Rev Rene. 2024;25:e93312.
DOI: 10.15253/2175-6783.20242593312
www.periodicos.ufc.br/rene

Original Article

Factors associated with death in patients with COVID-19 admitted to the adult Intensive Care Unit*

Fatores associados ao óbito em pacientes com COVID-19 internados em Unidade de Terapia Intensiva adulto

How to cite this article:
Generoso GM, Schmidt CR, Jesus ER, Boell JEW, Fabrizzio GC, Malkiewiez MM, et al. Factors associated with death in patients with COVID-19 admitted to the adult Intensive Care Unit. Rev Rene. 2024;25:e93312. DOI: https://doi.org/10.15253/2175-6783.20242593312

Gabriela Müller Generoso[1]
Catiele Raquel Schmidt[1]
Edna Ribeiro de Jesus[1]
Julia Estela Willrich Boell[1]
Greici Capellari Fabrizzio[1]
Michelle Mariah Malkiewiez[1]
Elisiane Lorenzini[1]

ABSTRACT

Objective: to identify factors associated with death in patients diagnosed with COVID-19 admitted to an intensive care unit. **Methods:** cross-sectional study with patients admitted with COVID-19 to two Intensive Care Units of two public hospitals. Data were collected from 222 electronic medical records and analyzed using Student's t-test, Fisher's exact test, Pearson's chi-squared test, and Poisson multiple regression with robust variance. **Results:** male patients prevailed, with a mean age of 63.4±15.6 years, white (92.9%), married or with a partner (64.6%), with elementary school education (64.4%). The factors that significantly impacted the outcome of death with the highest prevalence ratio were: dyspnea with respiratory effort (p=0.009), pulmonary involvement-CT pattern above 75% (p=0.006), acute renal failure requiring hemodialysis (p=0.001) and patients over 65 years of age (p=0.001). **Conclusion:** age was identified as the main independent factor for death. **Contributions to practice:** knowing the characteristics of hospitalizations in critical care units of patients with COVID-19 provides support for providing qualified nursing care, promoting patient safety.

Descriptors: COVID-19; Nursing; SARS-CoV-2; Hospitalization; Intensive Care Units.ation.

RESUMO

Objetivo: identificar os fatores associados ao óbito em pacientes diagnosticados com COVID-19 internados em unidade de terapia intensiva. **Métodos:** estudo transversal, com pacientes internados por COVID-19 em duas Unidades de Terapia Intensiva de dois hospitais públicos. Foi realizada coleta de dados em 222 prontuários eletrônicos e analisados por meio dos testes t de Student, Exato de Fisher, Qui-quadrado de Pearson e Regressão múltipla de Poisson com variância robusta. **Resultados**: prevaleceram pacientes do sexo masculino, com média de idade de 63,4±15,6 anos, cor branca (92,9%), casados ou com companheiro (64,6%), com escolaridade em nível de ensino fundamental (64,4%). Os fatores que impactaram de forma significativa sobre o desfecho óbito com maior razão de prevalência foram: dispneia com esforço respiratório (p=0,009), acometimento pulmonar-padrão tomográfico acima de 75% (p=0,006), insuficiência renal aguda com necessidade de hemodiálise (p=0,001) e pacientes acima de 65 anos (p=0,001). **Conclusão**: a idade foi identificada como principal fator independente para óbito. **Contribuições para a prática**: conhecer as características das hospitalizações em unidade crítica de pacientes com COVID-19 fornece subsídios para a prestação de cuidados de enfermagem qualificados, promovendo a segurança do paciente.

Descritores: COVID-19; Enfermagem; SARS-CoV-2; Internação Hospitalar; Unidades de Terapia Intensiva.

*Extracted from the Final Course "Análise de Internações por Covid-19 em Unidade de Terapia Intensiva Adulto", Universidade Federal de Santa Catarina, 2021.

[1]Universidade Federal de Santa Catarina. Florianópolis, SC, Brazil.

Corresponding author:
Edna Ribeiro de Jesus
Rua Delfino Conti, 275. Bloco C, andar térreo,
Trindade. CEP: 88040-900.
Florianópolis, SC, Brazil.
E-mail ednaenfa25@gmail.com

Conflict of interest: the authors have declared that there is no conflict of interest.

Received: Apr. 24th 2024; Accepted: Aug. 5th 2024.

Introduction

There are currently still many uncertainties about the outlook and especially about the future development of the COVID-19 pandemic. The main uncertainties in the period of 2023/2024 concern the evolution of this infection and its status as a disease[1-2]. The COVID-19 pandemic, caused by the new coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), was recognized as a global emergency in 2019. This recognition was due to the high demand for medical care and the growing need for hospital beds[3].

Approximately 15% of those infected require hospitalization due to deterioration of the disease, which can progress to acute respiratory distress syndrome (ARDS), pneumonia, and liver, heart, and kidney dysfunction, thus increasing the mortality rate[4-5]. Therefore, severe cases of COVID-19 require admission to Intensive Care Units (ICU), where higher mortality rates are often observed[6-7].

The emergence of severe cases of COVID-19 depends on several factors. Research indicates that older male patients and those with previous illnesses such as diabetes, high blood pressure, chronic kidney disease, neurological diseases and neoplasms, for example, have an increased risk of mortality[8-9].

In view of the above, understanding the characteristics of patients, as well as comorbidities, complications and factors associated with mortality of those admitted to critical units due to COVID-19 is essential to provide support for clinical decision-making and ensure qualified care. In turn, the study seeks to answer the following question: what are the characteristics and outcomes of patients with COVID-19 admitted to the Intensive Care Units of two hospitals in Santa Catarina?

Therefore, this study aimed to identify factors associated with death in patients diagnosed with COVID-19 admitted to an intensive care unit.

Methods

Study design

This is a cross-sectional study guided by the Strengthening the Reporting of Observational Studies in Epidemiology tool (STROBE).

Study location and period

The study was conducted at the Tereza Ramos Hospital and Maternity and at the Florianópolis Hospital, located in Lages and Florianópolis, Brazil, respectively. Both are references in providing care for those infected with Coronavirus. The study included all patients affected by COVID-19 and who were hospitalized from the beginning of the pandemic until the end of the first year, when there were still no vaccines available. In other words, patients hospitalized from April 1 to December 31, 2020. Thus, the data were collected in the period between November 1, 2020 and January 2021.

Population and data collection

The study population included: patients of both sexes, admitted to the Intensive Care Unit (ICU) due to COVID-19, with confirmation by reverse transcription polymerase chain reaction (RT-PCR), rapid test and serology; and they had to be over 18 years of age. No exclusion criteria were applied. Data were obtained from electronic records through a questionnaire prepared in the Survey Monkey program containing sociodemographic data, clinical data and information regarding death.

Exposure and outcome variables

The exposure and outcome variables were as follows: age, determined by the participant's date of birth; the age groups were divided between under 65

years old and 65 years old or older; sex: female and male; ethnicity: white, yellow, black, Asian, mixed race, indigenous, other; marital status, single, married/stable union, widowed, divorced or other; education level: never studied, completed elementary school, completed high school, completed higher education, specialization, Master's degree, doctorate.

The clinical variables included: number of hospitalizations for COVID-19; previous risk/severity classification in the emergency room: green, yellow or red; extent of lung involvement assessed by tomographic pattern: less than 50%, between 50% and 75% or greater than 75%; respiratory pattern: dyspnea with exertion, dyspnea without exertion or absence of dyspnea and use of high-concentration oxygen mask; pulmonary thromboembolism; pulmonary sepsis; cardiac dysfunction, acute respiratory syndrome; diabetes mellitus; systemic arterial hypertension; asthma; chronic obstructive pulmonary disease; chronic renal failure; congestive heart failure; overweight, obesity; stroke; smoking; human immunodeficiency virus; cancer; Alzheimer's; and Parkinson's. The outcome variable was death (yes or no).

Data analysis

Publishing the database facilitates data sharing with the global scientific community, promoting transparency and reproducibility of research. The data are accessible to anyone with an internet connection, allowing researchers around the world to access and use the data in their own research. The COVID-19 Hospital Admissions Database, from two hospitals, with 799 cases is published in the Springer Nature Figshare Dataset repository, which is publicly accessible[10]. This database covers hospitalizations that occurred in the clinical ward and Intensive Care Unit sectors, but only ICU admissions were used.

Statistical treatment of the data was performed using the SPSS program version 25.0 for Windows, and the data were initially organized in an electronic spreadsheet in the Microsoft Excel® program considering absolute and relative frequencies, as well as the mean and standard deviation (SD), with a study of the symmetry of continuous distributions analyzed by the Kolmogorov-Smirnov test.

The Student's t-test for independent samples, Pearson's chi-squared test with Yates correction and Fisher's exact test were applied to assess the associations between the variables, considering a significance level of 20% ($p<0.05$) for statistically significant association. The estimate of the effect of the independent variables on the outcome death was estimated by the crude prevalence ratio.

In addition, a Poisson Regression Model was estimated with robust variance adjustment in order to analyze the factors and effects related to the occurrence of the outcome (death). The dependent variable of the model was the occurrence of death, while all the factors which presented a minimum significance level of $p<0.20$ in the bivariate analysis were listed for the independent variables. The association magnitude was estimated by the adjusted Prevalence Ratio (PR), considering 95% confidence intervals (95% CI).

Ethical aspects

All ethical precepts were respected in accordance with Resolution 466/12. The study was approved by the Research Ethics Committee, Opinion number: 4.361.273/2020 and Certificate of Presentation of Ethical Appreciation 38674120.1.1001.0121. Patient consent was waived because it involves secondary data from electronic medical records.

Results

Data from 222 patients admitted to the ICU were included, the majority of whom were male, with a mean age of 63.4 years (SD±15.6 years), white, married or with a partner, and with elementary school education. Patients who had been admitted once and had a previous severity classification of red predominated regarding the clinical characteristics. The most

frequently performed test was RT-PCR. Most of the lung involvement was 50 to 70 according to the ventilatory pattern, while the majority presented dyspnea with respiratory effort and acute respiratory failure. The majority of the sample used a high-concentration mask. The most prevalent previous diseases were systemic arterial hypertension, diabetes mellitus, and obesity (Table 1).

Table 1 – Demographic and clinical characterization of the sample (n=222). Florianópolis, SC, Brazil, 2021

Variables	n (%)
Sex	
Male	136 (61.5)
Female	85 (38.5)
Age Mean ± standard deviation (63.3±15.6)	
Race / skin color	
White	197 (92.9)
Black / brown	15 (7.1)
Civil status	
Married, with companion	115 (64.6)
Not in a stable union	63 (35.4)
Education	
Elementary (incomplete + complete)	85 (64.4)
High school (incomplete + complete)	28 (21.2)
Higher education (incomplete + complete)	19 (14.4)
Number of hospitalizations	
1	200 (91.3)
2	17 (7.8)
≥3	2 (0.9)
Prior severity classification	
Green	30 (18.9)
Yellow	55 (34.6)
Red	74 (46.5)
COVID-19 exam type	
Reverse transcription followed by polymerase chain reaction	173 (82.4)
Rapid test	19 (9.0)
Serology	18 (8.6)
Pulmonary involvement - tomographic pattern (%)	
<50	58 (43.6)
50 to 75	49 (36.8)
≥75	26 (19.5)
Ventilation pattern	
Dyspnea with respiratory effort	165 (80.9)
Dyspnea without respiratory effort	34 (16.7)
No dyspnea	5 (2.5)
High concentration oxygen mask	
Yes	171 (82.6)
No	36 (17.4)
Evolution	
Pulmonary thromboembolism	8 (4.1)
Cardiac dysfunction ultrafiltration	24 (11.5)
Acute respiratory failure ultrafiltration	101 (45.9)
Pulmonary sepsis ultrafiltration	91 (42.5)
Acute kidney failure	
Yes, no dialysis required	36 (16.4)
Yes, with dialysis required	59 (26.9)
Non-ultrafiltrated	124 (56.6)
Previous diseases	
Diabetes mellitus	83 (37.4)
Systolic arterial hypertension	129 (58.1)
Chronic obstructive pulmonary disease	33 (14.9)
Asthma	11 (5.0)
Chronic kidney failure	10 (4.5)
Chronic heart failure	22 (9.9)
Overweight	8 (3.6)
Obesity	34 (15.3)
Stroke	13 (5.9)
Smoking	35 (15.8)
Human Immunodeficiency Virus	2 (0.9)
Cancer	5 (2.3)
Alzheimer's	5 (2.3)
Parkinson's	1 (0.5)

(the Tabel 1 continue...)

In the bivariate analysis, it was found that there was a statistically significant association between the occurrence of death and the variables age group, education, previous classification of severity, ventilatory pattern, cardiac dysfunction, acute respiratory failure ultrafiltration, pulmonary sepsis ultrafiltration, acute renal failure, obesity and smoking (Table 2).

Table 2 – Association between demographic and clinical characteristics and the occurrence of death (n=222). Florianópolis, SC, Brazil, 2021

Variables	Outcome		p-value
	Death (n=108) n (%)	No death (n=114) n (%)	
Sex			0.882*
Male	41 (38.0)	44 (38.9)	
Female	67 (62.0)	69 (61.1)	
Age range (years)			<0.001*
Up to 64	36 (33.3)	74 (64.9)	
≥ 65	72 (66.7)	40 (35.1)	
Race / skin color			0.400*
White	96 (91.4)	101(94.4)	
Black / brown	9 (8.6)	6 (5.6)	
Civil status			0.137*
Not in a stable union	25 (29.8)	38 (40.4)	
Married, with companion	59 (70.2)	56 (59.6)	
Education			0.016†
Higher education complete/incomplete	3 (4.9)	16 (22.5)	
Elementary complete/incomplete	44 (72.1)	41 (57.7)	
High school complete/incomplete	14 (23.0)	14 (19.7)	
Prior severity classification			<0.001‡
Green	12 (15.8)	18 (21.7)	
Yellow	17 (22.4)	38 (45.8)	
Red	47 (61.8)	27 (32.5)	

(the Table 2 continue in the next page...)

COVID-19 exam type			0.137‡
Serology	9 (8.9)	9 (8.3)	
Reverse transcription followed by polymerase chain reaction	87 (86.1)	86 (78.9)	
Rapid test	5 (5.0)	14 (12.8)	
Pulmonary involvement - tomographic pattern (%)			0.545‡
<50	20 (38.5)	38 (46.9)	
50 to 75	22 (42.3)	27 (33.3)	
≥75	10 (19.2)	16 (19.8)	
Ventilation pattern			0.006*
Dyspnea with respiratory effort	86 (89.6)	79 (73.1)	
Dyspnea without respiratory effort/No dyspnea	10 (10.4)	29 (26.9)	
High concentration oxygen mask			0.678*
Yes	79 (81.4)	92 (83.6)	
No	18 (18.6)	18 (16.4)	
Evolution (presence of diseases)			
Pulmonary thromboembolism			0.070†
Yes	1(1.1)	7(6.7)	
No	90 (98.9)	97 (93.3)	
Cardiac dysfunction ultrafiltration			0.044 *
Yes	16(59.2)	8(7.3)	
No	83 (83.8)	102(92.7)	
Acute respiratory failure ultrafiltration			<0.001*
Yes	60(64.5)	32(28.3)	
No	38 (35.5)	81 (71.7)	
Pulmonary sepsis ultrafiltration			<0.001*
Yes	61(59.2)	30(27.0)	
No	42 (40.8)	81 (73.0)	
Acute kidney failure			<0.001*
Non-ultrafiltrated	34 (31.8)	90 (80.4)	
Yes, no dialysis required	20(18.7)	16(14.3)	
Yes, with dialysis required	53 (49.5)	6 (5.4)	
Previous diseases (presence of disease)			
Diabetes Mellitus			0.916*
Yes	40 (37.0)	43 (37.7)	
No	68(63.0)	71(62.3)	
Systolic arterial hypertension			0.542‡
Yes	65 (60.2)	64(56.1)	
No	43(39.8)	50(43.9)	
Chronic obstructive pulmonary disease			0.463‡
Yes	18 (16.7)	15 (13.2)	
No	90 (83.3)	99 (86.8)	
Asthma			0.828‡
Yes	5 (4.6)	6 (5.3)	
No	103 (48.8)	108 (51.2)	
Chronic kidney failure			0.462†
Yes	6 (5.6)	4 (3.5)	
No	102 (94.4)	110 (96.5)	
Chronic heart failure			0.138‡
Yes	14(13.0)	8(7.0)	
No	94 (87.0)	106 (93.0)	
Obesity			0.015‡
Yes	10 (9.3)	24 (21.1)	
No	98 (90.7)	90 (47.9)	
Smoking			0.026‡
Yes	11 (10.2)	24 (21.1)	
No	97 (51.9)	90 (48.1)	
Human Immunodeficiency Virus			>0.999†
Yes	2 (1.9)	0 (0.0)	
No	106 (98.1)	114 100.0)	
Cancer			0.425†
Yes	5 (4.6)	3 (2.6)	
No	103 (95.4)	111 (97.4)	
Alzheimer's			0.877†
Yes	5 (4.6)	0 (0.0)	
No	103(95.40)	114(100.0)	
Parkinson's			>0.999†
Yes	0 (0.0)	1 (0.9)	
No	108(100.0)	113(99.1)	

*Pearson's chi-squared test with Yates correction; †Fisher's exact test; ‡Pearson's chi-squared test of independence

(the Table 2 continue...)

It was observed that the prevalence rate of death in patients aged 65 years or older was 1.96 times higher than in the group aged under 64 years. Patients with complete/incomplete elementary education had a 3.27 times higher prevalence of death when compared to those with complete/incomplete higher education.

Another relevant factor was the previous classification of severity, in which the prevalence of death in patients with a red classification was 1.58 times higher in relation to patients whose previous classification was green. Another important result was identified in the ventilatory pattern, indicating that the prevalence of death in patients with dyspnea with respiratory effort was 1.68 times higher compared to cases that fell into the dyspnea without respiratory effort/without dyspnea (Table 3).

In the questions that addressed clinical evolution, there is evidence that patients who died had a 1.48 times higher prevalence for cardiac dysfunction ultrafiltration; 2.13 times higher for acute respiratory failure ultrafiltration; as well as a 1.96 times higher prevalence of pulmonary sepsis ultrafiltration.

Regarding acute renal failure, it was identified that the prevalence ratio of death in patients with acute renal failure, without the need for dialysis and with the need for dialysis, was 2.03 and 3.27 times higher, respectively, compared to non-ultrafiltered patients. Furthermore, obesity stood out, as obese patients presented a prevalence ratio 1.77 times higher for the occurrence of death compared to those who did not present obesity. Finally, the prevalence ratio was 1.48 times higher for the occurrence of death regarding the presence of smoking compared to cases that were not smokers (Table 3).

Table 3 – Prevalence ratio and 95% confidence interval for death, on sociodemographic and clinical characteristics (n=222). Florianópolis, SC, Brazil, 2021

Variables	p-value*	PR	95%CI
Sex			
Female	–	1.0	–
Male	0.915	0.97	0.66–1.44
Age range (years)			
Up to 64	–	1.0	–
≥ 65	0.001	1.96	1.32–2.93
Race / skin color			
White	–	1.0	–
Black / brown	0.551	1.23	0.66–2.44
Civil status			
Not in a stable union	–	1.0	–
Married, with companion	0.282	1.29	0.81-2.06
Education			
Higher education complete / incomplete	–	1.0	–
Elementary complete / incomplete	0.047	3.27	1.02-10.55
High school complete / incomplete	0.070	3.17	0.91-11.01
Prior severity classification			
Green	–	1.0	–
Yellow	0.494	0.77	0.39–1.61
Red	0.037	1.58	1.09–2.99
COVID-19 exam type			
Serology	–	1.0	–
Reverse transcription followed by polymerase chain reaction	0.422	1.06	0.51–1.99
Rapid test	0.883	0.52	0.17–1.57
Pulmonary involvement - tomographic pattern (%)			
<50	0.540	1.0	–
50 to 75	0.874	1.11	0.52–2.38
≥75	0.250	1.30	0.71–2.33
Ventilation pattern			
Dyspnea with respiratory effort	0.009	1.68	1.11–2.43
Dyspnea without respiratory effort / No dyspnea	–	1.0	–
High concentration oxygen mask			
Yes	0.762	1.08	0.64-1.81
No	–	1.0	–
Clinical evolution (presence of diseases)†			
Pulmonary thromboembolism	0.874	0.35	0.01–3.32
Cardiac dysfunction ultrafiltration	0.027	1.48	1.08–2.53
Acute respiratory failure ultrafiltration	0.009	2.13	1.44-3.18
Pulmonary sepsis ultrafiltration	0.001	1.96	1.32–2.90
Acute kidney failure			
Non-ultrafiltrated	–	1.0	–
Yes, no dialysis required	0.012	2.03	1.17–3.52
Yes, with dialysis required	<0.001	3.27	2.13–5.04
Previous diseases (presence of disease) ‡			
Diabetes Mellitus	0.940	1.01	0.69–1.50
Systolic arterial hypertension	0.662	0.92	0.62–1.35
Chronic obstructive pulmonary disease	0.599	0.87	0.53–1.44
Asthma	0.923	0.62	0.46-1.66
Chronic kidney failure	0.508	0.73	0.38–1.48
Congestive heart failure	0.290	1.12	0.74–2.01
Obesity	0.041	1.77	1.02–3.39
Smoking	0.038	1.65	1.11–3.08
Human Immunodeficiency Virus	0.974	0.48	0.12–1.95
Cancer	0.306	0.74	0.31–1.89
Alzheimer's	0.167	0.47	0.19–1.16
Parkinson's	–	–	–

*Poisson regression with robust variance adjustment; †Reference category defined by the absence of progression of chronic disease; ‡Reference category defined by the absence of previous disease; PR: Prevalence ratio for the outcome death; CI: Confidence interval

Then in Table 4, the following were identified as potential predictors of death: age group, extent of lung involvement (CT pattern), ventilatory pattern and development of acute renal failure. Patients aged 65 years or older had a prevalence rate of death 3.51 times higher compared to younger patients.

The extent of lung involvement was the second most impactful variable in predicting death, with patients with more than 75% involvement having a prevalence rate of death 2.94 times higher than those with less than 50% involvement. The respiratory pattern with dyspnea on exertion is the third variable

that had the greatest impact in accounting for cases of death, with a prevalence rate of 1.72.

The progression to acute renal failure was listed as important in the model, in which those investigated with a need for dialysis had a prevalence ratio of 3.89 times more likely to die, and those without a need for dialysis had a prevalence ratio of 1.63 times more likely to die. Furthermore, dyspnea with effort stood out as significant in the model with a prevalence ratio of 1.72, indicating an important risk for the occurrence of death (Table 4).

Table 4 – Adjusted Poisson multiple regression model to predict the effects on the outcome death (n=222). Florianópolis, SC, Brazil, 2021

Variables	p-value*	PR	95%CI
Age range (years)			
Up to 64	–	1.0	–
≥ 65	<0.001	3.51	1.98 – 7.61
Education			
Elementary complete / incomplete	–	1.0	–
High school complete / incomplete	0.433	1.14	0.78 – 1.97
Higher education complete / incomplete	0.571	1.03	0.64 – 1.22
Prior severity classification			
Green	–	1.0	–
Yellow	0.324	0.75	0.58 – 1.12
Red	0.121	1.33	0.96 – 1.67
Pulmonary involvement - tomographic pattern (%)			
<50	–	1.0	–
50 to 75	0.098	1.23	0.98 – 1.76
≥75	0.006	2.94	1.66 – 5.04
Ventilation pattern			
Dyspnea without respiratory effort / No dyspnea	–	1.0	–
Dyspnea with respiratory effort	0.009	1.72	1.22 – 3.64
Clinical evolution (Presence of characteristics)			
Cardiac dysfunction	0.106	1.16	0.86 – 1.44
Acute respiratory failure ultrafiltration	0.098	1.08	0.94 – 1.18
Pulmonary sepsis	0.122	1.11	0.95 –1.21
Acute kidney failure			
Non-ultrafiltrated	–	1.0	–
Yes, no dialysis required	0.023	1.63	1.09 – 3.55
Yes, with dialysis required	<0.001	3.89	1.68 – 6.81

*Poisson multiple regression; PR: prevalence ratio; CI: confidence interval

Discussion

The clinical and demographic characteristics and predictors of death of patients admitted to the ICU due to COVID-19 before vaccinations in 2020 were analyzed in this study. There was a predominance of male patients, with a mean age of 63.3 years, corroborating global studies[3,7,10-11]. Although males had a higher incidence of infection, there was no statistical significance in the correlation with mortality (p=0.882), which is in line with other studies that found no significant differences in the death rate between the sexes[4,7,11].

Older patients were more likely to die, constituting results which are in line with previous studies[3,5,8]. It was observed that each additional year of age increases the risk of death by 6%, which implies an increase of approximately 32% in the risk of death for each decade of life. These findings highlight the importance of age as a determining factor in the adverse evolution of patients with COVID-19[5].

The advanced age of patients admitted to critical care units was prominent in the first year of the COVID-19 pandemic. The mean age among those admitted in 2021 was 55.06 years compared to 56.06 years among those not admitted to critical care units[12]. This reduction in the average age from 63.22 years to 58.88 years after the start of vaccination represents a decrease of 4.34 years. There is a continued trend of decreasing the mean age with increasing vaccination rates. For example, with 10% of the population vaccinated, the average age of patients drops to 52.35 years, and with 17% vaccinated, the proportion of patients over 60 years old drops to less than 50%[13].

In addition, 46.5% of patients were classified as red in the initial severity classification, indicating an emergency and the need for immediate care. This category showed a significant association with death (p<0.001), with a prevalence rate of death 1.58 times higher, suggesting that these patients were already seriously ill upon admission, which negatively influenced the disease prognosis. Fever and dyspnea were

frequently observed reactions upon admission of patients with COVID-19[3,6]. These symptoms are considered severe, and their early onset may be related to a delay in seeking medical care[7].

When analyzing the tomographic patterns of the patients, those with 50% lung involvement had the greatest damage, followed by those between 50 and 75%, and the lowest occurrence of damage in 75%. Bilateral and multilobar ground-glass opacities, common in COVID-19, are often associated with acute respiratory distress syndrome[14]. Furthermore, greater extent of lung involvement correlated with a greater need for ventilatory support (average of 55.4% lung involvement) and a higher mortality rate[6,15].

Patients with this type of dyspnea had a 1.68-fold higher prevalence of death compared to those who did not have dyspnea or with dyspnea without exertion. Additionally, 82.6% of patients required a high-concentration oxygen mask, with those who required this support showing a 1.08-fold higher prevalence of death. Previous studies have also highlighted dyspnea as a symptom associated with higher mortality among patients with COVID-19[7,16]. The high prevalence of dyspnea with exertion in this study possibly influenced the increased need for high-concentration oxygen mask use[16].

The most prevalent previous diseases were systemic arterial hypertension, present in 58.1% of patients, and diabetes, 37.4%. Obesity and smoking were also significant, with rates of 15.3 and 15.8%, respectively, presenting mortality prevalence ratios of 1.77 and 1.65 times higher, as observed in previous studies[6,7]. These conditions were frequently associated with ages over 65 years. However, the lack of data and information in the medical records may have influenced the discrepancies observed in relation to the results of previous studies that confirm the association between comorbidities and mortality risk[7-8,17].

The most common complications were acute respiratory failure, acute renal failure and pulmonary sepsis, associated with death and more frequent among non-surviving patients. Similar studies have indicated a high prevalence of acute respiratory distress syndrome (90%) and acute renal failure (34%) among deceased patients[3]. Moreover, 68% of patients with COVID-19 in intensive care units presented complications, with acute respiratory distress syndrome being the most prevalent (54%), followed by infections (47%) and sepsis (37%)[18]. Acute respiratory distress syndrome was developed by 81.8% of survivors admitted to critical care units, while all patients who died presented this complication[19].

Severe respiratory failure is frequently mentioned as a significant complication in patients severely affected by COVID-19, resulting in acute hypoxemic respiratory failure[10-20]. Patients with this syndrome had a two-fold increased risk of death compared to those who did not develop this complication[18]. The prone position, used as a complementary therapy in patients with coronavirus, has been shown to be effective in improving gas exchange and lung mechanics, which may contribute to increasing patient survival[13].

Clinically relevant complications associated with death included cardiac dysfunction, severe respiratory failure with ultrafiltration, and pulmonary sepsis with ultrafiltration. Cardiac disease in patients with coronavirus can be caused by several factors, such as endothelial dysfunction, oxidative stress, hypoxemia, and direct injury by the virus[18].

According to the information in the medical records analyzed in this study, it was observed that 43.3% of the patients developed acute renal failure, with 26.9% requiring hemodialysis, associated with a prevalence rate of death 3.27 times higher. These results are consistent with a previous study carried out with patients in critical care units, where 53.9% presented acute kidney injury and 29.4% required dialysis[21].

The main complications observed include cardiac dysfunction, myocardial infarction, myocardial inflammation, and heart rhythm disturbances[17]. Patients with a history of hypertension, obesity, advanced age, and pre-existing cardiovascular diseases appear to be more susceptible to developing these complications[21-24].

As observed in the study, a cohort study revea-

led that cardiovascular complications were significantly more prevalent among patients who died[15]. On the other hand, pulmonary thromboembolism was not associated with mortality in this study, corroborating the findings of another study in which this complication was less frequent (11%) and showed no impact on mortality[3].

The Poisson regression analysis performed in this study identified that age over 65 years, pulmonary involvement greater than 75%, occurrence of dyspnea with exertion, and development of acute renal failure requiring dialysis were independent factors of death among those infected with coronavirus. These findings are consistent with results from previous studies[3,7-8], which also highlighted advanced age and dyspnea as significant risk factors associated with mortality.

Nursing works to identify these sociodemographic and clinical variables through data collected in the nursing summary, physical examination and laboratory test results, among others. Understanding the complications and elements linked to hospital deaths of adult patients with COVID-19 admitted to the ICU provides information to support decision-making and nursing management. Nurses stand out in the hospital area and in Primary Healthcare in planning actions both in immediate care and in transitioning care[25] to the inpatient units of these patients with severe conditions and complications, which requires knowledge and action based on scientific evidence[26], such as that produced in this study. Thus, implementing nursing interventions tends to be more qualified and safe, which contributes to recovering the health of the patients under their care[27].

Study limitations

Limitations of this study include the existence of missing data, with some variables presenting a proportion greater than 10% of the total population, which prevented data imputation. However, a random pattern was identified in relation to characterizing information gaps (Missing Completely at Random), suggesting that the absences did not influence the observed results.

Contributions to practice

Knowing the characteristics of hospitalizations in the critical unit for patients infected with coronavirus provides support for providing adequate nursing care, promoting humanization and patient safety, in addition to identifying preventive measures focused on priority groups. Given this, considering the relevance of the study, we highlight its impact on nursing policy, practice and research, as it presents the most frequent clinical complications and characteristics, as well as those which presented a higher risk of death when compared to younger patients.

Conclusion

There was a predominance of men with an average age over 60 years. Patients over 65 years of age had a higher incidence of clinical problems and a higher prevalence of death compared to younger patients. In addition, dyspnea with exertion, pulmonary complications greater than 75% and the development of acute renal dysfunction requiring dialysis were found as independent factors associated with death among patients with coronavirus, with a 3.5 times higher prevalence ratio.

Acknowledgements

Fundação de Amparo à Pesquisa de Santa Catarina (FAPESC). Grant/Award Number: (2021TR1530). *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil* (CAPES) - Financing Code 001.

Authors' contributions

Conception and design or analysis and interpretation of data; Writing; Relevant critical review of

intellectual content; Agreement to be accountable for all aspects related to the accuracy or integrity of any part of the manuscript to be investigated and resolved appropriately; and Final approval of the version to be published: Generoso GM, Schmidt CR, Jesus ER, Boell JEW, Fabrizzio GC, Malkiewiez MM, Lorenzini E.

References

1. Jesus ER, Boell JEW, Reckziegel JCL, Ávila MCS, Piccolin MM, Silva MB, et al. Predictors of deaths associated with covid-19 in patients admitted to two hospitals in the state of Santa Catarina, Brazil. Texto Contexto Enferm. 2023;32:e20230107. doi: https://doi.org/10.1590/1980-265X-TCE-2023-0107en
2. Martín Sánchez FJ, Martínez-Sellés M, Molero-García JM, Moreno-Guillén S, Rodríguez-Artalejo FJ, Ruiz-Galiana J, et al. Insights for COVID-19 in 2023. Rev Esp Quimioter. 2023;36(2):114-24. doi: https://doi.org/10.37201/req/122.2022
3. Steffes I. A hundred days into the coronavirus disease (COVID-19) pandemic. Euro Surveill. 2020;25(14):2000550. doi: https://dx.doi.org/10.2807/1560-7917.ES.2020.25.14.2000550
4. Ferrando C, Mellado-Artigas R, Gea A, Arruti E, Aldecoa C, Bordell A, et al. Patient characteristics, clinical course and factors associated to ICU mortality in critically ill patients infected with SARS-CoV-2 in Spain: A prospective, cohort, multicentre study. Rev Esp Anestesiol Reanim. 2020;67(8):425-37. doi: https://doi.org/10.1016/j.redar.2020.07.003
5. Moraes EM, Almeida LHA, Giordani E. COVID-19: Nursing care in an intensive care unit. Sci Med. 2020;30(1):1-11. doi: https://doi.org/10.15448/1980-6108.2020.1.38468
6. Kaswa R, Yogeswaran P, Cawe B. Clinical outcomes of hospitalised COVID-19 patients at Mthatha Regional Hospital, Eastern Cape, South Africa: A retrospective study. S Afr Fam Pract. 2021;63(1):e1–e5. doi: https://doi.org/10.4102/safp.v63i1.5253
7. Vences MA, Pareja-Ramos JJ, Otero P, Veramendi-Espinoza LE, Vega-Villafana M, Mogollón-Lavi J, et al. Factors associated with mortality in patients hospitalized with COVID-19: A prospective cohort in a Peruvian national referral hospital. Medwave. 2021;21(6):e8231. doi: https://doi.org/10.5867/medwave.2021.06.8231
8. Jiménez E, Fontán-Vela M, Valencia J, Fernandez-Jimenez I, Álvaro-Alonso EA, Izquierdo-García E, et al. Characteristics, complications and outcomes among 1549 patients hospitalised with COVID-19 in a secondary hospital in Madrid, Spain: a retrospective case series study. BMJ Open. 2020;10(11):e042398. doi: https://dx.doi.org/10.1136/bmjopen-2020-042398
9. Macedo MCF, Pinheiro IM, Carvalho CJL, Fraga HCJR, Araújo IPC, Montes S. Correlation between demographics, symptoms, comorbidities and the COVID-19 pandemic of hospitalized patients in Bahia, Brazil. PLoS One. 2020;15(12):e0243966. doi: https://doi.org/10.1371/journal.pone.0243966
10. Jesus ER, Boell JEW, Reckziegel JCL, Vaz RS, Goulart MA, Peluso FM, et al. Sociodemographic and clinical characteristics of hospital admissions for COVID-19: A retrospective cohort of patients in two hospitals in the south of Brazil. F1000Research. 2023;12:627. doi: https://dx.doi.org/10.12688/f1000research.130532.1
11. Altunta M, Yilmaz H, Guner AM. Evaluation of patients with COVID-19 diagnosis for chronic diseases. Virol J. 2021;18(1):57. doi: https://dx.doi.org/10.1186/s12985-021-01524-0
12. Garcia PDW, Fumeaux T, Guerci P, Heuberger DM, Montomoli J, Roche-Campo F, et al. Prognostic factors associated with mortality risk and disease progression in 639 critically ill patients with COVID-19 in Europe: initial report of the international risc-19-icu prospective observational cohort. eClinicalMedicine. 2020;25:10044. doi: https://doi.org/10.1016/j.eclinm.2020.100449
13. Mogami R, Lopes AJ, Araújo Filho RC, Almeida FCS, Messeder AMDC, Koifman ACB, et al. Chest computed tomography in COVID-19 pneumonia: a retrospective study of 155 patients at a university hospital in Rio de Janeiro, Brazil. Radiol Bras. 2021;54(1):1-8. doi: https://dx.doi.org/10.1590/0100-3984.2020.0133
14. Hendrickson KW, Peltan ID, Brown SM. The Epidemiology of acute respiratory distress syndrome before and after coronavirus disease 2019. Crit Care Clin. 2021;37(4):703-16. doi: https://dx.doi.org/10.1016/j.ccc.2021.05.001

15. González CA, Cuenca FE, Fernandez A, Ferrero FR, Rodríguez BJC, Gonzalez C. Impact of vaccination on admissions to an intensive care unit for COVID-19 in a third-level hospital. Med Intensiva. 2022;46(7):406-7. doi: https://dx.doi.org/10.1016/j.medine.2022.05.001

16. Chen T, Wu D, Chen H, Yan W, Yang D, Chen G, et al. Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study. BMJ. 2020;368:m1295. doi: https://dx.doi.org/10.1136/bmj.m1091

17. Berlin DA, Gulick RM, Martinez FJ. Severe Covid-19. Engl J Med Med. 2020;383(25):2451-60. doi: https://doi.org/10.1056/NEJMcp2009575

18. Alshukry A, Ali H, Ali Y, Al-Taweel T, Abu-Farha M, AbuBaker J, et al. Clinical characteristics of coronavirus disease 2019 (COVID-19) patients in Kuwait. PLoS One. 2020;15(11):e0242768. doi: https://doi.org/10.1371/journal.pone.0242768

19. Virot E, Mathien C, Pointurier V, Poidevin A, Labro G, Pinto L, et al. Characterization of pulmonary impairment associated with COVID-19 in patients requiring mechanical ventilation. Rev Bras Ter Intensiva. 2021;33(1):75-81. doi: https://doi.org/10.5935/0103-507X.20210007

20. Abate SM, Ahmed AS, Mantfardo B, Basu B. Rate of Intensive Care Unit admission and outcomes among patients with coronavirus: A systematic review and Meta-analysis. PLoS One. 2020;15(7):e0235653. doi: https://doi.org/10.1371/journal.pone.0235653

21. Nascimento JHP, Costa RL, Simvoulidis LFN, Pinho JC, Pereira RS, Porto AD, et al. COVID-19 e injúria miocárdica em UTI brasileira: alta incidência e maior risco de mortalidade intra-hospitalar. Arq Bras Cardiol. 2021;116(2):275-82. doi: https://doi.org/10.36660/abc.20200671

22. Puah SH, Cove ME, Phua J, Kansal A, Venkatachalam J, Ho VK, et al. Association between lung compliance phenotypes and mortality in COVID-19 patients with acute respiratory distress syndrome. Ann Acad Med Singap. 2021;50(9):686-94. doi: https://doi.org/10.47102/annals-acadmedsg.2021129

23. 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. Lancet. 2020;395(10229):1054-62. doi: https://dx.doi.org/10.1016/S0140-6736(20)30566-3

24. Ribeiro AC, Poli P, Uehara SCSA. Increased risk of mortality from COVID-19 in people with obesity. Rev Rene. 2023;24:e81453. doi: https://doi.org/10.15253/2175-6783.20232481453

25. Lorenzini E, Boell JEW, Oelke ND, Rodrigues CD, Trindade LF, Winter VDB, et al. Care transition from hospital to home: cancer patients' perspective. BMC Res Notes. 2020;13:267. https://dx.doi.org/10.1186/s13104-020-05099-x

26. Lorenzini E, Banner D, Plamondon K, Oelke N. A call for knowledge translation in nursing research. Texto Contexto Enferm. 2019;28:e20190104. doi:https://doi.org/10.1590/1980-265X-TCE-2019-0001-0004

27. Fabrizzio GC, Santos JLG, Erdmann AL. Enfermería de precisión: una aliada para potenciar la gestión del cuidado. Av Enferm. 2022;40(2):179-82. doi: https://dx.doi.org/10.15446/avenferm.v40n2.102949