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ORIGINAL ARTICLE

Cross-sectional study of suspected and confirmed COVID-19 patients in a public hospital complex in Curitiba (PR), Brazil

Estudo epidemiológico de pacientes com suspeita e confirmação de COVID-19 em um complexo hospitalar público de Curitiba (PR), Brasil

Estudio epidemiológico de pacientes con COVID-19 sospechado y confirmado en un complejo hospitalario público de Curitiba (PR), Brasil

Fernando Werner Kasemodel,[1] Bernardo Olsson,[2] Maria Esther Graf,[3] Rafaela Scariot,[2] Somaia Reda.[1]
[1]Professor de Infectologia, Departamento de Biologia e Farmácia, Universidade de Santa Cruz do Sul (Unisc). Controle de Infecção e Epidemiologia Hospitalar. Hospital Santa Cruz do Sul, Santa Cruz do Sul, RS, Brasil.

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Corresponding Author:
Rafaela Scariot
rafaela_scariot@yahoo.com.br

ABSTRACT

Background And Objectives: The pandemic of coronavirus disease (COVID-19) stems from a virus capable of causing severe acute respiratory syndrome (SARS). The understanding of this new disease demands epidemiological data. To determine the epidemiological profile of SARS and confirmed COVID-19 patients in a public hospital complex. **Methods:** Three-month cross-sectional study at a public hospital complex in Curitiba (PR, Brazil). It was included SARS tested patients using nasopharyngeal swab for COVID-19 laboratory diagnosis. Age-range (by quartiles), sex, forwarding, city of origin, hospitalization and evolution (discharge or death) were analyzed. An alpha of 5% was considered statistically significant. **Results:** 741 SARS patients were included. The predominant age-range was 37 to 50 years (26.6%), 57.1% was female, 57.9% were forwarded and 81.1% were from Curitiba. The confirmed-COVID-19 patients predominant age-range was 51 to 66 years. Men and forwarded patients had greater risk of presenting the disease being prevalence ratio (PR) 1.38 (1.05-1.81 / 95% confidence interval (CI)) and PR 2.11 (1.51-2.93 / 95% CI) times, respectively. The confirmed-COVID-19 hospitalized patients prevalent age-range was 54 to 67 years. Men and forwarded patients had higher risk of hospitalization being PR 1.18 (95% CI = 1.04-1.33) and PR 2.17 (95% CI = 1.54-3.04) times, respectively. The confirmed discharged patients predominant age-range was 17 to 41 years and of those who died was 68 to 96 years. **Discussion:** COVID-19 is more prevalent in elderly, men and forwarded patients. This profile is also associated with higher risk of hospitalization. Age-range is associated with evolution.

Keywords: *Severe acute respiratory syndrome coronavirus 2; Virus diseases; Intensive care units; Epidemiological statistics.*

RESUMO

Justificativa e Objetivos: A pandemia da doença coronavírus (COVID-19) origina-se de um vírus capaz de causar síndrome respiratória aguda grave (SARS). A compreensão dessa nova doença exige dados epidemiológicos. Determinar o perfil epidemiológico de pacientes com SARS e COVID-19 confirmados em um complexo hospitalar público. **Métodos:** Estudo transversal de três meses em um complexo hospitalar público de Curitiba (PR, Brasil). Foram incluídos pacientes testados com SARS usando swab nasofaríngeo para diagnóstico laboratorial COVID-19. Foram analisadas faixas etárias (por

quartis), sexo, encaminhamento, cidade de origem, internação e evolução (alta ou óbito). Um alfa de 5% foi considerado estatisticamente significativo. **Resultados:** 741 pacientes com SARS foram incluídos. A faixa etária predominante foi de 37 a 50 anos (26,6%), 57,1% do sexo feminino, 57,9% encaminhados e 81,1% de Curitiba. A faixa etária predominante dos pacientes com COVID-19 confirmado foi de 51 a 66 anos. Homens e pacientes encaminhados tiveram maior risco de apresentar a doença, sendo a razão de prevalência (RP) 1,38 (1,05-1,81 / intervalo de confiança (IC) de 95%) e RP 2,11 (1,51-2,93 / IC 95%) vezes, respectivamente. A faixa etária prevalente em pacientes hospitalizados com COVID-19 foi de 54 a 67 anos. Homens e pacientes encaminhados apresentaram maior risco de internação, sendo RP 1,18 (IC 95% = 1,04-1,33) e RP 2,17 (IC 95% = 1,54-3,04) vezes, respectivamente. A faixa etária predominante dos pacientes confirmados com alta hospitalar foi de 17 a 41 anos e dos que morreram foi de 68 a 96 anos. **Discussão:** COVID-19 é mais prevalente em idosos, homens e pacientes encaminhados. Esse perfil também está associado a maior risco de hospitalização. A faixa etária está associada à evolução.

Palavras-Chave: *Síndrome respiratória aguda grave coronavírus 2; Doenças virais; Unidades de terapia intensiva; Estatísticas epidemiológicas.*

RESUMEN

Antecedentes y Objetivos: La enfermedad pandémica del coronavirus (COVID-19) se origina a partir de un virus capaz de provocar el síndrome respiratorio agudo severo (SARS). Comprender esta nueva enfermedad requiere datos epidemiológicos. Determinar el perfil epidemiológico de pacientes con SARS y COVID-19 confirmados en un complejo hospitalario público. **Métodos:** Estudio transversal de tres meses en un complejo hospitalario público de Curitiba (PR, Brasil). Se incluyeron pacientes sometidos a pruebas de detección del SRAS con un hisopo nasofaríngeo para el diagnóstico de laboratorio COVID-19. Se analizaron grupos de edad (por cuartiles), sexo, derivación, ciudad de origen, hospitalización y evolución (alta o muerte). Un alfa del 5% se consideró estadísticamente significativo. **Resultados:** Se incluyeron 741 pacientes con SARS. El grupo de edad predominante fue de 37 a 50 años (26,6%), 57,1% mujeres, 57,9% referidos y 81,1% de Curitiba. El rango de edad predominante de los pacientes con COVID-19 confirmado fue de 51 a 66 años. Los hombres y pacientes remitidos tenían un mayor riesgo de presentar la enfermedad, con la razón de prevalencia (RP) 1,38 (1,05-1,81 / intervalo de confianza (IC) del 95%) y RP 2,11 (1, 51-2,93 / 95% CI) veces, respectivamente. El grupo de edad prevalente en pacientes hospitalizados con COVID-19 fue de 54 a 67 años. Los hombres y los pacientes derivados tenían un mayor riesgo de hospitalización, con RP 1,18 (IC del 95% = 1,04-1,33) y RP 2,17 (IC del 95% = 1,54-3,04) veces, respectivamente. El grupo de edad predominante de pacientes confirmados con el alta hospitalaria fue de 17 a 41 años y los que fallecieron fueron de 68 a 96 años. **Discusión:** COVID-19 es más prevalente en ancianos, hombres y pacientes referidos. Este perfil también se asocia a un mayor riesgo de hospitalización. El grupo de edad está asociado a la evolución.

Palabras Clave: *Síndrome respiratorio agudo severo coronavirus 2; Enfermedades virales; Unidades de Terapia Intensiva; Estadísticas epidemiológicas.*

INTRODUCTION

Coronavirus disease (COVID-19) is the new disease from late 2019 and has its pathogen (severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) associated with SARS.[1] The symptomatology includes fatigue, fever, cough and dyspnea,[2] and in more severe cases it can be presented as SARS. Regarding SARS, it is defined by Brazil's Ministry of Health as a flu-like syndrome associated with dyspnea and respiratory distress or persistent pressure in the chest, or oxygen saturation below 95% in ambient air or bluish color of the lips or face. In children, in addition to the previous signs and symptoms, the observation of nose-wing beats, cyanosis, intercostal retractions, dehydration and loss of appetite is necessary.[3]

SARS-CoV-2 infection has become of great importance from the end of 2019 due to its high infectious degree, quickly becoming pandemic. In Brazil, the first confirmed case occurred on February 26, 2020. On June 7, it had 691,758 total cases and 35,930 deaths.[4] In parallel, the city of Curitiba, capital of the State of Paraná, during the 3 months evaluated in this study, evolved from zero official cases at the beginning of the study to a total of 1,312 infected and 57 deaths in the city at the end of the period.[5]

This disease has had a profound global impact, representing a serious threat to public health. It is believed that the last time the world witnessed a pandemic of this magnitude without access to a vaccine was in 1918-1919, with the Spanish flu.[6] In this context, studies that seek to analyze the epidemiological profile of the disease are essential for developing public health strategies to reduce the negative impact of the disease.

In a joint mission between China and the World Health Organization (WHO) on COVID-19, a variable lethality rate of 5.8% (Wuhan) to 0.7% in the rest of China was observed.[7] This variation in lethality also occurs between countries: in the middle of March, Italy had an estimated lethality of 7.2%, South Korea in the same period, had a rate of 0.9%.[8, 9] In addition, factors such as advanced age and clinical comorbidities seem to be able to aggravate the disease.[10]

In the American context, a study in New York City with 2,199 patients aimed to outline the profile of COVID-19 confirmed patients: the median age observed among all patients was 65 years; the median of patients who died was 75 years; and the majority of admitted patients were male (59%).[11] The data in relation to sex are in line with those obtained by Chinese cohorts, which demonstrated a greater severity disease in males.[12]

In Brazil, epidemiological studies on COVID-19 are scarce. Part of this deficiency is due to the fact that the epidemic arrived late when compared to other countries.

The present study aims to observe the epidemiological profile of suspected and confirmed COVID-19 patients, who sought care at a public hospital complex in Curitiba, which was considered a reference for the management of the disease in the capital of the State of Paraná.

METHODS

Ethical aspects

This research was approved by a local ethics committee, under protocol number 32149420.4.0000.5225 on May 28, 2020. All the research followed Helsinki declaration principles.

Study design

This cross-sectional and retrospective study was carried out in a public hospital complex of reference for the COVID-19 patients treatment in Curitiba, capital of the state of Paraná, in southern Brazil. The hospital complex consists of five units. At this time of pandemic, it contains a total of 74 intensive care unit (ICU) beds and 66 respiratory isolation beds, all specific for COVID-19, divided between three units.

The inclusion criteria were patients with SARS seen at

the hospital complex from March 7th to June 7th, 2020. For the SARS classification it was used oxygen saturation < 95% in ambient air; signs of respiratory distress or increased respiratory rate according to age; worsening of the clinical conditions of pre-existing disease; hypotension or signs and symptoms of shock: decreased tissue perfusion clinically evaluated, decreased diuresis, or diuresis less than 0.5 ml/kg/h, capillary filling > 3 seconds, skin pallor and altered level of consciousness; and individuals with acute respiratory failure during the pandemic. For the children, in addition to the previous items, nasal wing beats, cyanosis, intercostal retractions, clinically assessed dehydration and lack of appetite were also observed. All SARS patients became suspected of COVID-19 and therefore performed the nasopharyngeal swab collection for analysis using the real-time polymerase chain reaction (RT-PCR) technique, all processed by a single laboratory (LACEN, Curitiba (PR), Brazil). The exclusion criteria consisted of COVID-19 suspected patients who got hospital discharged before nasopharyngeal swab collection.

To determine whether immediate hospitalization was needed, the symptoms presented at the time of care were taken into account. The analysis consisted of observing the presence or not of the following signs: respiratory rate > 25 bpm, dyspnea, oxygen saturation in ambient air < 95%, respiratory distress and worsening of the clinical conditions of pre-existing disease. The signs evaluated for ICU admission were based on shock, vital organs dysfunction, respiratory failure and/or hemodynamic instability.

Data

The independent variables analyzed included age-range, sex, forwarding from another health service and city of origin. These data were obtained using a specific form filled-up on patient admittance was at hospital complex. The patient age was analyzed by age-ranges delimited by quartiles; the forwarding variable was dichotomized as “with forwarding”, covering patients who came from emergency care units, basic health units, mobile emergency care service or other hospitals, and “without forwarding”, comprising patients who seek care directly from their homes; the city of origin variable was dichotomized in Curitiba or Metropolitan area, which is composed by 29 cities.

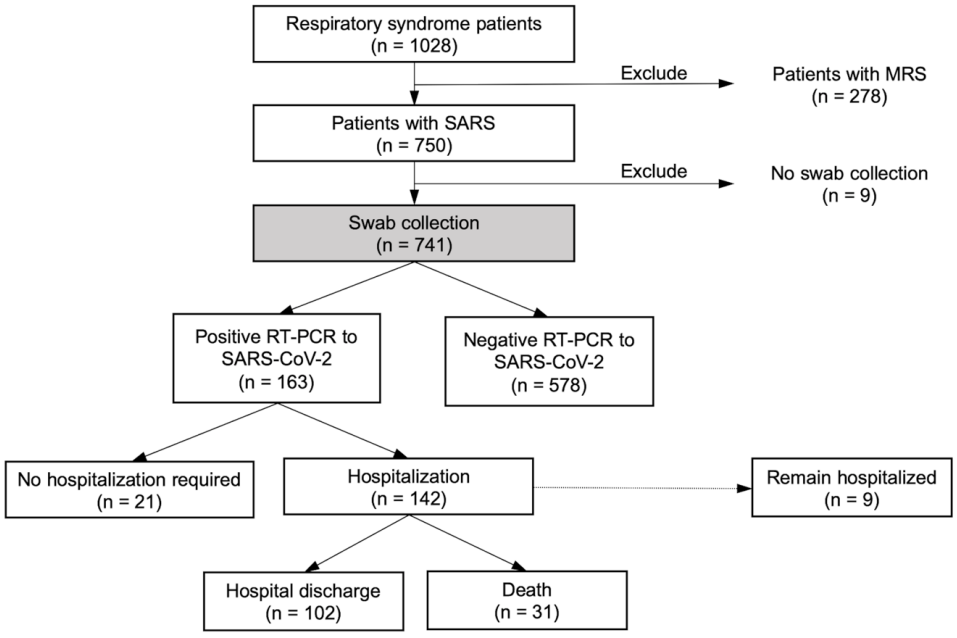
The independent variables were compared with the RT-PCR result (positive or negative), the need for hospitalization (yes or no) of the confirmed COVID-19 patients, and the outcome of the confirmed hospitalized patients (hospital discharge or death). In this manner, one main group and two subgroups were formed. The main group was composed by all patients included in the study, whereas the two subgroups were composed by confirmed-COVID-19 patients and confirmed-COVID-19 patients with an outcome (hospital discharge or death). It is worth to mention that the evolution of all patients who took part in this study was updated on June 30 in order to obtain a more complete picture of the clinical outcome of all patients included.

Statistical analysis

The computation of collected data was performed in a Microsoft Office Excel (2007, version 12.0 for PC) spreadsheet. The tests performed to compare the dependent variables with the independent variables were the Chi-Square test, Fisher's Exact test and Mann-Whitney U test. The IBM Statistical Package for the Social Sciences software (version 24.0; IBM SPSS, Chicago, United States of America) was used to perform those tests. An alpha of 5% was considered statistically significant ($P < 0.05$).

RESULTS

Altogether, 1,028 patients with respiratory conditions were treated at the hospital complex, of which 750 presented SARS and were suspected of COVID-19. Regarding the 750, 9 patients had no nasopharyngeal swab collection and were excluded from the study, resulting in 741 patients. Regarding the age of the patients included, the predominant age-range was 37 to 50 years (26.6%). As for sex, the sample was predominantly composed of women (57.1%). For the variables "forwarding" and "city of origin", 57.9% patients were forwarded to the hospital complex by other health units and 81.1% were from Curitiba, respectively. Regarding the RT-PCR result, 163 (22.0%) patients tested positive for COVID-19. The data referring to the study population as well as the positivity can be seen in figure 1.



MRS = mild respiratory syndrome; SARS = severe acute respiratory syndrome; RT-PCR = real-time polymerase chain reaction; SARS-CoV-2 = severe acute respiratory syndrome corona virus 2.

Figure 1. Flow diagram displaying exclusion criteria for the final study population and its evolution.

In relation to age, confirmed COVID-19 patients had a higher median age 53 (17 - 96) when compared to negatives [50 (1 - 96)] (P = 0.007) and the predominant age-range was 51 to 66 years (P = 0.020). Related to sex, men had PR 1.38 (1.05-1.81 / 95% CI) times the chance of presenting disease when compared to women (P = 0.019). With regards to forwarding, forwarded patients had PR 2.11 (1.51-2.93 / 95% CI) times the chance of presenting the disease when compared to patients without forwarding (P < 0.001). There was no statistically significant difference between origin and positivity (P = 0.442). Full data can be viewed in table 1.

With respect to age of positive patients who required hospitalization, it was observed that the predominant age-range was 54 to 67 years (P = 0.001). Regarding to sex, it was observed that the risk of men requiring hospitalization was PR 1.18 (1.04-1.33 / 95% CI) times when compared to women risk (P = 0.010). In relation to forwarding, it was observed that the forwarded patients had a greater risk [PR 2.17 (1.54-3.04 / 95% CI)] requiring hospitalization (P < 0.001). No statistically significant difference was found between origin and hospitalization (P = 0.569).

Among the 142 patients who required hospitalization, 102 (71.8%) evolved to hospital discharge and 31 (21.8%) to death. Nine patients (6.4%) were still hospitalized and therefore excluded from these analyzes. It was observed that the predominant age-range of confirmed patients who got hospital discharge was 17 to 41 years old (P = 0.001). There was no statistically significant difference between sex, forwarding and city of origin (P > 0.05). In the group of patients who evolved to death it was observed that the predominant age-range was 68 to 96 years (P = 0.001). There was no statistically significant difference between sex, forwarding and origin city (P > 0.05). Table 2 shows the results mentioned above.

Table 1. Distribution of patients with positive and negative results for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) according to age, sex, forwarding and city of origin.

	RT-PCR result		Total	P value	PR (95% CI)
	Positive	Negative			
Median age (min. - max.)	53 (17-96)	50 (1-96)		0.007+	-
	N (%)	N (%)	N (%)		
Age range					
1-36 years	28 (14.7)	163 (85.3)	191 (100.0)	0.020*	-
37-50 years	43 (21.8)	154 (78.2)	197 (100.0)		
51-66 years	50 (27.5)	132 (72.5)	182 (100.0)		
67-96 years	42 (24.6)	129 (75.4)	171 (100.0)		
Sex					
Male	83 (26.1)	235 (73.9)	318 (100.0)	0.019*	1.38 (1.05-1.81)
Female	80 (18.9)	343 (81.1)	423(100.0)		
Forwarding ¥					
Yes	113 (27.4)	300 (72.6)	413 (100.0)	< 0.001 *	2.11 (1.51-2.93)
No	39 (13.0)	261 (87.0)	300 (100.0)		
City of origin €					
Curitiba	124 (21.6)	451 (78.4)	575 (100.0)	0.442 *	0.88 (0.63-1.22)
Metropolitan area	33 (24.6)	101 (75.4)	134 (100.0)		

**Chi-square test; +Mann-Whitney U test; min. = minimum; max. = maximum; RT-PCR = real-time polymerase chain reaction; PR = prevalence ratio; CI = confidence interval; ¥ 28 missing data; € 32 missing data; Bold means statistically significant difference.*

Table 2. Distribution of COVID-19 confirmed patients according to hospitalization and evolution regarding age range, sex, forwarding and city of origin.

	Hospitalization		P value	PR (95% CI)	Evolution		P value	PR (95% CI)
	Yes N (%)	No N (%)			Discharge N (%)	Death N (%)		
Age range								
17-41 years	31 (70.5)	13 (29.5)	0.001*	-	29 (93.5)	2 (6.5)	0.001*	-
42-53 years	33 (86.8)	5 (13.2)			28 (87.5)	4 (12.5)		
54-67 years	44 (93.6)	3 (6.4)			30 (73.2)	11 (26.8)		
68-96 years	34 (100.0)	0 (0.0)			15 (51.7)	14 (48.3)		
Sex								
Male	78 (94.0)	5 (6.0)	0.010#	1.18 (1.04-1.33)	57 (78.1)	16 (21.9)	0.676*	1.04 (0.86-1.26)
Female	64 (80.0)	16 (20.0)			45 (75.0)	15 (25.0)		
Forwarding ¥, €								
Yes	113 (100.0)	0 (0.0)	<0.001#	2.17 (1.54-3.04)	79 (76.0)	25 (24.0)	0.357#	0.86 (0.70-1.04)
No	18 (46.2)	21 (53.8)			16 (88.9)	2 (11.1)		
City of origin £, ¢								
Curitiba	106 (85.5)	18 (14.5)	0.569#	0.94 (0.83-1.07)	76 (77.6)	22 (22.4)	0.547*	0.94 (0.77-1.14)
Metropolitan area	30 (90.9)	3 (9.1)			24 (82.8)	5 (17.2)		

**Chi-square test; # Fisher's exact test; PR = prevalence ratio; CI = confidence interval; ¥ Eleven missing data in hospitalization analysis; € Nine missing data in in evolution analysis; £ Six missing data in hospitalization analysis; ¢ Six missing data in evolution analysis; Bold means statistically significant difference.*

DISCUSSION

In the present study, we observed a predominance of females in SARS patients, which is similar to other studies.[13] A possible explanation for this distribution stems from the fact that women seek more health care than men.[14] This trend seems to be influenced by socio-cultural,[15] psychological and some biological factors.[26] In this same group, most patients sought care through forwarding. This result is somewhat expected, given the characteristic of the health system in which the hospital complex is inserted, which is stratified into levels of complexity and integrated. The reason (forwarded/total patients) found can serve as a measure of comparison with those of other systems or with other regions, in order to measure the efficiency of this type of logistics in the pandemic midst.[17]

Regarding the confirmed COVID-19 patients rate found, there is a possibility of comparison with some studies. In a study by Xiao et al., with 1,113 tested, 27% were positive,[18] a value close to what we found. In another study with 4,880 patients, 38% were positive,[19] this difference in relation to our measurement may result from the selection of suspected COVID-19 patients: close contact with confirmed patients was also used as a criteria for suspicion by Liu et al. The addition of criteria for testing may be responsible for the increase in positivity, as can be seen in the article by Ai et al,[13] in which they obtained 59% positives. In this last study, besides the clinical criteria, it was included as suspects, patients who had computed tomography changed signs. That said, it is very likely that if in our study the swab collection was also done in patients with mild conditions, we would obtain more confirmed cases, but less positivity.

We also found an association between age groups and positive patients, besides watching a higher median age in these patients compared to negative patients. A possible explanation for this result was exposed by Liu et al,[19] in which it was observed that the elderly have a higher risk for SARS-CoV-2 infection. The reason why this happens is not yet consolidated and further studies are needed, but may have relation to immunological disorders or to a higher notification in older people for presenting more symptoms. Comparing our data with another study in Brazilian population, we noticed a difference in the predominant age group of patients with COVID-19.[20] In the study by Cunha et al, carried out in Brazil's Northern region (Macapá, AP), the prevalent age range was 30 to 39 years. This difference can be explained by the methodological choice of the age group division, and by the regional differences between the study locations, mainly in relation to the age distribution in the cities of both studies.[21]

Our study showed that men are more likely to have COVID-19. This may be explained because Brazil's economically active population is mostly male,[14] thus, work outside and the moving need may have favored the SARS-CoV-2 transmission. Another probable factor, highlighted by Brazil's Surveillance of Risk and Protection Factors for Chronic Diseases by Telephone Survey,[22] is that men follow less social isolation and recommended prevention practices to COVID-19 when compared to women, therefore, they would possibly be more infected.

It was found that patients forwarded from other health levels are more likely to have the disease, as well as a greater chance of requiring hospitalization. In general, patients with severe forms of the disease are more likely to require hospitalization. In Brazil, despite the fact that hospitals attend the population that seeks hospital care directly, there is a health system that values the levels of care.[23] Primary care for public health in Brazil is provided by the Basic Health Units, while secondary care is provided by the emergency care units. These lower levels are responsible for evaluating and resolving mild cases and for forwarding moderate and severe cases to hospitals (tertiary care).[23] This must have been one of the main reasons why forwarded patients had a greater chance of presenting COVID-19 and requiring hospitalization, since they had a previous evaluation.

The predominant age group of confirmed hospitalized COVID-19 patients was practically the same as the confirmed patients. However, it was observed that the older the quartile of positives, the higher the percentage of hospitalized patients, reaching 100% in the range of 68 to 96 years. This information is in agreement with the study in Wuhan, in which it was reported that older patients are more likely to be victims of a more serious condition.[2] This may be due to the higher prevalence of comorbidities and physical inactivity in this age group.[24]

Culturally, unlike women, most Brazilian men seek help only for more serious health conditions, resulting in a worse clinical picture when they enter health care. This may explain the greater risk that men have to require hospitalization. In addition to the socio-cultural aspect, there are also differences in the biological spectrum, since women have better immune response to infections when compared to men, this divergence is probably related to the difference in sex hormones, since they influence the development of the immune system.[16]

In our study, of 163 confirmed cases, there were a total of 31 deaths, comparing this value with Macapá's research,[20] in which 37 deaths were found in a total of 1,560 patients, we observed a considerable difference, possibly due to the testing process and patients included in the analysis. In the comparison between age groups and hospital evolution, we found a prevalence of younger ages evolving to discharge and older ages evolving to death. This result is in line with those of some other studies,[11] in which older ages had greater severity of the disease.

In the present study there were some limitations like absence of data per capita income, presence of nine patients without outcome and the lack of testing of mild respiratory symptoms patients – due to the collection protocol at the hospital complex prioritizing moderate and severe conditions. Finally, there were missing data in some statistical analysis that fortunately did not limit our results.

Epidemiology is fundamental in the current pandemic of COVID-19 context. The disease is characterized by a clinical respiratory syndrome with varied symptoms, including fatigue, fever, cough and dyspnea,[2] which can progress to SARS in severe cases.[3] The pandemic in Brazil is characterized by adoption of uncoordinated public measures to combat COVID-19, low testing coverage,[4] intense underreporting and profound social inequality for access to health.[25] Therefore, epidemiological information on COVID-19 improves strategies accuracy to deal with the pandemic.

In conclusion, in the present study it was verified that COVID-19 is more prevalent in older patients, in men and in forwarded patients. This epidemiological profile is also associated with a higher risk of hospitalization in COVID-19 confirmed patients. Age is associated with hospital discharge and death. To increase the strength of evidence, further studies with larger samples would be interesting to confirm our results.

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