OBJN
ONLINE BRAZILIAN JOURNAL OF NURSING
ISSN: 1676-4285

ORIGINAL

Prevalence and factors associated with deaths caused by COVID-19: cross-sectional study

Prevalência e fatores associados aos óbitos pela COVID-19: estudo transversal

Mariane Cardoso Carvalho[1]
ORCID: 0000-0002-2034-8325

Rosana Alves de Melo[2]
ORCID: 0000-0001-9217-921X

Flávia Emília Cavalcante Valença Fernandes[1]
ORCID: 0000-0003-2840-8561

Amanda Regina da Silva Góis[1]
ORCID: 0000-0003-4661-772X

Rachel Mola de Mattos[1]
ORCID: 0000-0002-0180-2721

Roxana Braga de Andrade Teles[1]
ORCID: 0000-0001-9486-5109

[1]University of Pernambuco, Recife, PE, Brazil
[2]Federal University of the São Francisco Valley, Petrolina, PE, Brazil

Editors:
Ana Carla Dantas Cavalcanti
ORCID: 0000-0003-3531-4694

Paula Vanessa Peclat Flores
ORCID: 0000-0002-9726-5229

Érica Brandão de Moraes
ORCID: 0000-0003-3052-158X

Corresponding author:
Flávia Emília Cavalcante Valença Fernandes
E-mail: flavia.fernandes@upe.br

Submission: 05/02/2022
Approved: 04/24/2023

ABSTRACT

Objective: To evaluate the prevalence and factors associated with deaths due to covid-19 in Pernambuco. **Method:** Cross-sectional study with the use of databases related to the monitoring of COVID-19 notifications in Pernambuco. **Results:** Prevalence of male sex (54.1%), non-elderly (53.0%) with some comorbidity (55.6%). The flu symptoms prevailed (82.5%) and dyspnea (80.2%). Among the factors associated with mortality, the following prevailed: elderly (OR 3.57; p-value=0.000), presence of hepatic diseases (OR 4.81; p-value=0.000), kidney diseases (OR 2.94; p-value=0.000) and overweight or obesity (OR 2.38; p-value=0.000), symptoms like dyspnea (OR 1.31; p-value=0.000) and O2 saturation <95% (OR 1.42; p=value=0.000). **Conclusion:** The prevalence was men, non-elderly and with comorbidities. The main factors associated with deaths were the presence of the elderly and being elderly.
Keywords: COVID-19; Mortality; Risk Factors.

RESUMO

Objetivo: Avaliar a prevalência e os fatores associados aos óbitos pela COVID-19 em Pernambuco. **Método:** Estudo transversal com a utilização de bases dos dados referente ao acompanhamento das notificações por COVID-19 em Pernambuco. **Resultados:** Prevalência do sexo masculino (54,1%), não idoso (53,0%) com alguma comorbidade (55,6%). Prevaleceram os sintomas gripais (82,5%) e dispneia (80,2%). Entre os fatores associados com a mortalidade, prevaleceram os idosos (OR 3,57; p-valor=0,000), a presença de doenças hepáticas (OR 4,81; p-valor=0,000), doenças renais (OR 2,94; p-valor=0,000) e sobrepeso ou obesidade (OR 2,38; p-valor=0,000), sintomas como dispneia (OR 1,31; p-valor=0,000) e saturação de O2 <95% (OR 1,42; p=valor=0,000). **Conclusão:** A prevalência foi de homens, não idosos e com comorbidades. Os principais fatores associados aos óbitos foram a presença de comorbidades e ser idoso.
Descritores: COVID-19; Mortalidade; Fatores de Risco.

INTRODUCTION

The first reported cases of pneumonia caused by a new type of Coronavirus identified as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS--COV-2), designated as Coronavirus Disease-2019 (COVID-19) by the World Health Organization (WHO), were identified in Wuhan, a city in the province of Hubei in China, in December 2019[1].

The spread of SARS-CoV-2 on all continents has generated a large number of deaths and overloads in health systems, leading WHO to declare a Public Health Emergency of international interest on the global outbreak of the new coronavirus and to characterize COVID-19 as a pandemic[1]. The clinical symptoms most commonly associated with the disease are fever, cough, fatigue and dyspnea, reported both the international[2,3,4] and in the national[5] literature, while the least presented symptoms are expectoration, headache, hemoptysis and diarrhea[2].

The literature points out that some groups with a higher risk of illness and severity of the case are people aged 60 years or older and those with comor-

How to cite: Carvalho MC, Melo RA, Fernandes FECV, Góis ARS, Mattos RM, Teles RBA. Prevalence and factors associated with deaths caused by COVID-19: cross-sectional study. Online Braz J Nurs. 2023;22:e20236645. https://doi.org/10.17665/1676-4285.20236645

bidities such as heart disease, respiratory disease and diabetes[6]. Some factors may influence the lethality of cases, such as knowledge about the disease, capacity installed at the hospital level, ability to perform diagnoses, and cases still in progress[7].

The COVID-19 pandemic has resulted in considerable morbidity and mortality in more than 200 countries and regions around the world, on August 21st, 2022 the WHO registered a cumulative total of 6.4 million deaths reported globally[8]. Brazil, in more than two years of the pandemic, has already recorded more than 600 thousand cumulative deaths, with an average mortality rate of 325.4 deaths per 100 thousand inhabitants and a lethality rate of 2.0%[9], while the Northeast region presents an average mortality rate of 230.8 deaths per 100 thousand inhabitants, according to update performed on August 30th, 2022. In the state of Pernambuco, the cumulative deaths caused by COVID-19 already reach 22,160 cases, according to the records updated on August 23rd, 2022[10].

Thus, considering the health emergency that SARS-CoV-22 represents[1], it is necessary to carry out studies aimed at identifying the factors associated with mortality caused by COVID-19 for the production of scientific knowledge, once this knowledge can help in the creation of subsidies for the adoption of measures and strategies aimed at the disease control and prevention. In addition, the efforts produced by the scientific community and its professionals contributed decisively to controlling the pandemic and reducing the adverse outcomes of COVID-19[11].

Therefore, the aim of this study is to evaluate the prevalence and factors associated with deaths caused by COVID-19 in Pernambuco.

METHOD

A cross-sectional study was carried out using the databases related to the monitoring of COVID-19 notifications in the state of Pernambuco made available by the Secretariat of Planning and Management in conjunction with the State Secretariat of Health and State Information Technology Agency of Pernambuco[10].

The study population comprised all cases confirmed by COVID-19 in the state of Pernambuco. All records of confirmed cases were included in the sample between July 2020 and July 2021 and the cases that presented a lack of information in variables to decrease inconsistencies were excluded. The revision of the information was performed using the analysis of descriptive statistics by two researchers.

The dependent variable was the case evolution: death or improvement that occurred in the study period and reported in the notification records (https://dados.seplag.pe.gov.br/apps/corona.html#dados-pe). The independent variables were: sex, age group (elderly or non-elderly), signs and symptoms, presence and classification of comorbidities, need for hospitalization. It was considered elderly patients who were 60 years old or older, according to the Statute of the Elderly[12].

Considering the great diversity of combinations of signs and symptoms and comorbidities, these were treated in binary form in which they could appear in isolation or associated with other signs and symptoms/comorbidities.

Thus, dyspnea, O2 saturation <95%, was included in the variable of signs and symptoms of fatigue, respiratory discomfort and/or chest tightness, nasal congestion and loss of smell and/or taste, signs and symptoms of flu, such as runny nose, fever, cough, sore throat, myalgia and headache, and symptoms of the gastrointestinal tract (GI) such as nausea, vomiting or diarrhea. Furthermore, in the variable of comorbidities, heart disease, diabetes and hepatic diseases overweight and/or obesity, kidney diseases and respiratory diseases were analyzed.

The database was built by downloading spreadsheet files available on the SES/PE database, following the transfer to statistical software and analysis. Then descriptive statistics were used, applying frequency distribution and inferential statistics through multivariate analysis.

The associated factors were evaluated through binary logistic regression, whose effects were analyzed using odds ratios - OR and the signal of the coefficient z. The inclusion of the variables in the multivariate model was done by the stepwise method adopting $p<0.20$ as inclusion criteria and model adjustment. The significance level of 5% and 95% confidence was adopted. Stata 14.0 software was used for statistical analysis, and Microsoft Office Excel 2013 was used to construct the database and tables.

Considering the use of secondary data of notifications on a public domain data basis, the project followed the ethical precepts established in the Resolution of the National Health Council number 510/2016, dispensing with appreciation by the Research Ethics Committee.

RESULTS

Of the 22,463 cases of COVID-19 studied in the analysis period, 8,772 (39.0%) died and 13,691 were recovered (61.0%). Most were male sex (54.1%), non- elderly (53.0%) and had some comorbidity (55.6%). Among the comorbidities, 36.4% of the cases presented some form of heart disease isolated or associated with another type of comorbidity. Diabetes was present isolated or associated in 25.6% and overweight and/or obesity in 9.2%. Similarly, but in smaller proportion, respiratory diseases (4.5%), kidney diseases (3.4%) and hepatic diseases (0.9%) were also present in some cases. Most cases required hospitalization (96.3%) (Table 1).

Table 1 - Clinical and demographic profile of COVID-19 cases (n=22.463). Petrolina, PE, Brazil, 2020-2021

	n	%
Sex		
Female	10,305	45.9
Male	12,158	54.1
Elderly		
No	11,911	53.0
Yes	10,552	47.0
Presence of comorbidities		
No	9,974	44.4
Yes	12,489	55.6
Isolated or associated heart disease		
No	14,291	63.6
Yes	8,172	36.4
Isolated or associated hepatic disease		
No	22,273	99.2
Yes	190	0.9
Isolated or associated respiratory disease		
No	21,450	95.5
Yes	1,013	4.5
Isolated or associated kidney disease		
No	21,702	96.6
Yes	761	3.4
Overweight and obesity		
No	20,405	90.8
Yes	2,058	9.2
Isolated or associated diabetes		
No	16,721	74.4
Yes	5,742	25.6
Hospitalization		
No	829	3.7
Yes	21,634	96.3
Death		
No	13,691	61.0
Yes	8,772	39.0

Source: Elaborated by the authors, 2022.

Regarding signs and symptoms, most patients presented two or more flu symptoms such as runny nose, fever, cough, sore throat, myalgia and headache (82.5%) and isolated or associated dyspnea (80.2%). The presence of at least one symptom of the gastrointestinal tract (GI), such as nausea, vomiting, or diarrhea was present in 75% of the cases as well as the O2 saturation < 95% (70.5%). Among the other symptoms presented,47.0% showed respiratory discomfort and/or chest tightness, 18.6% had tiredness, 10.9% lost smell/taste and 10.2% showed isolated or associated nasal congestion (Table 2).

Table 2 - Characterization of signs and symptoms of the cases of COVID-19 (n=22.463). Petrolina, PE, Brazil, 2020-2021

	n	%
Isolated or associated Dyspnea		
No	4,454	19.8
Yes	18,009	80.2
Isolated or associated saturation O2 < 95%		
No	6,62	29.5
Yes	15,843	70.5
Isolated or associated tiredness		
No	18,278	81.4
Yes	4,185	18.6
Respiratory discomfort and/or isolated or associated chest tightness		
No	11,903	53.0
Yes	10,56	47.0
Isolated or associated nasal congestion		
No	20,168	89.8
Yes	2,295	10.2
Isolated or associated loss of smell/taste		
No	20,015	89.1
Yes	2,448	10.9
Isolated or associated flu symptoms (Runny nose/Fever/Cough/Sore Throat/Myalgia/ headache)		
Only 1 symptom	3,931	17.5
2 or more symptoms	18,532	82.5
Isolated or associated GI symptoms (Vomiting/nausea/diarrhea)		
Only 1 symptom	2,902	75.0
2 or more symptoms	969	25.0

Source: Elaborated by the authors, 2022.

When analyzing the factors associated with deaths, it was found that the cases that presented symptoms such as isolated or associated dyspnea (OR 1.31; p-value=0.000) and O2 saturation <95% (OR 1.42; p=value=0.000) had higher chances of evolution for death, and in addition, in elderly patients, these chances increased three times more (OR 3.57; p-value=0.000). The presence of comorbidities was also a significant factor for increased odds of death, especially isolated or associated hepatic diseases (OR 4.81; p-value=0.000), kidney diseases (OR 2.94; p--value=0.000) and overweight or obesity (OR 2.38; p-valor=0.000).

The previous existence of isolated or associated diabetes (OR 1.50; p-value=0.000), heart disease (OR 1.43; p-value=0.000) and respiratory diseases (OR 1.46; p-value=0.047) also increased the odds of COVID-19 deaths. It was observed that hospitalization was an important protective factor (OR 0.23; p-value=0.000), reducing the chances of death, while the variables sex and presence of two or IG more symptoms were insignificant in the model (Table 3).

DISCUSSION

From the results, it was possible to observe that most patients were male sex and non-elderly. The prevalence of men, especially young adults, is also reported in other studies[5,13], and a meta--analysis study showed that men corresponded to 60% of the cases[3], demonstrating the relevance of this sex in the distribution of the disease cases. In this study, the prevalence and distribution of comorbidities are compatible with the Data found in international[13,14] and national literature[5,15]. Of the 48% of patients with comorbidities in Wuhan, China, hypertension and diabetes were the most common, representing 30% and 19% respectively[14]. Similarly, in São Paulo, Brazil, the most common comorbidities were hypertension (59.4%), diabetes (35.8%), and obesity (30.7%)[15], corroborating the findings of the present study.

Regarding the comorbidities, the most frequent in the whole sample were heart diseases (n=8,172), Diabetes (n=5,742), Overweight and Obesity (n=2,058) and Chronic Respiratory Disease (n=1,013). In a study conducted in

Table 3 - Factors associated with death due to COVID-19 (n=22.463). Pernambuco, PE, Brazil, 2020-2021

	Odds Ratio	Z	p-valor	IC 95%	
Signs and symptoms					
Two or more GI symptoms	1.13	1.41	0.158	0.95	1.34
Presence of Dyspnea	1.31	2.99	0.000	1.10	1.57
O2 saturation < 95%	1.42	3.86	0.000	1.19	1.69
Presence of flu symptoms	0.62	-5.25	0.000	0.52	0.74
Comorbidities					
Presence of heart diseases	1.43	4.42	0.000	1.22	1.68
Presence of hepatic diseases	4.81	3.98	0.000	2.22	10.43
Presence of respiratory diseases	1.46	1.99	0.047	1.01	2.12
Presence of overweight or obesity	2.38	7.02	0.000	1.87	3.04
Presence of kidney diseases	2.94	5.47	0.000	2.00	4.32
Presence of Diabetes	1.50	4.64	0.000	1.26	1.78
Age group					
Elderly	3.57	15.87	0.000	3.05	4.17
Non-elderly	1.00				
Sex					
Male	1.13	1.65	0.099	0.98	1.32
Female	1.00				
Hospitalization	0.23	-7.88	0.000	0.16	0.33

Source: Elaborated by the authors, 2022.

Mexico, comorbidities such as diabetes, followed by hypertension and obesity, are pointed out as predisposing factors for infection and case severity[13]. In addition, these diseases are also related to the increase in the need for hospitalization in the Intensive Care Unit (ICU)[4], which may explain the large number of hospitalizations observed in the present study.

As for the symptoms presented, most had flu symptoms such as fever, runny nose, cough, sore throat, myalgia and headache, plus some symptoms of GI such as nausea, vomiting and diarrhea. Dyspnea and oxygen saturation lower than 95% were present in most cases, as well as respiratory discomfort and chest tightness. The patients reported other symptoms, such as tiredness, loss of smell and taste and nasal congestion, but in less quantity.

The literature refers to the predominance of flu symptoms, especially fever, cough and headache, in addition to symptoms such as dyspnea and fatigue, present in most cases of the disease[2,4]. A study conducted in Lima, Peru, showed that oxygen saturation below 90% at admission strongly predicts hospital mortality in patients with COVID-19[16].

Regarding the risk factors associated with deaths, it was observed that in elderly patients, the chances of death were three times higher compared to other patients. Age over 60 years is significantly associated with higher mortality, and elderly presented five times more chances of death than the other determinants, according to a US study[17]. Similarly, in Peru, every ten years the age of patients increased, the risk of death was 32% higher[18].

Symptoms such as dyspnea and oxygen saturation lower than 95% also increased the chances of death of patients in the present study. Hypoxemia, Oxygen saturation below 89% increases the need for ICU care and mechanical ventilation, which is strongly associated with mortality[17]. The presentation of some degree of hypoxemia at admission suggests a late hospitalization that may be associated with ignorance of alarm signals, lack of access to transport, fear of going to a hospital and other limitations to timely access to medical care of emergency that influence the worsening of the case and the potential mortality[16].

The presence of hepatic diseases as a comorbidity was a significant risk factor, increasing the chances of death four times more. An international study reports that pre-existing chronic hepatic diseases were independent risk factors for poor outcomes, and the degree of cirrhosis was defined as a predictor of mortality in patients infected with SARS-CoV-2[19]. Hepatic dysfunction in severe cases occurs due to the direct cytopathic effect of the virus, an uncontrolled immune reaction, sepsis or liver injury induced by drugs, and also the worsening of the underlying chronic hepatic disease, leading to liver hepatic decompensation and acute-chronic hepatic failure, presenting higher mortality of the cases[20].

Kidney diseases, as well as overweight and obesity, represented an increase of twice as many chances of progression to death. Regarding kidney diseases, a study performed in the United States showed that 50% of patients with Chronic Kidney Disease died 28 days after admission to the ICU[21]. Since SARS-CoV-2 infection can cause or accelerate kidney damage, it is important to monitor changes in the kidney function of the patients because the intervention as early as possible can improve the prognosis, according to the case report carried out in China[22].

Obesity and overweight are also risk factors for severe COVID-19 infection, as it reduces the protective cardiorespiratory reserve and enhances the immunological deregulation that can mediate progression to critical disease and organ failure in a proportion of critically ill patients[23]. In addition, heart diseases, diabetes and respiratory diseases were also significant in increasing odds of mortality among COVID-19 cases. The literature points to the presence of these comorbidities as determinants for the need for intensive care and the increase in the risk of death[17,18].

However, the occurrence of hospitalization proved to be an important factor to reduce the potential mortality of cases, since it decreases the chances of death, as observed in the present study. A study on the clinical outcome of hospitalized patients in the ICU, showed that 86% of cases that did not have associated risk factors, had better recuperation and hospital discharge after intensive care, however older patients with comorbidities that required high demand for support therapies and prolonged hospitalization in ICU showed greater intra-hospital morbimortality[19].

Thus, it is possible to understand how social determinants of health can negatively influence the COVID-19 outcomes as they are directly related to increased exposure to risk factors in the most vulnerable populations, and these factors, mainly socioeconomic and demographic factors[24], interfere with the process of getting sick and dying

of this population, especially in the context of the pandemic[25]. Moreover, studies indicate that there is a social determination in both incidence and in mortality due to COVID-19, and that the association with high lethality and mortality rates may suggest weaknesses in access to quality specialized care, especially in areas with lower economic development[26].

It is worth highlighting the importance of public sectors in the intervention of these determinants to ensure the reduction of contamination by SARS-CoV-2 and its health-related outcomes[25]. And that the creation of public policies and coping strategies includes intersectoral actions, aiming to guarantee sanitary and economic conditions for the accomplishment of the recommended prevention actions and the expansion of public investment in health and the strengthening of health networks in vulnerable areas[26], thus reducing the enormous inequality in the distribution of the health infrastructure throughout the Brazilian territory[27].

The study limitation refers to the use of a secondary source, which may present sub-notifications, inconsistencies and incompleteness due to inadequate completion of notification and feeding Sheets in the Information System by the Municipal Health Secretariats of the analyzed state. Other limitations were related to the large quantitative combinations of symptomatology and comorbidities reported, which needed to be studied isolated or associated.

CONCLUSION

The results of this study showed a higher prevalence of non-elderly patients and male, in addition to the presence of comorbidities, especially heart disease and diabetes, and need for hospitalization. Regarding the signs and symptoms, flu symptoms, dyspnea, gastrointestinal tract symptoms and oxygen saturation lower than 95% prevailed. Among the factors that were associated with deaths, the presence of comorbidity, especially hepatic diseases, kidney diseases, and overweight and obesity were highlighted, besides the age group of the elderly was also relevant in increasing the chances of death. Some symptoms such as oxygen saturation lower than 95% and dyspnea were significant as a risk factor for mortality.

The study contributed to the identification of the epidemiological profile with greater potential aggravation of the case and mortality due to exposure to the risk factors that are associated with a higher chance of death. In addition, it can promote subsidies for the evaluation and planning of the control actions of the transmission of SARS-CoV-2 and care strategies that can minimize this problem, as well as improve the hospital care and intensive care provision for patients exposed to risk factors.

CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

FUNDING

This paper was carried out with the support of the National Council for Scientific and Technological Development (CNPq). Process No. 32323/2021-4.

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AUTHORSHIP CONTRIBUTIONS
Project design: Carvalho MC, Melo RA, Fernandes FECV
Data collection: Carvalho MC, Fernandes FECV
Data analysis and interpretation:Carvalho MC. Melo RA, Fernandes FECV
Writing and/or critical review of the intellectual content: Carvalho MC, Melo RA, Fernandes FECV, Góis ARS,Mattos RM, Teles RBA
Final approval of the version to be published: Carvalho MC, Melo RA, Fernandes FECV, Góis ARS, Mattos RM, Teles RBA
Responsibility for the text in ensuring the accuracy and completeness of any part of the paper: Carvalho MC, Melo RA, Fernandes FECV, Góis ARS, Mattos RM, Teles RBA