Original Article

Hospitalization of elderly people due to COVID-19 in the State of Paraná, Brazil: analysis of associated factors

Hospitalização de idosos por COVID-19 no Paraná: uma análise de fatores associados

Hospitalización de personas mayores por COVID-19 en Paraná: un análisis de factores asociados

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Abstract

Objective: To analyze the prevalence and factors associated with hospitalization of elderly people with COVID-19 in the State of Paraná, PR, Brazil.

Methods: A cross-sectional study linked to the cohort "Longitudinal Monitoring of adults and elderly people who were discharged from hospital admission due to COVID-19", was carried out using information contained in the compulsory notification forms of the Notifiable Diseases Information System. Analyzes were carried out using relative and absolute frequencies, applying the chi-square test adopted in the logistic regression model. The study population included people aged 60 years or over and residing in the State of Paraná, who were hospitalized for COVID-19 from March 2020 to September 2021.

Results: A higher hospitalization prevalence was identified among elderly people with eight years of education or more. Individuals not vaccinated against COVID-19 had a greater chance of hospitalization. Males had a greater chance of admission to the Intensive Care Unit compared to females. Cardiovascular diseases, lung disease, and obesity have increased the prevalence of the severe form of the disease.

Conclusion: Factors such as education and non-adherence to vaccination against COVID-19 can increase the risk of hospitalization due to the disease. Elderly people of the male sex have a greater chance of hospitalization in the ICU compared to the female sex. Furthermore, not using antivirals can contribute to worsening health status.

Resumo

Objetivo: Analisar a prevalência e os fatores associados à hospitalização de idosos com COVID-19 no estado do Paraná, PR, Brasil.

Métodos: Estudo transversal vinculado à coorte "Acompanhamento Longitudinal de adultos e idosos que receberam alta da internação hospitalar por COVID-19", realizado por meio de informações contidas nas fichas de notificação compulsória do Sistema de Informação de Agravos de Notificação. As análises foram realizadas através de frequências relativas e absolutas, com aplicação do teste de qui-quadrado adotado no modelo de regressão logística. A população do estudo englobou pessoas residentes no Estado do Paraná com idade de 60 anos ou mais, hospitalizadas por COVID-19 no período de março de 2020 a setembro de 2021.

Resultados: Foi identificada maior prevalência de hospitalização entre idosos com escolaridade igual ou maior a oito anos. Indivíduos não vacinados contra COVID-19 apresentaram maior chance de internação. O sexo masculino apresentou mais chance de admissão em Unidade de Terapia Intensiva em comparação com o sexo feminino. Doenças cardiovasculares, pneumopatia e obesidade aumentaram a prevalência da forma grave da doença.

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Conflicts of interest: The authors have no conflict to declare.

Conclusão: Fatores tais como escolaridade e não adesão à vacinação contra COVID-19 podem aumentar o risco de hospitalização pela doença. Pessoas idosas do sexo masculino apresentam maior chance de hospitalização na UTI se comparadas às do sexo feminino; além disso, a não utilização de antivirais pode contribuir para o agravamento do estado de saúde.

Resumen

Objetivo: Analizar la prevalencia y los factores asociados a la hospitalización de personas mayores por COVID-19 en el estado de Paraná.

Métodos: Estudio transversal vinculado a la cohorte "Seguimiento longitudinal de adultos y personas mayores que recibieron alta de internación hospitalaria por COVID-19", realizado mediante información contenida en las fichas de notificación obligatoria del Sistema de Información de Agravios de Notificación. Los análisis fueron realizados a través de frecuencias relativas y absolutas, con aplicación de la prueba ji cuadrado adoptada en el modelo de regresión logística. La población del estudio incluyó personas residentes del estado de Paraná, de 60 años o más, hospitalizadas por COVID-19 en el período de marzo de 2020 a septiembre de 2021.

Resultados: Se identificó mayor prevalencia de hospitalización en personas mayores con escolaridad igual o mayor a ocho años. Individuos no vacunados contra COVID-19 presentaron mayor probabilidad de internación. El sexo masculino presentó más probabilidad de admisión en Unidad de Cuidados Intensivos en comparación con el sexo femenino. Enfermedades cardiovasculares, neumopatía y obesidad aumentaron la prevalencia de la forma grave de la enfermedad.

Conclusión: Factores tales como escolaridad y no adhesión a la vacunación contra COVID-19 pueden aumentar el riesgo de hospitalización por la enfermedad. Personas mayores de sexo masculino presentaron mayor probabilidad de hospitalización en la UCI al compararlas con las de sexo femenino. Además, la no utilización de antivirales puede contribuir al agravamiento del estado de salud.

Introduction

In December 2019, a set of types of pneumonia caused by a virus known as the new coronavirus, which came to be called SARS-CoV-2, was reported in China. In March 2020, it reached pandemic proportions due to the large number of cases in several countries.[1] Until October 2022, Brazil recorded more than 4.6 million cases and 687,144 deaths from the disease.[2]

The acute respiratory syndrome caused by COVID-19 spread rapidly, mainly affecting the respiratory tract, leading infected individuals to develop symptoms such as fever, dyspnea, cough, and loss of smell and taste. In some cases, involvement of the gastrointestinal system occurred.[1]

Any individual can be infected by SARS-CoV-2 regardless of age group and other factors, but elderly people present greater complications. The presence of underlying diseases and deficits in the physical, sensory, and cognitive functions of the elderly, implies restrictions in their daily activities, making them dependent in their respective areas, resulting in the need for caregivers and implying classifying them as a group of higher risk.[3]

In the elderly population, who already have some underlying chronic condition, such as hypertension, diabetes *mellitus*, chronic obstructive pulmonary disease, and other cardiovascular diseases, serious health complications were observed and many of these individuals died. In these cases, the disease manifests more aggressively: the symptoms presented, such as dyspnea, dry cough, and runny nose, are generally focused on the upper airways, and headache and fever may also occur. In general, its onset requires hospitalization, which can lead to death due to complications.[4,5]

In addition to underlying diseases being a greater risk factor for worsening COVID-19, studies have shown that sociodemographic factors such as male sex (in addition to advanced age) also contribute to possible complications. Survival in countries with low development, where the majority of the population is elderly, people already have some comorbidity.[6]

The studies that identified the causes involved in the development of the severe form of COVID-19 allowed for filling the knowledge gaps that still exist and implementing specific health actions to reduce and control the disease, directly impacting the severity of cases and hospital admission and mortality rates.

Thus, the present study intended to contribute to the advancement of knowledge based on evidence and prevent the development of the severe form of the disease, which would make it possible to reduce the number of hospitalizations and deaths and thus the costs to the health system. Therefore, the objective of this study was to analyze the prevalence and factors associated with the hospitalization of elderly people with COVID-19 in the State of Paraná, PR, Brazil.

Methods

This population-based cross-sectional study, nested to the cohort "Longitudinal Follow-up of adults and elderly who were discharged from hospitalization due to COVID-19", was carried out in cooperation between the Universidade Estadual de Maringá (UEM) and the Health Secretariat of the State of Paraná with financial support from the National Council for Scientific and Technological Development (CNPQ).

The study was conducted in the State of Paraná (southern region of Brazil), with a total area of 199,298,981 km^2. It has 399 municipalities, divided into four health macro-regions, which are subdivided into 22 Regional Health Sections.[7]

The State of Paraná has a population of 11,675,661 inhabitants (2022 estimate), maintaining the ranking as the most populous state in the southern region of Brazil. The different age groups were estimated to reach around 1.9 million (over 60 years old), 1.1 million (60-69 years old; prevalent), just over 0.5 million (70-79 years old), and around 265 thousand inhabitants (80 years or more).[8]

The study population included people aged 60 years or older living in Paraná, who were hospitalized for COVID-19 in the period from March 2020 to September 2021.

As eligibility criteria, people residing in Paraná with an age equal to or older than 60 years, such as confirmed cases of Severe Acute Respiratory Syndrome (SARS) associated with Coronavirus and people hospitalized in the ward or ICU who were discharged in the period from March 2020 to September 2021 were included according to the SARS notification forms. Case notifications of elderly people hospitalized in Paraná, but living in other states, were excluded from the analysis.

The population sampling was composed based on the compulsory notification forms of SARS associated with Coronavirus that are part of the Influenza Epidemiological Surveillance Information System (SIVEP/IESIS-Influenza), in databases made available by the Ministry of Health (MH) [8] and updated on November 8, 2021.

The dependent variables used in this study consist of the effect, illness, or injury observed by individuals during the study, who underwent hospitalization in the ward and/or ICU due to the worsening of COVID-19.

The independent or predictive variables were subdivided into Sociodemographic Data: age (≥60 years), sex (male or female), race or skin color (white, black, yellow, brown, or indigenous), education [no education or illiterate, primary (1st Cycle), primary (2nd cycle), secondary, higher education, and not applicable], zone (urban, rural, or peri-urban), regional health department corresponding to the location of residence (according to the MH definitions), and resides in the municipality of hospitalization (yes or no).

Vaccination History of the Elderly: Referring to elderly data on the use of antiviral medication against influenza (yes or no), and whether he/she received flu vaccine in the last campaign (yes or no). Clinical Data consisted of the following: Do you have a risk factor or comorbidity (yes or no)? Among the risk factors cited are as follows: Diabetes *mellitus*, immunodeficiency or immunosuppression, asthma, and obesity, including chronic diseases (cardiovascular, hepatic, neurological, renal, hematological, and pneumopathy). In addition, the existence of signs and symptoms (yes or no) such as fever, cough, sore throat, dyspnea, respiratory discomfort, O_2 saturation <95%, diarrhea, vomiting, etc. was investigated; duration time (days) was quantified from the onset of symptoms to the date of notification.

The data was compiled into spreadsheets using the Microsoft Office Excel program. For analysis, the *R* statistical (*R* Core Team, 2020; v. 4.0.0) program was used. Logistic regression models were employed to determine factors associated with elderly ICU admissions; by definition of the method, and values one (1) and zero (0) were indicative of admission to the ICU and ward, respectively.

The logistic regression models applied in the univariate analysis (p<0.20) determined the choice of variables for constructing the multiple models resulting in the final model after applying the Stepwise method. Associations were estimated by

calculating the odds ratio (OR), adopting the 95% confidence interval as a measure of precision.[9]

The study linked to this research was approved by the Ethics Committee on Research with Human Beings (Opinion 4,214,589). The ethical precepts on research with human beings presented in Resolutions (466/2012 and 510/16) of the National Health Council were ensured in documentary-based studies using secondary data, thus ruling out the need for Free and Informed Consent Form (TCLE) (Certificate of Presentation of Ethical Assessment: 34787020.0.3001.5225).

Results

During the period evaluated, 46,099 elderly people with a positive diagnosis for COVID-19 were admitted in Paraná: 25,986 of them in the ward (56.4%) and 20,113 in the ICU (43.6%). Among patient characteristics (types of hospitalization), a significant difference was highlighted between gender distributions, with prevalent male admissions to the ward (50.9%) and ICU (56.0). The prevalence of elderly females showed a reduction in admissions to the ward (49.1%) and ICU (44.0%) (Table 1). Likewise, the race or self-declared skin color variable showed statistical significance.

Table 1 indicates that white race or skin color was the most admitted to the ward (84.9%) and ICU (83.0%). In both forms of treatment, indigenous people had a hospitalization prevalence of less than 1.0%, whereas those with yellow skin had a prevalence of less than 2.0% in general hospitalizations and between the two levels of treatment.

In table 1, greater hospitalization of elderly people with education equal to or greater than eight years of study can be noted. The use of antiviral drugs was low in admissions to the ward (8.6%) and ICU (8.1%), as well as having received at least one dose of flu vaccine (ward: 32.9%; ICU: 27.5%). In hospitalization, the vaccine against COVID-19 showed statistically significant differences, with higher percentages in non-vaccinated than in vaccinated people/patients. The municipality of residence was the same as that of hospitalization in the ward (68.7%)

Table 1. Characterization of the sample of elderly patients hospitalized for COVID-19

Variables	n (%)	Hospitalizations		*p-values***
		Ward (n=25,986; 56.4%) n (%)	UTI* (n=20,113; 43.6%) n (%)	
Age (years) (n=46,099)				
60-74	29,745(64.5)	16,865(64.9)	12,880(64.0)	0.0002
75-84	11,627(25.2)	6,379(24.5)	5,248(36.1)	
≥85	4,727(10.3)	2,742(10.6)	1,985(9.9)	
Sex (n=46,098)				
Feminine	21,612(46.9)	12,768(49.1)	8,844(44.0)	<0.0001
Masculine	24,486(53.1)	13,217(50.9)	11,269(56.0)	
Race or skin color (n=38,737)				
White	32,575(84.1)	18,497(84.9)	14,078(83.0)	<0.0001
Black or Brown (Negro)	5,631(14.5)	3,007(13.8)	2,624(15.5)	
Yellow	509(1.3)	265(1.2)	244(1.4)	
Indigenous	22(0.1)	12(0.1)	10(0.1)	
Education (n=46,099)				
< 8 years of study	10,743(23.3)	6,462(24.9)	4,281(21.3)	<0.0001
≥ 8 years of study	5,219 (11.3)	3,059(11.8)	2,160(10.7)	
Residence Zone (n=41,825)				
Urban	39,946(95.5)	22,387(95.2)	17,559(95.9)	0.0022
Rural	1,790(4.3)	1,078(4.6)	712(3.9)	
Periurban	89(0.2)	51(0.2)	38(0.2)	
The patient lives in the same municipality as the hospital (n=46,099)				<0.0001
Yes	29,978(65.0)	17,841(68.7)	12,137(60.3)	
No	16,121(35.0)	8,145(31.3)	7,976(39.7)	
Health macro-region of the residence (n=46,099)				
East	23,575(51.1)	13,752(52.0)	9,823(48.8)	<0.0001
Northwest	6,540(14.2)	3,790(14.6)	2,750(13.7)	
North	7,649(16.6)	3,557(13.7)	4,092(20.3)	
West	8,335(18.1)	4,887(18.8)	3,448(17.1)	
Use of antiviral drug for influenza (n=39,221)				0.0943
Yes	3,287(8.4)	1,894(8.6)	1,393(8.1)	
No	35,934(91.6)	20,156(91.4)	15,778(91.9)	
Vaccination against flu (n=21,523)				<0.0001
Yes	6,593(30.6)	4,115(32.9)	2,478(27.5)	
No	14,930(69.4)	8,408(67.1)	6,522(72.5)	
Vaccination against COVID-19 (n=15,697)				<0.0001
Yes	7,019(44.7)	4,104(47.8)	2,915(41.0)	
No	8,678(55.3)	4,479(52.2)	4,199(59.0)	
The patient has risk factors or comorbidities (n=46,099)				<0.0001
Yes	35,453(76.4)	19,232(74.0)	16,221(80.6)	
No	10,646(23.1)	6,754(26.0)	3,892(19.4)	
Risk factors or comorbidities (n=46,099)				
Down's syndrome	79(0.2)	39(0.2)	40(0.2)	0.2532
Diabetes *mellitus*	14,066(30.5)	7,333(28.2)	6,733(33.5)	<0.0001
Immunodeficiency or Immunosuppression	974(2.1)	459(1.8)	515(2.6)	<0.0001
Chronic Cardiovascular Disease	21,606(46.9)	11,397(43.9)	10,209(50.8)	<0.0001
Chronic Liver Disease	456(1.0)	199(0.8)	257(1.3)	<0.0001

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Continuation.

Variables	n (%)	Hospitalizations		*p-values***
		Ward (n=25,986; 56.4%) n (%)	UTI* (n=20,113; 43.6%) n (%)	
Chronic Neurological Disease	2,867 (6.2)	1,538 (5.9)	1,329(6.6)	0.0025
Chronic Kidney Disease	2,068 (4.5)	865(3.3)	1,203(6.0)	<0.0001
Chronic Hematological Disease	308(0.7)	157(0.6)	151(0.8)	0.0631
Asthma	1,058(2.3)	580(2.2)	478(2.4)	0.3188
Other Chronic Pneumopathy	2,776(6.0)	1,412(5.4)	1,364(6.8)	<0.0001
Obesity	3,571(7.7)	1,525(5.9)	2,046(10.2)	<0.0001
Signs and Symptoms (n=46,099)				
Fever	1,9601(42.5)	11,251(43.3)	8,350(41.5)	0.0001
O_2 saturation <95%	30,557(66.3)	16,064(61.8)	14,493(72.1)	<0.0001
Cough	28,450(61.7)	16,856(64.9)	11,594(57.6)	<0.0001
Sore throat	6,608(14.3)	4,055(15.6)	2,553(12.7)	<0.0001
Diarrhea	6,073(13.2)	3,759(14.5)	2,314(11.5)	<0.0001
Vomiting	3,914(8.5)	2415(9.3)	1,499(7.5)	<0.0001
Dyspnea	32,643(70.8)	17,257(66.4)	15,386(76.5)	<0.0001
Respiratory discomfort	24,200(52.5)	12,395(47.7)	11,805(58.7)	<0.0001
Abdominal pain	2,108(4.6)	1,325(5.1)	783(3.9)	<0.0001
Loss of smell	3,042(6.6)	1,937(7.5)	1,105(5.5)	<0.0001
Loss of taste	3,190(6.9)	2,035(7.8)	1,155(5.7)	<0.0001
Use of ventilatory support (n=46,099)				
Yes, invasive	12,233(26.5)	0(0.0)	12,233(60.8)	<0.0001
Yes, non-invasive	25,189(54.6)	18,269(70.3)	6,920(34.4)	
No	8,677(18.8)	7,717(29.7)	960(4.8)	
Outcome of the case (n=44,006)				
Cure	24,199(55.0)	18,919(78.2)	5,280(26.6)	<0.0001
Death	19,639(44.6)	5,215(21.6)	14,424(72.8)	
Death from other causes	168(0.4)	52(0.2)	116(0.6)	

* Elderly people admitted to the Intensive Care Unit (ICU) or who used invasive ventilatory support were considered as ICU outcome; **Pearson chi-square

and ICU (60.3%) hospitalizations. Table 2 shows the raw and adjusted Odd Ratios (OR). The variables sex, area of residence and use of antiviral drug for influenza were associated with the outcome, as well as having cardiovascular disease, kidney disease, lung disease, obesity, having had cough, dyspnea, loss of smell, living in the same municipality as that of hospitalization, and the health macro-region corresponding to the residence. Males had a 36.0% higher chance of admission to the ICU when compared to the chances of females, whereas rural areas of residence reduced the prevalence of ICU admission by 38.0%. The final outcome of hospitalizations due to COVID-19 was less distant; hospitalizations resulted in death (55.0%) and the disease was cured (44.6%), highlighting the high rate of deaths in elderly people admitted to the ICU (72.8%).

Upon admission to the ICU, not having taken an antiviral drug against influenza showed a 52.0% increase when compared to elderly people who took the medicine. Concerning clinical data, cardiovascular diseases increased the prevalence of the severe form by 35.0%, whereas lung diseases increased ICU admission by 64.0%. Obesity was associated with a 45.0% increase in ICU referrals. Dyspnea presented a 55.0% greater probability of developing the severe form of the disease. Cough showed a 36.0% reduction in ICU admissions, similar to loss of smell, with a 29.0% decrease in the need for ICU for treatment. Not living in the same municipality as hospitalization increased the chance of developing the severe form of COVID-19 by 34.0%. Likewise, a reduction in ICU referrals was observed in the north (35.0%), northwest (24.0%), and west (32.0%) macro-regions when compared to the east macroregion.

Discussion

Throughout the COVID-19 pandemic, hundreds of elderly people became infected. A significant part of this age group required hospital assistance due to the severity with which the disease manifested itself in the body. Some factors, including the sociodemographic, presence of comorbidity, and immunization factors, were associated with this need.

The results above show that the largest number of hospitalizations in the ward and ICU were male, with a small drop in female hospitalizations in the ward (49.1%) and ICU (44.0%).

The predominance of hospitalizations for COVID-19 in elderly men confirms the study that analyzed the epidemiological profile of cases reported in the southern region of the country[10] and the one that described the clinical-epidemiological profile of cases of hospital admission in the State of Paraíba.[11] In this state, the determinants responsible for the divergence in clinical outcomes of elderly people infected with SARS-CoV-2 according to sex have not yet been exactly established, despite the data presented and publications.

Table 2. Crude and adjusted analysis of associations between independent variables and admission to the Intensive Care Unit (ICU) in the elderly

Variables	ICU (n=20,113; 43.6%) n (%)	Raw Analysis			Adjusted model[1]			Final adjusted model[2]		
		OR	95%CI	p-values	OR	95%CI	p-values	OR	95%CI	p-values
Age (years)										
60-74	12880(64.0)	Ref.	-	-	Ref.	-	-	-	-	-
75-84	5248(26.1)	1.08	1.03-1.12	0.0007	1.11	0.92-1.32	0.2777	-	-	-
≥85	1985(9.9)	0.95	0.89-2.01	0.0915	0.95	0.73-1.25	0.7244	-	-	-
Sex										
Feminine	8844(44.0)	Ref.	-	-	Ref.	-	-	Ref.	-	-
Masculine	11269(56.0)	1.23	1.19-1.28	<0.0001	1.36	1.17-1.58	<0.0001	1.36	1.17-1.58	<0.0001
Race or skin color										
White	14078(83.0)	Ref.	-	-	Ref.	-	-	-	-	-
Black or Brown (Negro)	2624(15.5)	1.15	1.08-1.21	<0.0001	0.98	0.80-1.20	0.8672	-	-	-
Ethnic minorities (yellow and indigenous)	254(1.5)	1.20	1.01-1.43	0.0334	1.78	0.83-3.83	0.1417	-	-	-
Education										
< 8 years of study	4281(21.3)	Ref.	-	-	Ref.	-	-	Ref.	-	-
≥ 8 years of study	2160(10.7)	1.07	1.00-1.14	0.0632	1.14	0.97-1.33	0.1060	1.15	0.99-1.34	0.0752
Residence Zone										
Urban	17559(95.9)	Ref.	-	-	Ref.	-	-	Ref.	-	-
Rural	712(3.9)	0.84	0.76-0.93	0.0005	0.64	0.45-0.91	0.0130	0.62	0.44-0.88	0.0071
Periurban	38(0.2)	0.95	0.62-1.45	0.8109	1.02	0.20-5.35	0.9776	0.99	0.19-5.16	0.9936
The patient lives in the same municipality as the hospitalization										
Yes	12137(60.3)	Ref.	-	-	Ref.	-	-	Ref.	-	-
No	7976(39.7)	1.44	1.39-1.50	<0.0001	1.32	1.13-1.55	0.0006	1.34	1.14-1.57	0.0003
Residence Health Macroregion										
East	9823(48.8)	Ref.	-	-	Ref.	-	-	Ref.	-	-
Northwest	2750(13.7)	1.01	0.96-1.07	0.5790	0.74	0.61-0.89	0.0016	0.76	0.64-0.92	0.0039
North	4092(20.3)	1.61	1.53-1.70	<0.0001	0.63	0.48-0.83	0.0010	0.65	0.50-0.85	0.0019
West	3448(17.1)	0.99	0.94-1.04	0.6340	0.67	0.54-0.84	0.0005	0.68	0.55-0.85	0.0007
Use of antiviral drug against flu										
Yes	1393(8.1)	Ref.	-	-	Ref.	-	-	Ref.	-	-
No	15778(91.9)	1.06	0.99-1.14	0.0908	1.20	0.77-1.87	0.4107	1.52	1.31-1.77	<0.0001
Vaccination against flu										
Yes	2478(27.5)	Ref.	-	-	Ref.	-	-	-	-	-
No	6522(72.5)	1.29	1.21-1.37	<0.0001	1.03	0.87-1.22	0.7437	-	-	-
Vaccination against COVID										
Yes	2915(41.0)	Ref.	-	-	Ref.	-	-	-	-	-
No	4199(59.0)	1.32	1.24-1.41	<0.0001	1.51	1.29-1.77	<0.0001	-	-	-
The patient has risk factors or comorbidities										
Yes	16221(80.6)	Ref.	-	-	-	-	-	-	-	-
No	3892(19.4)	0.68	0.65-0.71	<0.0001	-	-	-	-	-	-
Risk factors or comorbidities*										
Down's syndrome	40(0.2)	1.33	0.85-2.06	0.2110	4.65	0.90-23.88	0.0658	-	-	-
Diabetes *mellitus*	6733(33.5)	1.28	1.23-1.33	<0.0001	1.13	0.96-1.34	0.1477	1.13	0.96-1.34	0.1456
Immunodeficiency or Immunosuppression	515(2.6)	1.46	1.28-1.66	<0.0001	1.35	0.76-2.40	0.3066	-	-	-
Chronic Cardiovascular Disease	10209(50.8)	1.32	1.27-1.37	<0.0001	1.37	1.17-1.60	<0.0001	1.35	1.16-1.58	0.0001
Chronic Liver Disease	257(1.3)	1.68	1.39-2.02	<0.0001	0.85	0.35-2.05	0.7184	-	-	-
Chronic Neurological Disease	1329(6.6)	1.12	1.04-1.21	0.0024	0.87	0.61-1.23	0.4243	-	-	-
Chronic Kidney Disease	1203(6.0)	1.85	1.69-2.02	<0.0001	1.37	0.93-2.01	0.1141	1.36	0.93-2.00	0.1129
Chronic Hematological Disease	151(0.8)	1.24	0.99-1.56	0.0558	0.69	0.27-1.80	0.4487	-	-	-
Asthma	478(2.4)	1.07	0.94-1.21	0.3040	1.52	0.94-2.44	0.0853	1.48	0.92-2.37	0.1052
Other Chronic Pneumopathy	1364(6.8)	1.27	1.17-1.37	<0.0001	1.60	1.11-2.31	0.0114	1.64	1.14-2.35	0.0072
Obesity	2046(10.2)	1.82	1.70-1.95	<0.0001	1.43	1.09-1.88	0.0095	1.45	1.10-1.89	0.0072
Signs and symptoms*										
Fever	8350(41.5)	0.93	0.90-0.97	0.0001	0.99	0.85-1.15	0.9176	-	-	-
O_2 saturation <95%	14493(72.1)	1.59	1.53-1.68	<0.0001	1.13	0.94-1.37	0.1994	1.17	0.98-1.41	0.0826
Cough	11594(57.6)	0.74	0.71-0.77	<0.0001	0.66	0.56-0.78	<0.0001	0.64	0.55-0.75	<0.0001
Sore throat	2553(12.7)	0.79	0.75-0.82	<0.0001	0.99	0.82-1.19	0.8952	-	-	-
Diarrhea	2314(11.5)	0.77	0.73-0.81	<0.0001	0.98	0.79-1.21	0.8383	-	-	-
Vomiting	1499(7.5)	0.79	0.73-0.84	<0.0001	0.89	0.68-1.15	0.3690	-	-	-
Dyspnea	15386(76.5)	1.65	1.57-1.72	<0.0001	1.50	1.23-1.83	<0.0001	1.55	1.29-1.87	<0.0001
Respiratory discomfort	11805(58.7)	1.56	1.50-1.62	<0.0001	1.14	0.95-1.38	0.1636	-	-	-
Abdominal pain	783(3.9)	0.75	0.69-0.83	<0.0001	0.84	0.61-1.14	0.2629	-	-	-
Fatigue	4249(21.2)	0.92	0.88-0.96	0.0004	0.93	0.79-1.10	0.3892	-	-	-
Loss of smell	1105(5.5)	0.72	0.67-0.78	<0.0001	0.84	0.54-1.31	0.4319	0.71	0.54-0.92	0.0107
Loss of taste	1155(5.7)	0.72	0.67-0.77	<0.0001	0.87	0.57-1.34	0.5380	-	-	-

* Not presenting a risk factor or morbidity and not presenting any sign or symptom is the reference category. [1]Intercept: OR=0.14; CI (95%) = 0.05-0.37.53; p<0.0001. [2]Hosmer and Lemeshow test: p=0.9327; Intercept: 0.20; OR=?; 95%CI =0.14-0.30; p<0.0001. OR: Odds ratio. 95%CI: 95% confidence interval

We believe that the greater predisposition to worsening clinical conditions and deaths among men may be correlated with a set of hormonal, genetic, and lifestyle characteristics and the presence of comorbidities.[10] A netnographic study conducted in Brazil also detected that men are also more likely to present prolonged symptoms of COVID-19 in addition to this greater susceptibility, with a systemic impact on the body.[12]

In addition to these factors, correlating the worsening of the clinical picture with the fact that women have twice as many genes that act in the immune system is also possible (the X chromosome has a greater quantity of these genes in the genome).[1]

When considering the self-declaration of race or skin color, the predominance in the worsening of the clinical condition in the elderly in the State of Paraná is among those who declared themselves white (ward: 84.9%; ICU: 83.0%), followed by brown or black people (ward: 13.8%; ICU: 15.5%), yellow (ward: 1.2%; ICU: 1.4%), and indigenous people (ward: 0.01%).

These data may be directly related to the numerical distribution of the sociodemographic surveys of the Brazilian Institute of Geography and Statistics (IBGE). Based on the National Household Sample Survey (PNAD; 2019), the Brazilian population is made up of white (42.7%), brown (46.8%), black (9.4%), and yellow or indigenous (1.1%) people.[13]

The relationship between the proportion and number of people in Brazilian society and the number of people hospitalized due to the worsening of COVID-19 is only justified among those who declare themselves white, yellow, and indigenous people, as the difference between the number of self-declared brown or black people and the number of self-declared elderly people of this color is significant. The socioeconomic conditions of this population and the social inequalities that prevent or hinder access to healthcare may be one of the explanations, just as they prevent or hinder access to education, culture, employment, and leisure.[11]

Differently, a longitudinal study identified that the risk of mortality was similar for different ethnicities in the USA, which can be explained by the economic and social development of this country.[14]

Regarding education, we found that the predominance of hospitalization due to COVID-19 in the elderly occurred in those who had less than 8 years of education (ward: 24.9%; ICU: 21.3%). A study carried out in Brazil stated that the transmission rates of respiratory diseases and infections are directly related to social inequality, contributing to understanding our epidemiological observation.[15]

The incidence of hospitalizations in elderly people who used antiviral drugs against influenza is another important data; the vast majority of those who did not use antiviral drugs required medical treatment in a ward or ICU. The difference between elderly people who used antiviral drugs against influenza and those who did not is significant: 35,934 elderly people who did not use antiviral drugs required hospital medical treatment due to COVID-19. Treatment of COVID-19 patients requires exclusivity; developing pharmacological treatment is necessary to act on the target proteins of the virus. The World Health Organization (WHO) warned that we could live with the virus for decades; therefore, developing specific and safe treatments for the population is essential for the weapon against COVID-19 to be effective.[16]

Among the signs and symptoms of the sample of elderly people hospitalized for COVID-19, the presence of dyspnea (70.8%), O_2 saturation <95% (66.3%), cough (61.7%), respiratory discomfort (52.5%), and fever (42.5%) stood out as the highest percentages in elderly people admitted to the ICU, indicating that the population in this age group is more susceptible to worsening of the disease. Despite the different clinical manifestations of COVID-19, around 80% of those infected may not have any symptoms. This requires constant monitoring of suspected cases so that the cases, in which the diagnosis of the disease is not certain, are not abandoned. Considering the diversity of clinical presentation that each elderly person may present, health services must establish criteria to better guide care, defining a set of actions based on the characteristics and symptoms that each elderly person is presenting.[17]

The flu vaccine is also a factor in reducing cases of hospitalization of the elderly due to worsen-

ing of the clinical condition of COVID-19, as the probability of admission of unvaccinated people (69.4%) to the ICU was greater than that of those vaccinated (30.6%). Regarding vaccination against COVID-19, the percentage of hospitalization of unvaccinated elderly people (55.3%) in the ICU was higher than that of vaccinated people, indicating that immunization can minimize the risks of hospitalization and the need for ICU.

After contamination by the virus, elderly people who did not receive any antiviral drug or had a vaccine against flu or COVID-19 were admitted to the ward and ICU. This points to an unfavorable prognostic outcome for elderly people who have not received any vaccine. We also emphasize that the spread of unreliable rumors and information has caused distrust and insecurity in a large part of the population.[18] A study carried out in Qatar (2022) showed that the propensity to develop severe COVID-19 in individuals vaccinated against influenza was about 90% lower than in those who were not vaccinated.[19]

A study on factors associated with an increase in the risk of death from COVID-19 (2020), showed that male individuals with a mean age equal to or greater/older than 66 years had a higher risk of death from the disease.[20] This correlates with the outcome of hospitalizations due to COVID-19 in the present study, in which patients who died (55.0%) and those who were cured of the disease (44.6%) obtained similar rates, highlighting the high death rate of people admitted to the ICU (72.8%).

The present study presented strengths and limitations that should be highlighted. Identification of the prevalence and factors associated with hospitalization of elderly people who acquired COVID-19 was the main advance in knowledge. Our findings can be used as a reference to evaluate and compare the health risk factors of the elderly population group in the current context and future pandemic contexts; they may also contribute to the analysis of factors associated with hospitalization of elderly people due to the disease in future studies.

The potential limitations found in the present study were as follows: data generated and inserted incorrectly into the system, missing data in the notification forms, and incorrect completion of the forms.

Conclusion

Education and non-adherence to vaccination against COVID-19 can increase the risk of hospitalization for the disease. The chance of ICU hospitalization for elderly men is greater than for elderly women. The non-use of antivirals can contribute to the worsening of the health of elderly people. Pre-existing cardiovascular and lung diseases and obesity contribute to worsening the disease with consequent admission to the ICU. Sociodemographic factors and underlying diseases influence the clinical outcome of the disease in this age group, contributing to hospitalization and possible referral to ICU. After suspected or confirmed COVID-19 in the elderly, health professionals must identify the factors that could lead to hospitalization, plan actions that prevent injuries, and monitor those infected, thus mitigating hospital effects and avoiding both overloads on the service and lack of beds for hospitalization.

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References

1. Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. Mil Med Res. 2020;7(1):11. Review.
2. Johns Hopkins University & Medicine. Mortality analyses. Baltimore, Maryland; Johns Hopkins University & Medicine; 2023 [cited 2022 Dec 17]. Available from: https://coronavirus.jhu.edu/data/mortality
3. Van Orden KA, Bower E, Lutz J, Silva C, Gallegos AM, Podgorski CA, et al. Strategies to promote social connections among older adults during "Social Distancing" Restrictions. Am J Geriatr Psychiatry. 2021;29(8):816-27.
4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506. Erratum in: Lancet. 2020 Jan 30.

5. Ventura MW, Diógenes MS, Albuquerque NL, Lima GA, Oliveira PM, Alexandre IC, et al. Análise comparativa das características demográficas, sintomatologia e comorbidades de adultos e idosos notificados e confirmados com COVID-19 nas capitais brasileiras. Rev Min Enferm. 2022;26:e1438.

6. Santos IL, Zimmermann IR, Donalísio MR, Santimaria MR, Sanchez MN, Carvalho JL, et al. Vulnerabilidade social, sobrevida e letalidade hospitalar pela COVID-19 em pacientes com 50 anos ou mais: coorte retrospectiva de casos no Brasil em 2020 e 2021. Cad Saude Publica. 2022;38(1):e00261921.

7. Brasil. Organização Pan-Americana de Saúde. Folha informativa COVID-19 - Escritório da OPAS e da OMS no Brasil. Brasília (DF): OPAS, OMS; 2021 [citado 2021 Mar 10]. Disponível em: https://www.paho.org/pt/covid19

8. Brasil. Departamento de Informática do Sistema Único de Saúde. Tabnet. Brasília (DF): DATASUS, 2022 [citado 2021 Dez 1]. Disponível em: https://datasus.saude.gov.br/informacoes-de-saude-tabnet/

9. Hosmer Jr DW, Lemeshow S, Sturdivant RX. Applied logistic regression. 3rd Edition; John Wiley & Sons; 2013. 528 p.

10. Klokner SG, Luz RA, Araujo PH, Knapik J, Sales SS, Torrico G, et al. Perfil epidemiológico e preditores de fatores de risco para a COVID-19 na região sul do Brasil. Res Soc Devel. 2021;10(3):e17710313197.

11. Nascimento IM, Alencar Neta RL, Souza AC, Bezerra YC, Silva CJ, Lima ER, et al. Perfil clínico-epidemiológico dos casos de hospitalização por COVID-19 na nona região de saúde da Paraíba, Brasil. Res Soc Devel. 2022;11(1):e29011124761.

12. Santana WC, Lima AA, Muniz VO, Machuca-Contreras V, Vale PR, Carvalho ES, et al. Manifestações clínicas e repercussões dos sintomas prolongados e sequelas pós-COVID-19 em homens: netnografia. Acta Paul Enferm. 2023;36:eAPE018532.

13. Brasil. Instituto Brasileiro de Geografia e Estatística (IBGE). Pesquisa Nacional por Amostra de Domicílios. Brasília (DF): IBGE; 2019 [citado 2023 Ago 18]. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/populacao/9127-pesquisa-nacional-por-amostra-de-domicilios.html?=&t=destaques

14. Richardson S, Martinez J, Hirsch JS, Cerise J, Lesser M, Roswell RO, Davidson KW; Northwell Health COVID-19 Research Consortium. Association of race/ethnicity with mortality in patients hospitalized with COVID-19. PLoS One. 2022;17(8):e0267505.

15. Pires LN, Carvalho L, Xavier LL. COVID-19 e desigualdade: a distribuição dos fatores de risco no Brasil. Experimet Findings; 2020. DOI:10.13140/RG.2.2.27014.73282.

16. Ferreira LL, Andricopulo AD. Medicamentos e tratamentos para a Covid-19. Estud Av. 2020;34(100):7-27.

17. Iser BP, Sliva I, Raymundo VT, Poleto MB, Schuelter-Trevisol F, Bobinski F. Definição de caso suspeito da COVID-19: uma revisão narrativa dos sinais e sintomas mais frequentes entre os casos confirmados. Epidemiol Serv Saúde. 2020;29(3):e2019354. Review.

18. Araújo TM, Carvalho AM, Fronteira I, Silva AA, Rodrigues KA, Queiroz GS, et al. Aceitação da vacina contra COVID-19 entre público diagnosticado com síndrome gripal. Acta Paul Enferm. 2021;34:eAPE000086.

19. Tayar E, Abdeen S, Abed Alah M, Chemaitelly H, Bougmiza I, Ayoub HH, et al. Effectiveness of influenza vaccination against SARS-CoV-2 infection among healthcare workers in Qatar. J Infect Public Health. 2023;16(2):250-6.

20. Maciel EL, Jabor P, Goncalves Júnior E, Tristão-Sá R, Lima RC, Reis-Santos B, et al. Fatores associados ao óbito hospitalar por COVID-19 no Espírito Santo, 2020. Epidemiol Serv Saude. 2020;29(4):e2020413.