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Severe acute respiratory syndrome in indigenous people in the context of the COVID-19's pandemic in Brazil: an analysis from the perspective of epidemiological surveillance

Síndrome respiratória aguda grave em indígenas no contexto da pandemia da COVID-19 no Brasil: uma análise sob a perspectiva da vigilância epidemiológica

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ABSTRACT

Introduction: Indigenous populations are more vulnerable to respiratory infections and face situations that can worsen the evolution and prognosis of COVID-19. In this context, identifying the groups exposed to the greatest risk and proposing strategies for prediction, prevention and control are the premises of Epidemiological Surveillance. **Objective:** To analyze the impact of COVID-19's pandemic on the Brazilian indigenous population considering hospitalizations for Severe Acute Respiratory Syndrome (SARS). **Method:** Epidemiological, descriptive and quantitative study of SARS cases in self-declared indigenous patients notified to the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe) of the Health Surveillance Secretary of the Ministry of Health (SVS/MS) of Brazil, from 01/01 to 16/06 of 2017, 2018, 2019 and 2020. **Results:** The total number of SARS cases was 688, with 318 confirmed for COVID-19. Of the patients with SARS, 237 evolved with discharge and 211 with death. For COVID-19, 81 evolved with discharge and 155 with death. Cases and deaths by SARS and COVID-19 were predominated in males. The cases and deaths were predominant among children under 1 year old and among those over 50 years old. For SARS, rural cases and deaths predominated and, for COVID-19, the urban ones. There was a predominance of cases of SARS and COVID-19 in the states of Amazonas, São Paulo and Pará. Deaths predominated in the states of Amazonas, Pará and Roraima. **Conclusions:** The populations are subjected to situations of greater vulnerability during the pandemic, representing a risk to their health and their cultural heritage. More research and effective epidemiological surveillance actions aimed at this population are essential.

KEYWORDS: COVID-19; Epidemiology; Pandemics; Health of Indigenous Peoples, Health Surveillance

RESUMO

Introdução: As populações indígenas são mais vulneráveis a infecções respiratórias e enfrentam situações que podem agravar a evolução e o prognóstico da COVID-19. Nesse contexto, identificar os grupos expostos a maior risco e propor estratégias de predição, prevenção e controle são as premissas da vigilância epidemiológica. **Objetivo:** Analisar o impacto da pandemia da COVID-19 na população indígena brasileira a partir das internações por síndrome respiratória aguda grave (SRAG). **Método:** Estudo epidemiológico, descritivo e quantitativo dos casos de SRAG em pacientes autodeclarados indígenas notificados ao Sistema de Informação de Vigilância Epidemiológica da Gripe (SIVEP-Gripe) da Secretaria de Vigilância em Saúde do Ministério da Saúde (SVS/MS) do Brasil, de 1º de janeiro a 16 de junho de 2017, 2018, 2019 e 2020. **Resultados:** O total de casos de SRAG foi de 688, com 318 confirmados para a COVID-19. Dos pacientes com a SRAG, 237 evoluíram com alta e 211 com óbito. Para a COVID-19, 81 evoluíram com alta e 155 com óbito. Casos e óbitos por SRAG e COVID-19 predominaram no sexo masculino. Houve pico de casos e óbitos entre os menores

de 1 ano e entre maiores de 50 anos. Para SRAG, predominaram casos e óbitos rurais e para COVID-19, urbanos. Houve predomínio de casos da SRAG e COVID-19 nos estados do Amazonas, São Paulo e Pará. Já os óbitos predominaram nos estados do Amazonas, Pará e Roraima. **Conclusões:** As populações ficam sujeitas a situações de maior vulnerabilidade durante a pandemia, constituindo risco para suas saúdes e para o seu patrimônio. Mais pesquisas e ações de vigilância epidemiológica efetivas voltadas para essa população se mostram essenciais.

PALAVRAS-CHAVE: COVID-19; Epidemiologia; Pandemia; Saúde Indígena, Vigilância em Saúde

INTRODUCTION

The COVID-19 pandemic has had serious consequences for health systems around the world, including in Brazil, especially among marginalized populations.[1] The initial focuses of transmission of COVID-19 in the country were the states of São Paulo (SP) and Rio de Janeiro (RJ), from where the disease quickly spread to other state capitals, and by the end of March 2020, most of them already had cases of the disease.[1] Months later, in late August, we notice that the Southeast region still stands out in number of cases and deaths of COVID-19.[2] However, despite this regional predominance of the southeast, the region of the Legal Amazon, which is home to many indigenous peoples and 24 Special Indigenous Health Districts (DSEIS), concentrate approximately 1/5 of the cases and deaths in the country.[3]

According to the 2010 demographic census,[4] 896,000 individuals declared themselves to be indigenous, of which approximately 64% lived in rural areas. Indigenous populations around the world are much more vulnerable to respiratory infections, which can evolve, as well as COVID-19, to severe acute respiratory syndrome (SARS), even outside epidemic periods. These infections are one of the main causes of morbidity and mortality among these individuals.[1] The Oswaldo Cruz Foundation[1] confirms that "different viruses, like measles, smallpox, and influenza, have led to major epidemics and even the extermination of some native peoples in Brazil".

Although some indigenous peoples are considered isolated, several of them are often in contact with urban areas and maintain economic and service bonds with these areas. This is particularly true in the state of Amazonas, which concentrates a substantial part of these indigenous populations and has, therefore, a high potential for spreading the virus among these individuals.[1,5] It should also be noted that the state of Amazonas was once the state with the second highest number of confirmed cases of COVID-19 and the highest number of deaths. It currently ranks ninth in confirmed cases and seventh in total deaths among other Brazilian states.[6]

According to the Brazilian Association of Public Health (ABRASCO), studies have confirmed worrisome situations of vulnerability that can worsen the evolution and prognosis of COVID-19 among indigenous peoples, like anemia, malnutrition, malaria, diabetes, and obesity.[7] Geography appears as another important aggravating factor, since these people often live in remote locations and have difficulty accessing the health system. Additionally, small towns usually have little or no availability of hospital facilities, specialized beds, and intensive care unit (ICU) beds, whereas in bigger cities the beds are subject to periods of overcrowding, as has already occurred in Manaus, for example.[5,7]

Furthermore, Brazil still has a low rate of population testing, so the numbers of cases and deaths may be underreported, thus failing to portray the real situation of the country,[1] although this can be perceived in other ways, like in the sharp increase in the number of deaths from SARS. SARS is one of the main complications of the virus and is monitored in Brazil by the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe) of the Health Surveillance Secretariat of the Ministry of Health (SVS/MS).[1]

In this context, it is emphasized that, according to the Health Surveillance Guide of 2019 from the Ministry of Health, during epidemics and outbreaks we should seek to identify the groups that are exposed to greater risks and risk factors and establish causal relationships to determine the main epidemiological characteristics of the disease, the conditions that affect its spread, and the health measures adopted to curtail it. Therefore, it is important to enforce effective Health Surveillance practices targeted at the indigenous population, from the production of technical information to the adoption of conducts for the prevention and control of COVID-19.[8,9]

Given the risk of underreported cases and deaths of COVID-19 and the different contexts of vulnerability to which indigenous peoples are exposed, in addition to situations of ethnic conflicts and prejudice that undermine the fight against the disease,[1] there is a clear need for better investigation of the impact of the pandemic on this population. Thus, the objective of the present study was to analyze the impact of the COVID-19 pandemic on the Brazilian indigenous population through the analysis of hospitalizations for SARS among these individuals.

METHOD

This was an epidemiological, descriptive, and quantitative study of SARS cases in self-declared indigenous patients reported to SIVEP-Gripe of SVS/Brazil's Ministry of Health. The periods from January 1 to June 16 of years 2017, 2018, 2019 and 2020 have been analyzed. Epidemiological data were accessed on the Integrated Health Surveillance Platform (IVIS) of the Ministry of Health,[10] which makes them available in an open spreadsheet format.

In 2020, Brazil had 211.755.692 inhabitants, with a demographic density of 24.88 inhabitants/km², according to population

estimates of the Brazilian Institute of Geography and Statistics (IBGE).[11] According to the 2010 census survey, 817,963 individuals declared themselves to be indigenous.[12]

In this study, we considered the cases that met the criteria for filling out the reporting form for SARS cases: individual hospitalized with fever, even if self-reported, accompanied by cough or sore throat and dyspnea or O_2 saturation < 95% or respiratory discomfort or who died of SARS regardless of hospitalization.[13]

The variables analyzed were: epidemiological week; state of the federation; sex [male; female; unknown]; age group; race/color of the patient [white; brown; black; indigenous; yellow; unknown]; residence area [urban, rural, peri-urban; unknown]; ICU admission [yes; no; unknown]; use of ventilatory support [yes; no; unknown]; final classification of the case [SARS of other etiologies; unspecified SARS; COVID-19]; outcome of the case [cure; death; unknown].

The analysis of all variables was performed using descriptive statistics, presented in gross numbers and frequency measures. The analysis of cases from 2017 to 2019 per epidemiological week (EW) was carried out using simple arithmetic means and measures of minimum (the lowest number among the three years for the EW) and maximum (the highest number among the three years for the EW). The incidence of SARS cases was calculated using the number of cases divided by the indigenous population in the 2010 census survey and multiplied by 100,000 inhabitants, and case lethality was calculated using the number of deaths divided by the number of cases and multiplied by 100. The software used for data analysis was Microsoft Office Excel 2016.

Nominal patient data or any other piece of data that enabled their identification were not accessed, since the research was carried out from a secondary database. Therefore, there was no need to submit it to the Research Ethics Committee (CEP), according to Resolution of the National Health Council n. 510, of April 7, 2016, for compliance with Brazilian ethical standards.

RESULTS

The total number of reported cases of SARS for the indigenous population was 688, with 318 (46.22%) confirmed for COVID-19, 354 (51.45%) unidentified, and another 16 diagnosed with another etiology. Of the patients with SARS, 237 (34.45%) progressed with discharge, 211 (30.67%) with death, and 240 (34.88%) had no identified evolution. The incidence of SARS was 84.11, whereas lethality was 30.66. For COVID-19, 81 (25.47%) progressed with discharge, 155 (48.74%) with death, and 82 (25.79%) with no identified evolution. The incidence was 38.87, whereas lethality was 48.74. Of the total deaths, 73.45% were due to COVID-19.

The number of cases and deaths due to SARS was higher for males. Regarding age groups, there was a surge of cases and deaths among children under 1 year old and another among those over 50 years old. As for location, there was a predominance of deaths among rural dwellers. For COVID-19, the male gender also predominated both in cases and in deaths. As for age groups, there were also two surges of cases and deaths, the first among those under 1 year old and the second among those over 60 years old. For location, urban cases and deaths predominated (Table 1).

Table 1. Gross and relative frequency of cases and deaths from SARS and SARS with COVID-19 among indigenous people, according to sex, age group, and area of residence, from January 1, 2020, to June 16, 2020, Brazil.

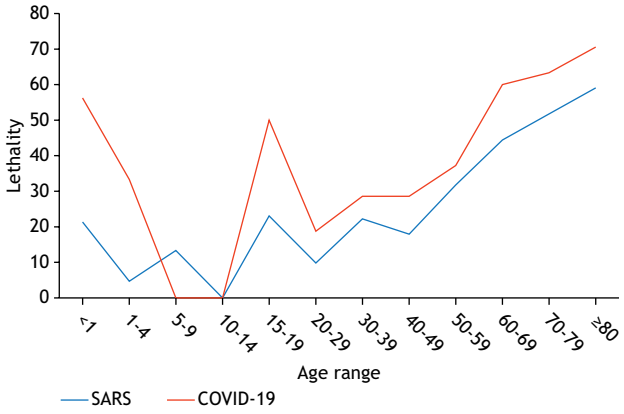
	Cases		Deaths	
	N	%	N	%
SARS				
Sex				
Male	399	57.99%	138	65.40%
Female	289	42.01%	73	34.60%
Age range				
< 1	75	10.90%	16	7.58%
1-4	64	9.30%	3	1.42%
5-9	15	2.18%	2	0.95%
10-14	6	0.87%	0	0.00%
15-19	26	3.78%	6	2.84%
20-29	51	7.41%	5	2.37%
30-39	54	7.85%	12	5.69%
40-49	67	9.74%	12	5.69%
50-59	85	12.35%	27	12.80%
60-69	72	10.47%	32	15.17%
70-79	85	12.35%	44	20.85%
≥ 80	88	12.79%	52	24.64%
Area of residence				
Urban	309	44.91%	92	43.60%
Rural	325	47.24%	95	45.02%
Periurban	8	1.16%	2	0.95%
Unknown	46	6.69%	22	10.43%
SARS with COVID-19				
Sex				
Male	195	61.32%	107	69.03%
Female	123	38.68%	48	30.97%
Age range				
< 1	16	5.03%	9	5.81%
1-4	6	1.89%	2	1.29%
5-9	3	0.94%	0	0.00%
10-14	1	0.31%	0	0.00%
15-19	6	1.89%	3	1.94%
20-29	16	5.03%	3	1.94%
30-39	21	6.60%	6	3.87%
40-49	42	13.21%	12	7.74%
50-59	51	16.04%	19	12.26%
60-69	45	14.15%	27	17.42%
70-79	60	18.87%	38	24.52%
≥ 80	51	16.04%	36	23.23%
Area of residence				
Urban	166	52.20%	73	47.10%
Rural	122	38.36%	65	41.94%
Periurban	3	0.94%	2	1.29%
Unknown	27	8.49%	15	9.68%

Source: Data from SIVEP-Gripe of SVS/Brazilian Ministry of Health, 2020.
SARS: Severe acute respiratory syndrome.

Lethality for both conditions surged in the first year of life and showed a correlation with aging (Figure 1).

For Brazilian states, there was a predominance of cases of SARS and COVID-19 among indigenous people in the states of Amazonas, São Paulo and Pará (Figure 2). Deaths predominated in the states of Amazonas, Pará and Roraima.

For SARS, compared with 2019, in 2020 there was an increase of 160.60% in cases and 744.00% of deaths. While lethality in 2019 was 9.4, in the following year it was 30.66, which means an increase of 226.17%. For patients who required admission to the ICU, there was an increase of 162.74% in relation to the previous year and, for ventilatory support, 133.33% (Figure 3).



Source: Data from SIVEP-Gripe of SVS/Brazilian Ministry of Health, 2020.

Figure 1. Lethality according to the age group in cases of severe acute respiratory syndrome (SARS) and SARS with COVID-19 among indigenous people, from January 1, 2020, to June 16, 2020, Brazil.

Of the total number of patients who required ICU admission in 2020, 43.28% were confirmed for COVID-19. Considering the need for ventilatory support, the percentage for this disease corresponded to 46.64%.

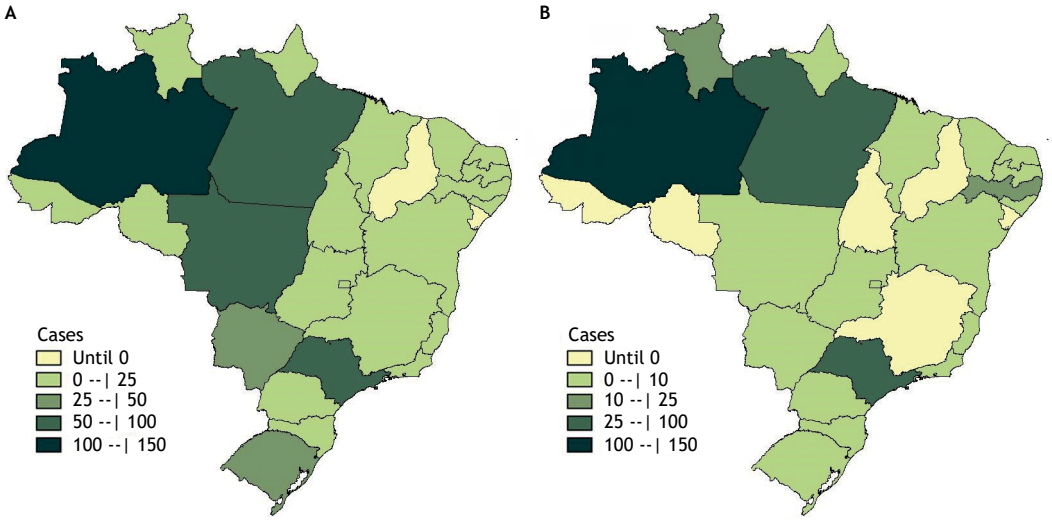
As of EW 13, the cases of SARS were significantly higher than in previous years, accompanied by the increase in cases of COVID-19. Compared to previous years, cases of SARS not confirmed for COVID-19 also exceed the average (Figure 4).

DISCUSSION

An analysis of the total number of cases in the Brazilian population reveals that there were 291,130 cases of SARS in 2020, with 67,618 deaths. Of these cases, 117,432 were positive for COVID-19, with 14,275 deaths, which represents a significant increase in the number of cases and deaths by SARS, accompanied by COVID-19 cases and deaths, when compared with previous years. It is interesting to note (Figure 4) that SARS cases, including those not confirmed for COVID-19, also had a clear increase among indigenous people.

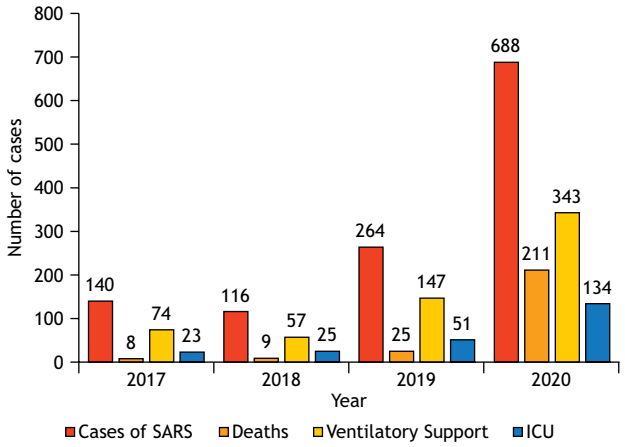
As explained by França et al.,[14] the basic cause of death (BC), defined as the circumstance of the accident or illness that started the chain of events that led to death, may be different in the current context of the COVID-19 pandemic, including SARS and pneumonia, as initially characterized in cases in China, and respiratory failure, with a recent increase in these pathologies reported as the cause of death in several Brazilian state capitals.[14,15,16]

In the context of the current pandemic of COVID-19, particularly in Brazilian state capitals, one can notice the increase in the records of pathologies like SARS, pneumonia, and



Source: Prepared by the authors based on data from SIVEP-Gripe of SVS/Brazilian Ministry of Health, 2020.

Figure 2. A: Number of reported cases of severe acute respiratory syndrome (SARS) per state to the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe) of the Ministry of Health's Health Surveillance Secretariat (SVS/Ministry of Health) among indigenous people. B: Number of reported cases of SARS with COVID-19 per state to SIVEP-Gripe of SVS/Ministry of Health among indigenous people. Period from January 1, 2020, to June 16, 2020.



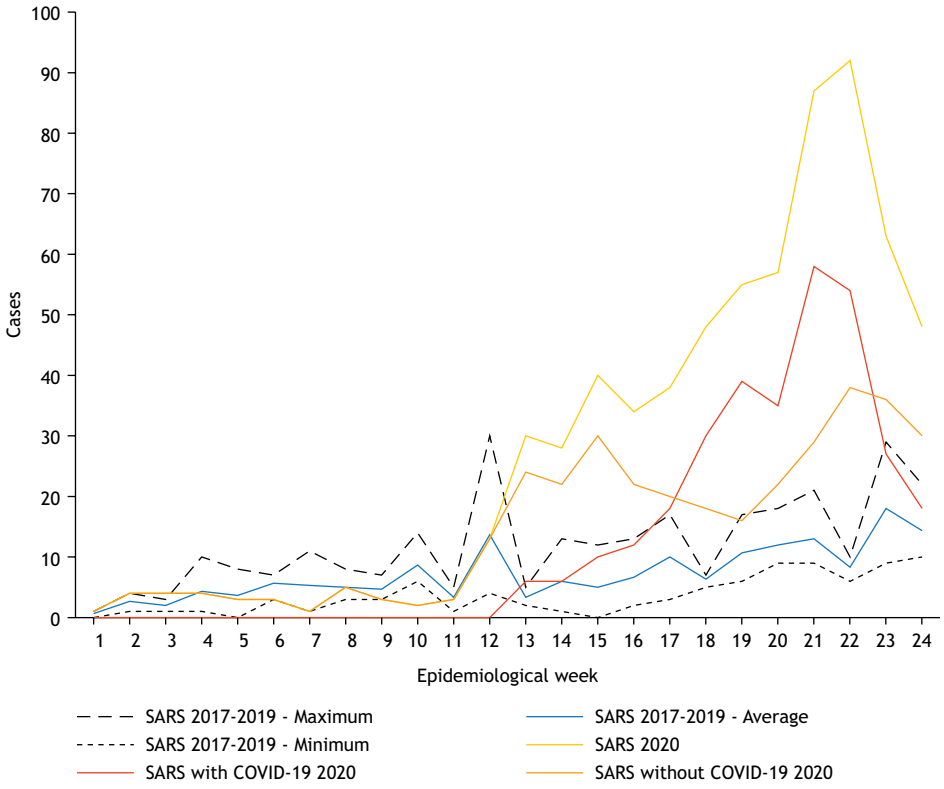
Source: Data from SIVEP-Gripe of SVS/Brazilian Ministry of Health, 2020.

Figure 3. Total number of cases of severe acute respiratory syndrome (SARS) in indigenous people and, among these, number of individuals who received ventilatory support, were admitted to intensive care units (ICU) and/or died, from January 1 to June 16, 2017, 2018, 2019, and 2020.

respiratory failure as the basic causes of death in death certificates.[14,15,16] Studies carried out by Alves et al.[15] and Bastos et al.[16] suggested the possibility of COVID-19 underreporting in the country and that some cases could have been reported in other ways, including SARS, without laboratory testing for COVID-19, which can be seen in the significant increase in the number of cases and deaths of patients with this syndrome in 2020 when compared with previous years, even after exclusion of cases identified with the SARS-CoV-2 virus. In Brazil, the increase in the number of deaths due to SARS is driven by the precarious working conditions in urgencies and emergencies, poor completion of death certificates, and little or nonexistent medical assistance during terminal illnesses.[14] Thus, the cases and deaths declared as having other causes may affect our concrete knowledge of the incidence and mortality by COVID-19, both in the Brazilian context and in the particular context of the indigenous population.

In 2020, in the indigenous population there were 688 cases of SARS, with 46.22% of these confirmed for COVID-19. The indigenous people who acquired SARS-CoV-2 died in 48.74% of the cases, which represents a lethality of 48.74 with an incidence of 38.87, versus a lethality of 23.23 and an incidence of 138.53 in the total Brazilian population.[10]

For decades and in the recent past, indigenous populations have been devastated by infectious diseases like measles, against which they could have been previously immunized.[17] COVID-19 is a new challenge to the whole world,[7,17] but these individuals remain even more vulnerable to the situation, since they are subject to other factors, such as the inequity of medical factors, social and environmental factors, high prevalence of



Source: Data from SIVEP-Gripe of SVS/Brazilian Ministry of Health, 2020.

Figure 4. Total cases of severe acute respiratory syndrome (SARS) among indigenous people and measures of average, minimum and maximum according to the epidemiological week, from the 1st to the 24th week, for 2017-2019, and including COVID-19, 2020.

tuberculosis and malaria, poor access to drinking water, insufficient or non-recognized lands, food insecurity, poor housing, and even the presence of illegal gold miners and evangelical missionaries who act as vectors of disease transmission.[7,17,18] These populations also have lower income and lower levels of education, in addition to suffering from systemic racism and historical discrimination.[19]

The region of the Legal Amazon, which includes the states of Amazonas, Pará and Roraima and is home to a large number of indigenous peoples, has a higher proportion of alternative sources of water and less access to electricity and bathrooms or toilets. Local populations often have to rely on natural resources and are also more isolated than in the rest of the country, which could have been a protective factor.[1] On the other hand, less access to electricity, goods and services, remoteness, and worse communication conditions may lead to the late identification and assistance to patients.[1,18]

It is interesting to note that the Legal Amazon has Brazil's largest proportion of rural indigenous population in municipalities with a high probability of epidemics.[1] It is noteworthy that Amazonas and Pará, until August 28, 2020, were among the ten states with the highest number of cases of COVID-19: Amazonas ranked 8th, with 148,923 cases, and Pará ranked 6th, with 196,874 infected people.[6]

Furthermore, in the Amazon region, with its substantial indigenous population, there are fewer cities with hospitals equipped with ICUs, which are usually already occupied, and a consequently a smaller number of beds and ventilators.[5,17,18,20] Additionally, a quarter of the region's population live in rural locations, including indigenous people, with the lowest human development index in the country.[5] The North and Northeast regions of Brazil, in the epidemiological reports provided by the Special Secretariat for Indigenous Health (SESAI), presented the highest growth rate and the shortest doubling time (time necessary for the disease to double its number of cases) of COVID-19, which ratifies the social and economic inequities of these areas.[21]

There was a considerable number of cases and deaths among indigenous people due to SARS also in the state of São Paulo, in the Southeast region, where there is widespread access to electricity, water from wells or public supply, and a higher proportion of use of bathrooms or septic tanks. These factors can contribute to the greater proximity of indigenous people to urban areas and, despite purportedly better living conditions, they also increase the risk of disease transmission.[1] São Paulo, until August 28, 2020, was the state with the highest number of cases. The state is also home to the Jaraguá indigenous land (IL), which has the highest vulnerability index in the country, because, in addition to social marginalization and territorial confinement, 18% of its population is over 60.[6,18] It is important to note that the disappearance of the elderly population in indigenous communities, whether by COVID-19 or by any other conditions related to severe social, geographical, and economic vulnerability, has irreversible consequences for indigenous cultural integrity.[18]

The inflow of indigenous people to regional centers that concentrate services and commerce and where the frequency of cases may be greater increases the vulnerability of this population,[1] since access to basic services is usually more available in urban areas, albeit insufficiently to meet all the demand.[5] Rural residents come into contact with at least one infected person (IP) when visiting a city. This variable has been created to demonstrate the importance of the inflow of indigenous people to cities during the pandemic. The IP concept was created to explain the process of spreading the disease in the municipalities of inland Amazonas through the application of different scenarios of social distancing and the flow of people. It was found that social distancing, number of visits to cities, and the duration of these visits are preponderant factor in the infection of visitors.[5]

The emergency financial aid recently given by the Brazilian government, of BRL 600 per person per month and covering several indigenous communities, can only be withdrawn in cities, which forces indigenous peoples to leave their villages and be potentially infected in urban centers.[17] Brazil's National Indian Foundation (Funai) has even launched a booklet advising the indigenous population not to leave their villages unnecessarily.[22] A study by Ramalho et al.[5] has shown that the places where the aid and supplies can be withdrawn, as well as grocery stores and banks, are places of people gathering, despite local measures of social distancing. In addition, a mathematical model has shown that residents or non-residents of IL close to cities like Manaus, Fortaleza, Salvador, Boa Vista, Belém, and the capitals of the South and Southeast, including São Paulo and Belo Horizonte, were more likely to spread the disease,[1] since these cities rank among the 20 Brazilian cities with the highest number of cases.[6] This is also consistent with the geographic distribution of cases and deaths by SARS among indigenous people in the South obtained in this study.

As for the area of residence of the affected individuals, SARS presented 2.33% and 1.42% more cases and deaths, respectively, in rural areas, which does not represent a statistically significant difference, whereas for COVID-19, urban cases and deaths predominated by 13.83% and 5.16% (Table 1). The number of urban cases and deaths by COVID-19 can be explained by the greater viral transmission in these areas, since SARS-CoV-2 is transmitted from person to person through droplets, as well as through fomites,[23] which are much more common in urban environments. It is worth remembering that cities also have higher population density, greater trade, services and people,[1] as well as greater collection of biological material for testing. This reinforces the predominance of urban cases and deaths by COVID-19, whereas rural residents are more subject to the generic diagnosis of SARS.

The results have shown that, in relation to age groups, there was a surge of cases and deaths due to SARS among children under 1 year old and another among patients over 50 years old. For COVID-19, the surges occurred in children under 1 year old and adults over 60 years old (Table 1).

Infection with SARS-CoV-2 has a higher proportion of severe cases in people over 55 or 60 years old,[23,24,25] which is in line with the results found. In addition, more severe cases are also related to chronic cardiovascular and cerebrovascular comorbidities.[23,24] Controversially, fewer cases have been found in children under 15 years of age, with symptoms that are generally milder and good prognosis, even in the presence of pulmonary opacity in radiology exams.[23,24,26] The literature shows that COVID-19 has mortality and severity similar to SARS in pediatric patients and that children of all ages can be infected with SARS-CoV-2, but are less affected.[26] There is, of course, the possibility of underreporting in this age group precisely because the symptoms are milder, so parents and guardians do not seek medical help, and there are also the already listed factors of poorer communication and identification of cases among indigenous people.[23]

In pediatric patients, the main form of infection is through contact with infected family members.[26] This is a preponderant factor in indigenous communities, where households tend to have a high number of members.[7] Within the pediatric age group, studies have shown that the rate of hospitalization in intensive care was about 4%, with 80% of those under 1 year of age,[26] which corroborates the results found. However, this does not ratify the surge of lethality, which raises the hypothesis that the increase in cases in the age group under 1 year is due, in addition to the current underreporting, to the aforementioned social, economic, and geographical vulnerabilities. Additionally, the correlation between age and lethality found in the indigenous population follows the trend in the literature, with an increase in the risk of mortality over the age groups, with the greatest risk found in those over 85.[23,24]

The difference observed both in SARS, with 57.99% of male cases, and in COVID-19, with 61.32%, in terms of difference between sexes, is in line with the scientific literature, where men tend to be more infected, have more severe forms of COVID-19 and, consequently, evolve more often to death. This characterizes the male gender as a risk factor for both incidence and mortality in the context of SARS-CoV-2 infection.[25,27]

There are contradictions in the literature in defining the exact pathophysiology and the role of the main factors involved in the epidemiological difference between sexes. However, angiotensin-converting enzyme 2 (ECA2) receptors, which participate in the renin-angiotensin-aldosterone system, play an important role, since they are the tool used by the virus to enter host cells, and this is influenced by sex hormones.[24,25,27,28,29] In addition, women have better immune response recognition and modulation than men.[25] In the context of COVID-19, differences in gender, norms, roles, attributions, and cultural and social behaviors are also involved. Men usually have higher rates of comorbidities, more risky behaviors, including smoking and drinking, and are less compliant with measures to prevent viral transmission, such as handwashing, social distancing, and other socioeconomic variables.[25]

The interesting thing is that the hypothesis related to ACE2 receptors is also valid and helps explain the higher mortality related to older age: elderly people would have a different expression of ACE2 and, therefore, greater associated lethality.[29] We cannot forget, of course, that the elderly are epidemiologically the greatest carriers of chronic diseases,[30] which also helps explain the greater lethality in this age group, especially when there are cardiovascular pathologies, usually associated with a worse prognosis.[25]

The National Contingency Plan for Human Infection by SARS-CoV-2 in Indigenous Peoples takes into account the particularities of indigenous healthcare and proposes measures like strengthening the detection, reporting, and monitoring of suspected cases, prevention and infection control initiatives, pharmaceutical assistance for the distribution and strategic stocking of medicines, and laboratory support with the guarantee of diagnostic workflows for different levels of response: alert, imminent danger, and emergency in public health.[31]

We can relate the national contingency plan to the epidemiological reports made available by SESAI through the variables of effective reproduction number (Re), growth rate, and doubling time.[21] The number of Re can be explained as the number of secondary cases generated by a primary case, with values > 1 indicating that there is active transmission.[32] The growth rate represents the increase in cases per day, and the doubling time is the number of days that the current series of cases takes to double in indigenous communities.[32]

Over the analyzed period, epidemiological reports have shown a decrease in Re, with 1.43 in the report of EW 24, the first report with this variable, and 1.33 in the report of EW 30, with a minimum of 1.29 in the report. of the 26th EW.[21] Thus, all figures indicate active transmission of COVID-19 in Special Indigenous Health Districts (DSEI). In addition, the growth rate went from 5.3 cases/day to 6.3, and the doubling time went from 13 to 11 days from EW 28 to EW 30,[21] which indicates that COVID-19 grows at a faster pace and doubles the number of cases in less time. These data confirm the growth of the disease, despite the national contingency plan, which raises the hypothesis of inefficient enforcement of this plan.

It is noteworthy that, in the epidemiological bulletin of June 16, 2020, by SESAI,[21] there were only 103 deaths from COVID-19 among indigenous people, while in the data presented in this manuscript, with analysis until the same date, there were 155 confirmed deaths of patients with SARS and COVID-19, 52 more than what was informed on the bulletin and a number that was surpassed by the bulletins only on June 30, after 14 days. The arrival of the new virus has challenged Brazil's surveillance structure and its ability to detect and respond early.[33] With frequent shortages of kits for detection and trained personnel, Brazil suffers from delays in the release of test results, overworked reference laboratories and, finally, late reporting.[33] In many locations in the country, paper reporting forms are still used, which not only delays the entry of data into the systems, but also leads to the entry of incorrect data that could be

automatically corrected if such forms were filled out directly in electronic forms.[33] The substantial difference between the number of deaths informed by different government reports reveals the need to restructure the way diseases are reported in the country. According to the Health Surveillance Guide (2019) of the Ministry of Health, effective Health Surveillance during a pandemic must share data as early as possible,[9] especially because pandemics have become increasingly frequent.[33] According to the World Health Organization (WHO), nations must prepare in advance for the emergence of new pathogens and, to do that, it is essential to adopt systems that can report and share information more quickly and reliably.[33]

Finally, it is emphasized that the role of Health Surveillance during outbreaks and epidemics is to identify sources of infection and modes of transmission, to confirm the number of cases and deaths and laboratory diagnoses, as well as to determine the conditions related to the spread of diseases in groups exposed to greater risks or risk factors.[9] These findings reinforce the need for updated and reliable data to protect vulnerable indigenous populations and preserve their ways of life, since the main objective of the investigation of an epidemic is to identify ways to curtail it and prevent the occurrence of new cases.[9] In this sense, it is worth mentioning a relevant limitation of the analysis: the most recent population survey of indigenous peoples is the one published by the demographic census conducted in 2010, by the IBGE. This limits the analysis and effective monitoring of this population by Health Surveillance agencies, making it difficult to accurately measure the impact of the pandemic among these peoples.

It is clear that measures to mitigate the transmission of COVID-19 must therefore be proposed. However, it is vital that the heterogeneity and diversity of regional contexts of indigenous populations be considered, as well as their epidemiological profiles.[18,19] The control of access of people, albeit asymptomatic, to IL, the guarantee of access to health actions, adequate food, and the implementation of control and surveillance actions against the disease with indigenous leaders and organizations are solutions proposed in the literature.[7] Other relevant measures include avoiding crowding and physical contact, having more hospital beds and relocating ICU patients,[18] reducing the number and length of visits to urban centers and, finally, coordinating information on measures to be adopted by families in order to protect themselves from the virus,[15] including the necessary guidelines in case a family member becomes ill.[19]

CONCLUSIONS

The present study analyzed the impact of the COVID-19 pandemic on the Brazilian indigenous population during 2020 through the analysis of hospitalizations for SARS among these individuals. The analysis was performed using secondary data, subject to errors and bias in filling, as well as underreporting.

We identified a significant impact of cases and deaths from SARS and SARS with etiological diagnosis of COVID-19 in these populations. Men over 50 years of age living in urban and rural areas of indigenous populations in the states of Amazonas, São Paulo, Pará, and Roraima were the most frequently affected.

Finally, it is clear that the indigenous populations scattered throughout Brazil suffer the consequences of several factors that made them more vulnerable during the pandemic. Not only is their health at risk, but also their cultural heritage and the knowledge of past generations. It is necessary, therefore, to carry out actions that take into account the particularities of these peoples, so that prevention, monitoring and control, and treatment measures can be enforced. It is of paramount importance that updated data on the Brazilian population of indigenous people be collected more frequently and that other studies with this population be done so we can better understand the dynamics of indigenous health in the midst of the pandemic and ways to intervene in this process.

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Authors' Contributions

Silva WNT, Rosa MFP, Mendonça KS, Queiroz GA, Oliveira SV – Conception, planning (study design), data acquisition, analysis, and interpretation, and writing of the manuscript. All authors approved the final draft of the manuscript.

Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.