP) provided a list of patients with notifications of non-infectious incidents Related Diagnostics Group (DRG Brazil) provided data related to the patient's profile during the hospitalization period.

The study's independent variable was the non-infectious incident, and the dependent variables were the length of hospital stay and the use of MV.

The following sociodemographic and clinical data were compiled to identify and characterize the sample: age, sex, chronic non-communicable diseases, description of severity using the DRG methodology, expected length of hospital stay, incurred length of hospital stay, occurrence of the

non-infectious incident, use MV and hospital outcome (discharge, transfer, and death).

DRG BRAZIL[®]

The DRG Brazil[®] is a hospital management tool that enables patients to be categorized according to social, demographic, nosological, and therapeutic characteristics and is used to evaluate the efficiency of services and guarantee patient care safety¹⁴. The DRG classifies the patient's level of severity using the Major diagnostic categories (MDC), which considers three hierarchical levels of complexity; the least complex is without comorbidities or complications (CC), the intermediate level has CC, and the most complex has comorbidities and complications (MCC). Furthermore, patients who used Extracorporeal Membrane Oxygenation (ECMO) and tracheostomy with MV for more than 96 hours are not categorized in the MDC^{5,14,15}. Allied to the MDC, the DRG provides the Case Mix, which uses variables such as primary and secondary diagnoses, type of treatment, age and sex of the patient, surgery, existence of comorbidities/acquired conditions, discharge status and the procedures performed in order to define and group the patient profiles. The final value of the Case Mix varies according to the profile of patients served by the institution, making it important data for measuring hospital performance concerning the patient's severity¹⁶. The cut-off point for Case Mix is not described in the literature, however the higher the Case Mix value, the greater the level of severity and costs allocated to care, which allows us to relate the care provided with efficiency, effectiveness and the obtained results¹⁶.

NON-INFECTIOUS INCIDENTS

According to the WHO classification, incidents are classified into reportable circumstances: a preventive view preceding the incident, near miss: perception of the error before it affects the patient; incident without damage and incident with damage/adverse event⁶. Incidents with harm, known as adverse events, are classified as: mild harm, moderate harm, severe harm, and death¹⁷.

The non-infectious incidents in this study were collected through the hospital's incident notification form, made available via electronic medical records and, confirmed by the NSP. The form includes data to assist in the investigation of incidents that occurred in the institution, such as the name of the incident, the type and classification of the incident, a brief description of the incident scenario, the immediate action taken in response to the incident, the date of the occurrence, the professional who notified it, and the shift of the occurrence separated into morning (08:00 to 13:00 hours), afternoon (13:01 to 18:00 hours) and night (18:01 to 22:00 hours).

The descriptions of non-infectious incidents (Table 1) are defined using an internal hospital classification derived from the NSP to categorize non-infectious incidents.

The interprofessional team monitors non-infectious incidents though incidents monitored by physiotherapists refer to those that occurred during their care or that are part of their area of expertise.

Table 1. Description of non-infectious incidents.

NON-INFECTIOUS INCIDENTS	DEFINITION
Failure to follow up with physiotherapy	Incident resulting from a professional error.
Bronchoaspiration without respiratory prosthesis	Entry of undue substances into the lower airway from the oropharynx and gastric route in those patients without the use of a respiratory prosthesis.
Bed assembly failure	Bed with incomplete equipment and utensils necessary for assistance.
Oxygenation ineffectiveness	Inadequate oxygen delivery to achieve the patient's target peripheral saturation.
Bronchoaspiration risk	Patient with probability of occurrence of undue substances entering the lower airway from the oropharynx and gastric route.
Inadequate oral hygiene	Accumulation of waste in the oral region.
Respiratory change	Change in the breathing pattern's rhythm, frequency and/or amplitude
Ineffectiveness of nasogastric tube/nasogastric tube (NET/NGT) fixation	Unstable fixation of the NET/NGT.
Inadequate insulation	Failure to follow contact, airborne, droplet and aerosol isolation guidelines.
Inadequate sedation	Inadequate control of the level of sedation or psychomotor agitation.
Ineffectiveness of the tracheostomy cuff/orotracheal tube (TC/OT)	Inadequate CUFF pressure above or below 30 cmH ₂ O.
Ineffectiveness of TC/OT fixation	Unstable fixation of the TC/OT.
Airflow ineffectiveness	Airflow obstruction that leads to loss of lung volume.
Risk of self-extubation	Probability of unscheduled removal of the ventilatory device.
Accidental extubation	Unscheduled removal of the ventilation device.
Inadequate humidification	Inappropriate heating and humidification of medicinal gases.
Respirator ineffectiveness	Inefficiency of air entry and exit offered by the mechanical fan.
Non-dated Heat and Moisture Exchanger Filter (HMEF)	HMEF without identification label with an expiration date.
Inadequate orotracheal intubation (IOT) COVID-19 protocol	Failure to follow IOT guidelines for patients with COVID-19 due to the risk of aerosol dispersion.
Leaky mechanical ventilation circuit	Ventilation circuit with holes that lead to loss of tidal volume.
Skin injury by device	Localized damage to the skin caused by pressure from devices on the dermis.
Pneumothorax	Presence of air between the parietal and visceral pleura

Professionals at this public hospital are trained every six months to report incidents to disseminate the culture of healthcare safety. It is essential to highlight that the reported incidents did not necessarily occur during the provision of care directly to the patient.

ETHICAL ASPECTS

The present study was approved by the Research Ethics Committee (CEP) of the Faculty of Medical Sciences of Minas Gerais (FCMMG) under CAAE

opinion: 43076520.6.0000.5134. The use of an Informed Consent Form (ICF) was waived in this study because it is a retrospective study with medical record analysis, which makes it impossible to contact all the patients whose records were analyzed and many of them have already died.

STATISTICAL ANALYSIS

The sample was descriptively analyzed using central tendency and dispersion measures (mean, median, standard deviation and, 25th and 75th percentiles) for continuous

variables and through absolute (n) and relative frequency (%) measures for categorical variables. The quantitative variables (age, length of stay, MV time, expected and actual length of stay in the intensive care center, expected length of hospital stay and, number of non-infectious incidents) were tested for normality using the Kolmogorov-Smirnov test. Comparison of variables was performed using the unpaired t-test or Mann-Whitney test when appropriate.

Non-parametric tests were used to characterize the sample based on the occurrence of a non-infectious incident due to the small sample size (17 patients). The age, Case Mix, and MV time variables, as well as all variables related to hospital stay were compared regarding the incident with and without damage using the Mann-Whitney test. Chi-squared tests with Monte Carlo simulation were used for the following categorical variables: hospital outcome, MDC classification, and number of chronic diseases. In addition, the Fisher's

Exact test was used for the gender, hypertension, diabetes, chronic obstructive pulmonary disease, cardiomyopathy, chronic kidney disease and, use of MV variables.

The significance level considered in all tests was $p < 0.05$ and the SPSS (Statistical Package for the Social Science) version 25.0 software was used for all statistical analyses.

RESULTS

A total of 174 medical records were analyzed, however 84 records which had incomplete information, patients with neurodegenerative diseases or those who did not receive physiotherapeutic care during the hospitalization period were excluded. Therefore, the sample for this study consisted of 90 patients diagnosed with COVID-19, characterized by a high prevalence of diabetes mellitus (36.7%) and a higher level of severity according to the MDC (46.7%) (Table 2).

Table 2. Sample characterization (N=90).

Variables	n	%	Mean (SD)
Sex			
Masculine	50	55.6	-
Age (years)	-	-	65.6 (14.7)
Description of chronic non-communicable diseases			
Diabetes Mellitus	33	36.7	-
Systemic arterial hypertension	28	31.1	-
Chronic obstructive pulmonary disease	20	22.2	-
Cardiomyopathy	9	10.0	-
Hospital stay time (days)			
Expected	-	-	10.8 (6.8)
Actual	-	-	18.4 (17.1)
Length of stay in the ICU (days)			
Expected	-	-	9.6 (6.5)
Actual	-	-	5.6 (4.8)
Major diagnostic categories (MDC) classification			
ECMO or tracheostomy with mechanical ventilation over 96 hours	20	22.2	-
Higher severity level	42	46.7	-
Intermediate severity level	11	12.2	-
Minor severity level	8	8.9	-
No complications or comorbidities	9	10.0	-
Mechanical Ventilation (MV)			
Number of patients who used MV	37	41.1	-
Non-infectious incidents			
Number of patients with incident occurrence	17	18.9	-
Total number of incidents	50*	100	-

Legend: Extracorporeal Membrane Oxygenation (ECMO); Intensive Care Center (CTI); Data expressed as n (%). Mean or standard deviation (SD); *total number of non-infectious incidents occurring in the 17 patients.

Table 3 compares the study variables of patients with and without the presence of non-infectious incidents. Male gender and age ≥ 65 years have prevailed in both groups. The time using MV ($p < 0.020$) and the length of stay in the ICU ($p < 0.007$) were significantly longer in patients with non-infectious incidents compared to those without. In the MDC classification, 52.9% of the category with non-infectious incidents had ECMO or tracheostomy with MV older than 96 hours. In comparison, 50.7% of patients without non-infectious incidents had a higher severity level. However, in patients with non-infectious incidents, the Case Mix was significantly higher ($p = 0.005$). In patients with non-infectious incidents, the outcome of death prevailed (70.6%), while in patients without non-infectious incidents, the outcome of transfer prevailed (61.6%).

Among the 50 non-infectious incidents reported in the 17 patients, 18 (36%) were not related to MV, with the

most frequent being failure to assemble the bed (8%), risk of bronchoaspiration without a respiratory prosthesis (6%), oral hygiene inadequate (6%), ineffectiveness of nasoenteric tube and nasogastric tube (SNE/NGT) fixation (6%) and bronchoaspiration without ventilatory prosthesis (4%). Non-infectious incidents related to MV totaled 32 (64%), with the most frequent being ineffectiveness of tracheostomy and orotracheal tube (TC/OT) fixation (10%), accidental extubation (8%), ineffectiveness of airflow (8%), skin injury due to device (8%), ineffectiveness of the cuff (4%), ineffectiveness of oxygenation (4%) and pneumothorax due to invasive mechanical ventilation (IMV) (4%).

The types of non-infectious incidents were grouped into “non-infectious incidents without harm” in Table 4, which are incidents that did not affect or result in harm to the patient, thus including near miss, reportable circumstances

Table 3. Comparison of study variables with the presence of non-infectious incidents and no non-infectious incidents.

Variables	With non-infectious incident (n =17)	No non-infectious incident (n=73)	p-value
Age years)	69 (12)	65 (15)	0.238 ^t
Sex			
Masculine	11 (64.7%)	39 (53.4%)	0.339 ^{x²}
Use of mechanical ventilation			
Number of patients who used MV	16 (94.1%)	5 (6.8%)	-
Mechanical ventilation time (days)	9 (6)	5 (4)	0.020^t
Intensive care center time (days)	18.4 (15.9 - 24)	12.7 (8.3 - 20)	0.007^w
Hospital stay time (days)			
Expected length of stay in hospital	7.8 (4.4 - 8.5)	7.6 (3.9 - 8.4)	0.560 ^w
Expected stay for discharge	18.8 (6.5 - 19.9)	8.4 (6.5 - 10.8)	0.057 ^w
Length of stay in the ICU (days)			
Expected	18.8 (8.0 - 19.9)	7.6 (5.1 - 9.5)	<0.001^w
Actual	8.2 (4.1 - 12.1)	3.8 (1.8 - 6.7)	0.007^w
Case Mix	5.1 (2.5 -7.8)	1.8 (1.6 - 3.7)	0.005^w
Hospital outcome			<0.001^{x²}
High	2 (11.8%)	13 (17.8%)	
Transfer	3 (17.6%)	45 (61.6%)	
Death	12 (70.6%)	15 (20.5%)	
Classification Major diagnostic categories			0.012^{x²}
ECMO or tracheostomy with invasive mechanical ventilation over 96 Hours	9 (52.9%)	11 (15.1%)	
High severity level	5 (29.4%)	37 (50.7%)	
Intermediate severity level	2 (11.8%)	9 (12.3%)	
Minor severity level	1 (5.9%)	7 (9.6%)	
No complications or comorbidities	0 (0.0%)	9 (12.3%)	

Legend: Extracorporeal Membrane Oxygenation (ECMO); Intensive Care Center (CTI); Data expressed as Mean (SD). Median (P25-P75) or n (%); t: T-test; w: Mann-Whitney test; X²: Chi-squared with Monte Carlo Simulation.

and, incident without harm. The “non-infectious incident with harm” grouping includes incidents that affected the patient and resulted in harm, thus including incidents of mild, moderate and, severe harm. Thus, the comparison among the groups is exposed, subdivided by the number of occurrences in the sample referring to the 17 patients who had an incident. Although the comparison does not present statistically significant differences ($p < 0.05$), the data are essential to characterize this sample.

When analyzing the group of patients who had one or more damaging incidents, Table 5 shows that the length of hospital stay was statistically significant ($p = 0.019$) and longer than of patients who did not have a damaging incident. Although the result is not statistically significant

($p = 0.133$), it is noted that patients with one or more incidents of damage have longer MV use.

Of the 50 non-infectious incidents occurring in 17 patients, 39 (78%) were reported by physiotherapists, with 25 (50%) reportable circumstances, six (12%) incidents of mild damage, three (6%) incidents of moderate damage, and five (10%) incidents of serious harm. The other 11 (22%) non-infectious incidents were reported by speech therapists, with 9 (18%) being reportable circumstances, one (2%) incident of moderate harm, and one (2%) incident of severe harm. The proportion of occurrence was 2.94 non-infectious incidents per patient ($n = 17$) and 0.55 non-infectious incidents per patient about the total number of the sample ($n = 90$).

Table 4. Characterization of the sample with occurrence of a non-infectious incident (N=17).

Variables	Non-infectious incident without harm		p-value	Non-infectious incident with harm		p-value	
	0 or 1	2 or more		0	1 or more		
Sex							
Feminine	1 (14.3%)	5 (50.0%)	0.304 ^f	3 (42.9%)	3 (30.0%)	0.644 ^f	
Masculine	6 (85.7%)	5 (50.0%)		4 (57.1%)	7 (70.0%)		
Hospital outcome							
High	0 (0%)	2 (20.0%)	0.602 ^q	1 (14.3%)	1 (10.0%)	>0.999 ^q	
Transfer	1 (14.3%)	2 (20.0%)		1 (14.3%)	2 (20.0%)		
Death	6 (85.7%)	6 (60.0%)		5 (71.4%)	7 (70.0%)		
Number of chronic diseases							
One	1 (14.3%)	5 (50.0%)	0.910 ^w	1 (14.3%)	2 (14.3%)	0.889 ^w	
Two	3 (42.9%)	1 (10.0%)		0.454 ^q	1 (14.3%)		3 (30.0%)
Three	2 (28.6%)	3 (30.0%)			2 (28.6%)		3 (30.0%)
Four	1 (14.3%)	1 (10.0%)			1 (14.3%)		1 (10.0%)
Hypertension							
Yes	6 (85.7%)	9 (90.0%)	>0.999 ^f	5 (71.4%)	10 (100.0%)	0.154 ^f	
No	1 (14.3%)	1 (10.0%)		2 (28.6%)	0 (0%)		
Diabetes Mellitus							
Yes	4 (57.1%)	5 (50.0%)	>0.999 ^f	4 (57.1%)	5 (50.0%)	>0.999 ^f	
No	3 (42.9%)	5 (50.0%)		3 (42.9%)	5 (50.0%)		
COPD							
Yes	1 (14.3%)	0 (0%)	0.412 ^f	0 (0.0%)	1 (10.0%)	>0.999 ^f	
No	6 (85.7%)	10 (100.0%)		7 (100.0%)	9 (90.0%)		
Cardiomyopathy							
Yes	2 (28.6%)	1 (10.0%)	0.537 ^f	2 (28.6%)	1 (10.0%)	0.537 ^f	
No	5 (71.4%)	9 (90.0%)		5 (71.4%)	9 (90.0%)		
CKD							
Yes	2 (28.6%)	4 (40.0%)	>0.999 ^f	2 (28.6%)	4 (40.0%)	>0.999 ^f	
No	5 (71.4%)	6 (60.0%)		5 (71.4%)	6 (60.0%)		

Variables	Non-infectious incident without harm		p-value	Non-infectious incident with harm		p-value
	0 or 1	2 or more		0	1 or more	
Major diagnostic categories (MDC) classification						
ECMO or tracheostomy with invasive mechanical ventilation over 96 Hours	3 (42.9%)	6 (60.0%)		4 (57.1%)	5 (50.0%)	
Higher severity level	2 (28.6%)	3 (30.0%)	0.870 ^a	3 (42.9%)	2 (20.0%)	0.568X ²
Intermediate level of severity	1 (14.3%)	1 (10.0%)		0 (0%)	2 (20.0%)	
Minor severity level	1 (14.3%)	0 (0.0%)		0 (0%)	1 (10.0%)	
Use Mechanical Ventilation						
Yes	7 (100.0%)	9 (90.0%)		6 (85.7%)	10 (100.0%)	
No	0 (0.0%)	1 (10.0%)	>0.999 ^f	1 (14.3%)	0 (0.0%)	0.412 ^f

Legend: Chronic Obstructive Pulmonary Disease (COPD); Extracorporeal Membrane Oxygenation (ECMO); Data expressed in n (%); f: Fisher's exact test; X²: Chi-squared with Monte Carlo Simulation; w: Mann-Whitney test.

Table 5. Comparison of variables concerning the occurrence and number of non-infectious incidents with damage or without damage.

Variables	NON-INFECTIOUS INCIDENT WITHOUT DAMAGE					NON-INFECTIOUS INCIDENT WITH DAMAGE				
	0 or 1 (n=7)		2 or more (n=10)			0 (n=7)		1 or more (n=10)		
	Mean (DP)	Median (IQR)	Mean (SD)	Median (IQR)	p-value	Mean (DP)	Median (IQR)	Mean (SD)	Median (IQR)	p-value
Age	70 (15)	69 (57 - 84)	69 (11)	69 (62 - 77)	0.887	71 (16)	73 (51 -86)	68 (9)	65 (62 -77)	0.475
Expected length of hospital stay (days)	11.5 (7.7)	8.4 (5.8 - 18.8)	17.6 (10.7)	18.8 (10.4 - 19.9)	0.23	14.3 (7.2)	18.8 (5.9 -16.5)	15.7 (11.6)	16.2 (6.5 -18.8)	0.740
Actual length of hospital stay (days)	21.7 (11.2)	22.5 (12.6 - 31.9)	24.5 (17.2)	17.5 (16.3 - 23.9)	0.887	15.8 (2.8)	15.9 (13.0 -16.5)	28.6 (17.4)	24 (18.4 -31.9)	0.019
Expected length of stay in the ICU (days)	12.4 (6.1)	10.4 (6.8 - 18.8)	19.5 (10.1)	19.9 (18.8 - 19.9)	0.043	14.9 (7.2)	18.8 (8.0 -19.9)	17.8 (10.6)	18.8 (7.8-19.9)	0.962
Actual length of stay in the ICU (days)	6.5 (5.1)	7.5 (1.1 - 12.3)	11.2 (7.4)	10.1 (6.9 - 12.1)	0.315	9.3 (6.3)	8.1 (4.1 -12.3)	9.2 (7.4)	9.1 (2.8-12.1)	0.962
Case Mix	4.2 (2.8)	3.2 (1.4- 7.8)	5.3 (3.1)	5.3 (3.2 - 7.8)	0.475	4.4 (2.26)	5.1 (2.2-5.5)	5.2 (3.5)	4.3 (2.5-7.8)	0.740
VM time (days)	9 (7)	7 (5 - 10)	8 (5)	8 (4 - 10)	0.813	6 (4)	4 (4-10)	10 (6)	8 (6-12)	0.133

Legend: Intensive Care Center (CTI); Mechanical Ventilation (VM); Data expressed as Median (P25-P75). Mean or Standard Deviation (SD); Mann-Whitney test.

About the shift, non-infectious incidents occurred in more significant proportion in the morning, with 58% being reportable circumstances, 10% incidents of minor damage, 6% incidents of moderate damage, and 10% incidents of severe damage. There were 8% reportable circumstances in the afternoon shift, 2% incidents of minor damage, 2% incidents of moderate damage and, 2% incidents of severe damage. Finally, only 2% reportable circumstances occurred in the evening shift.

DISCUSSION

The results of the present study demonstrate that patients diagnosed with COVID-19 who have a more extended hospital stay and use of MV are exposed to a greater occurrence of non-infectious incidents. Such findings are extremely relevant, as their presence contributes to death, as demonstrated in a previous study¹⁸.

The prevalence of COVID-19 diagnosis in men over 60 years of age and with associated chronic diseases is presented in the literature as a risk factor for exacerbating the clinical picture of COVID-19¹⁹⁻²³. Although the present study did not correlate the presence of chronic diseases as a mortality factor for this population, other studies have described the association between the presence of chronic diseases, such as diabetes mellitus, arterial hypertension, cardiomyopathy, and chronic kidney disease as predictors of mortality during the period of COVID-19 infection¹⁹⁻²³. The high rate of patient transfers may explain such discrepancies, as the study center is not a reference for the treatment of patients with COVID-19.

Patients infected with the COVID-19 virus initially present flu-like symptoms, and some quickly progress to severe acute lung injury, known as acute respiratory distress syndrome (ARDS)^{6,7}. Overall, between a quarter and a third of hospitalized patients will be admitted to the ICU, which will require prolonged use of MV and longer ICU stays^{6,7}. A body of evidence shows that prolonged stay in this environment is associated with increased death outcomes for these patients^{12,24-27}. A study performed in the metropolitan region of Detroit in the United States of America (USA), with a sample of 463 patients diagnosed with COVID-19, with an average age of 57.5 years and at least one associated chronic disease, demonstrated that 73.8% of individuals had an average hospital stay of 8.5 days²⁷. These results are similar to ours, as the sample studied is approximately five times smaller than the Detroit study. Therefore, the present study corroborates the previously found concerning prolonged hospital stay²⁷.

When analyzing the association between the use of MV and increased mortality, it is necessary to highlight that there is evidence that links the occurrence of incidents to unfavorable outcomes for critically ill patients^{18,28}. According to Alonso-Ovies et al. (2018)²⁹, patients using MV or air isolation are at greater risk of having a damaging incident. Such findings were evidenced in the present study since the average number of days spent on MV was approximately double in patients who had incidents compared to those who did not. Moreover, it was found that exposure to the

incident makes the patient susceptible to a greater risk of new events occurring³⁰. In this sense, this study reinforces that patients using MV must be constantly monitored by the multidisciplinary team due to its relationship with increased mortality.

The DRG methodology was used in the present study to combine with Case Mix, which categorizes and values the population requiring health services through the analysis of severity, costs and, complexity. Along with the present study, the study by Couto and Pedrosa (2018)⁵ reported that patients with COVID-19 who had an incident during hospitalization remained on invasive MV for a longer time and in the ICU, with a significantly higher Case Mix. The high Case Mix leads to greater inefficiency in the care costs allocated to a patient who has an incident, and this acquired condition generates financial waste for the hospital. Therefore, such findings reinforce the importance of monitoring and preventing incidents.

It was observed that patients who had some type of non-infectious incident had a higher incidence of death than patients who were not exposed. This fact corroborates findings in the literature that confirm the relationship between death and the occurrence of incidents³¹⁻³³. However, the results of this study limit this association, as no specific statistical analysis was performed to assess the impact of incidents on the survival of these patients.

During the pandemic period, there was a reduction in notifications of non-infectious incidents without harm and an increase in incidents with serious harm in critical patients, who require greater monitoring. Most of these incidents could have been avoided^{7,34}. According to the "Patient Safety and Quality of Health Services Bulletin", failures during care correspond to the second most reported incident in Brazilian hospitals between 2014 and 2021³². In the present study, it was significantly evident that the number of notifications of reportable circumstances exceeded the number of incidents involving harm. Therefore, it is possible that reportable circumstances may serve as a warning for hospital management to maximize patient safety, as this incident may be due to human error.

One of the responsibilities of the hospital physiotherapist is to contribute to interdisciplinary work by creating protocols to prevent clinical and acquired complications during the hospitalization period³⁵. The current study shows that the physiotherapist was the professional who most reported incidents during hospitalization, with a higher proportion of notifications in the morning shift. This fact which is justified by the study center not offering physiotherapy coverage for 24 hours and notifications of incidents occurring retroactively on the professional's next shift. Furthermore, 50% of reportable circumstances were reported by the physiotherapist and, 28% of incidents involving harm during the hospitalization period. In contrast to the findings described, other authors present reports of incidents only during the physiotherapist's work and incidents only related to nursing care^{10,18,36}. Therefore, there is a restriction in the systematized view of multidisciplinary care.

The present study presents strong methodological points and clinical implications. Patients with the clinical profile demonstrated in this study may have a greater predisposition to exposure to non-infectious incidents with harm. In this perspective, the results aim to warn about the importance of ensuring improved care for these patients to prevent them from being exposed to non-infectious incidents with harm through reportable circumstances.

Although the present study observed evidence relevant to the literature, some limitations must be considered. First, the study was conducted in a single center where it was not a reference for patients diagnosed with COVID-19, a fact that did not allow absolute monitoring of the hospitalization period of patients eligible for the study due to the high hospital transfer rate. Furthermore, non-infectious incidents not monitored by physiotherapists, such as pressure injuries and loss of invasive access, were not considered, as such notifications are performed by other professionals. Therefore, the number of non-infectious incidents occurring per patient may have been underestimated due to the absence of this information that is monitored by other professionals.

CONCLUSION

The increased length of hospital stay associated with MV in patients with COVID-19 contributes to a more significant occurrence of non-infectious incidents in this population. In agreement with previously presented outcomes in the literature, the importance of monitoring incident notifications can be observed. Moreover, strategies must be implemented in order to minimize the occurrence of damaging incidents, thereby contributing to better patient survival, mainly with regard to length of stay and prolonged use of MV.

AUTHORS' CONTRIBUTIONS

Author contributions are structured according to the taxonomy (CRediT) described below:

Conceptualization, Investigation, Methodology, Visualization & Writing – analysis and editing: Ana Karolina Lima Souza, Ana Carolina Diniz, Flávia de Paula Castro Ferreira, Ana Flávia Nunes Faiad, Bruno Porto Pessoa, Maria da Glória Rodrigues Machado and Amanda Aparecida Oliveira Leopoldino. *Project Administration, Supervision & Writing – original draft:* Bruno Porto Pessoa, Maria da Glória Rodrigues Machado and Amanda Aparecida Oliveira Leopoldino. *Data Curation & Formal Analysis:* Bruno Porto Pessoa, Maria da Glória Rodrigues Machado and Amanda Aparecida Oliveira Leopoldino.

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