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Epidemiology of COVID-19 Among Indigenous Populations in Brazil

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Abstract

Background Due to social and geographical isolation, indigenous people are more vulnerable to adverse conditions; however, there is a lack of data on the epidemics' impact on these populations. Thus, this article's objective was to describe the epidemiological situation of COVID-19 in indigenous communities in Brazil.

Methods This descriptive observational study was carried out in indigenous communities in the municipality of Amaturá (Amazonas, Brazil). Individuals from the Alto Rio Solimões Special Indigenous Sanitary District (DSEI) who met the Sars-Cov-2 infection case definitions during the period between January and August 2020 were included. For case notification, the definitions adopted by the Ministry of Health of Brazil and by the Special Secretariat for Indigenous Health were considered.

Results Out of the entire population served by the Alto Rio Solimões DSEI ($n = 2890$), 109 indigenous people were suspected of having been infected with Sars-Cov-R during the study period; a total of 89 cases were actually confirmed (rate: 3.08 cases/100,000 inhabitants). Most patients diagnosed with COVID-19 were female (56.2%), with a mean age of 32.4 (± 23.6) years. Predominant symptoms were fever (76.4%), dry cough (64%), and headache (60.7%). Complications occurred in 7.9% of the patients; no deaths were reported.

Conclusion These results enhance the observation that indigenous populations, even if relatively isolated, are exposed to COVID-19. The disease cases assessed showed a favorable evolution, which does not mean reducing the need for caring of this population.

Keywords Health of indigenous people · Health of ethnic minorities · Coronavirus infections

Introduction

Sars-Cov-2, identified in December 2019 as a new type of human Coronavirus, is a highly transmissible virus which, until August 31, 2020, has been for the cause of almost 25 million disease cases worldwide and 800,000 deaths since its outbreak began [1–3].

However, there is little information about the impact of this pandemic on vulnerable populations, such as indigenous people, who are most susceptible due to their social and geographical isolation. In addition, the Unified Health System subsystem for indigenous people suffers from a lack of structure and resources for the treating of the most severe disease complications; they also lack logistical resources to help the health teams reach the riverside populations [4–7].

Until August 31, 2020, the 34 Special Indigenous Sanitary Districts (DSEI) in Brazil had notified 23,178 confirmed cases of coronavirus disease (COVID-19), according to the Special Secretariat for Indigenous Health (SESAI). The State of Amazonas recorded the highest number of deaths during the same period [8].

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In this connection, the present study aimed to describe the epidemiological situation of Sars-Cov-2 in the indigenous communities located in the Alto Solimões region (AM, Brazil), characterizing the confirmed cases with regard to their constituent factors, comorbidities, associated signs and symptoms, and their evolution.

Methods

This is a descriptive observational study on COVID-19 in indigenous communities in the municipality of Amaturá, Amazonas. In the region, the Alto Rio Solimões Indigenous Special Health District (DSEI) maintains the Polo Base Nova Itália as its arm, which assists thirteen semi-isolated villages, with a population of 2896 indigenous people [9].

The information was collected from the medical records of indigenous patients reporting to the DSEI of Alto Rio Solimões. The study included individuals belonging to the Ticuna, Witoto, Kambeba, Kanamari, and Kocama ethnicities who, during the period January to August 2020, presented with signs and symptoms consistent with Sars-Cov-2 infection and met the cases definition. Patients whose data did not offer the minimum information necessary to help meeting the study objectives were excluded.

For case notification purpose, the definitions adopted by the Ministry of Health of Brazil and the Special Secretariat for Indigenous Health were considered. For suspected case: a subject who had fever and/or at least one of the respiratory signs or symptoms of the disease (cough, shortness of breath, nasal wings flapping, among others), who returned to the village during the last 14 days (from a place with local or community transmission), or even a case of an individual who did not leave the village, but who had had close contact with a suspected or confirmed case of Coronavirus (2019-nCoV), during the previous 14 days before the appearance of the signs or symptoms. A confirmed case is considered to be one with conclusive laboratory confirmation for the new Coronavirus, according to the Charité protocol and/or the Rapid Test, regardless of signs or symptoms. Using clinical-epidemiological criteria, a suspected case of Influenza syndrome or severe acute respiratory syndrome is considered when, together with signs and symptoms, there is a history of close or home contact, with a laboratory-confirmed case of COVID-19 in the last 7 days before the onset of symptoms, and for whom it was not possible to carry out the specific laboratory investigation [10].

To outline the epidemiological profile of Sars-Cov-2 in the population of interest, data on the disease and related conditions were extracted from the individuals' health care records. The descriptive variables used were the following: gender, age, ethnicity, village, history of travel to a place where cases of transmission occur or having stayed in a location with declared community transmission, or having maintained contact with confirmed cases; also signs and symptoms presented, date of symptoms onset, test results when available, diagnostic method (laboratory confirmation, or clinical-epidemiological criteria), description of the disease evolution, such as complications, treatment, and outcome.

From the counting of confirmed cases taking into account the sociodemographic characteristics, the disease incidence rates were calculated, using the number of cases as the numerator and the referring population in each category as the denominator, using the constant 100,000. The geographical distribution of cases throughout the indigenous communities of the Alto Rio Solimões district was also evaluated with the aid of the Geographical Information System (GIS) Terraview version 4.2.0.

Statistical Analysis

Data analysis was performed using the SPSS version 21.0 program. Quantitative variables were described using mean ± standard deviation or median and interquartile distance, according to the data's normality, indicated by the Shapiro-Wilk test. Qualitative variables were described as absolute (*n*) and relative (%) frequency. Potential differences between subgroups of the studied population, regarding sociodemographic and clinical characteristics, and the outcome presented, were evaluated using ANOVA and Tukey tests for multiple comparisons, in the case of quantitative variables and chi-square test, or Fisher's exact test in the case of qualitative variables. Frequency rate comparisons were performed using the rate ratio (RR), with a confidence interval (CI) of 95% and a significance level of 5%.

Ethical Considerations

Data collection and treatment were carried out only after approval of the project by the National Research Ethics Committee (opinion N° 4,212,250) and authorization by the general coordinator of DSEI ARS to conduct the investigation and to access the data.

Results

This study consisted of 109 records of indigenous patients who are part of the Alto Rio Solimões DSEI, Polo Base Nova Itália. These patients showed signs and symptoms consistent with Sars-Cov-2 infection during the period from January to August 2020. Out of the 109 suspected indigenous subjects, 20 were excluded for presenting a negative result of the COVID19 rapid test, while 89 subjects were confirmed cases for COVID-19 (rate of 3.08 cases/100,000 inhabitants). Out of these, 86 cases were detected by the rapid test and three by the clinical-epidemiological criteria, which were

subsequently confirmed by the rapid test. The epidemic curve (Fig. 1) indicates the distribution of cases over the period reviewed, with the first case identified in April and the peak occurring at the end of July 2020.

Out of the confirmed subjects, 50 were women (56.2%). The average age was 32.4 (±23.6) years, with 55.1% of the individuals infected aged between 20 and 59 years, 15.7% were under 4 years of age, and 13.5% were 60 years or older. The median age was 30 years (Q3 = 51 and Q1 = 10.5 years). About ethnicity, the majority of those infected belonged to the Tikuna indigenous group (66.7%), followed by Kokama (25.8%) and Witoto (7.9%). All patients reported having traveled to places with COVID-19 cases in the 14 days prior to the diagnosis. In addition, 12 (13.5%) had been in contact with a confirmed case in the last 14 days. A total of 89.9% of those infected reported fulfilling the quarantine period.

When the symptoms were analyzed, it was noticed that most of the Indigenous people diagnosed with the virus had a fever (76.4%), dry cough (64%), and headache (60.7%) (Fig. 2). Complications occurred in 7.9% of the infected population; four developed atypical pneumonia, two patients adult respiratory distress syndrome (ARDS), and one of them developed severe dehydration and the other severe dehydration with hypoglycemia. Three patients needed hospitalization, and no deaths occurred among the infected indigenous people. Among patients who experienced complications, 42.9% required hospitalization, contrasting with none of those with no complications ($p < 0.001$).

Out of the 89 cases, 26 (29.2%) received expectant treatment because they presented only with mild symptoms. Among the patients treated ($n = 63$), 34 (54.0%) received an antipyretic (paracetamol or dipyrone) and local traditional medicine; one (1.6%) received antibiotic and antipyretic, 17 (27.0%) only traditional medicine, and 11 (17.5%) received all the options (antibiotic, antipyretic, and traditional medicine).

It was found that the use of antibiotics was associated with the occurrence of complications, since 40% of those who used this type of medication reported some untoward event; whereas, in patients who did not use these medications, only 3.8% reported untoward events (RR = 10.5 95% CI 2.75–40.4; $p = 0.003$). The average age of patients who developed complications was 46 ± 22.4 years, and the age of the patients who evolved without complications was 32.5 ± 23.0 years. However, there were no significant differences. Regarding the in-patients' age, the average was 32 ± 30.6 years, while the age of non-hospitalized patients was 32.5 ± 23.5. Likewise, complications of the disease had no significant differences related to age as well as hospital admissions associated with gender. As to the type of treatment, no age difference for the use of antibiotics was observed. However, for the use of local traditional medicine combined with antipyretics, patients' age was 42.2 ± 21.6 years among those who reported local traditional medicine use, in contrast to 26.4 ± 22.1 years for those who did not use it ($p = 0.002$).

The geographical distribution of cases according to their relevant indigenous community is represented in Fig. 3. A total of 14 indigenous communities of the municipality of Amaturá were assessed regarding the incidence of confirmed cases of COVID-19 in each village. The São Domingos community had the highest rate of COVID-19 confirmed cases (12,727.30/100,000), followed by Porto Gama (12,631.60/100,000). In Nova Itália, despite being the most populous community of Amaturá (1497 inhabitants), the proportion of cases was minimal (2204.40/100,000) compared to other villages. The rate of COVID-19 patients in Canimaru was

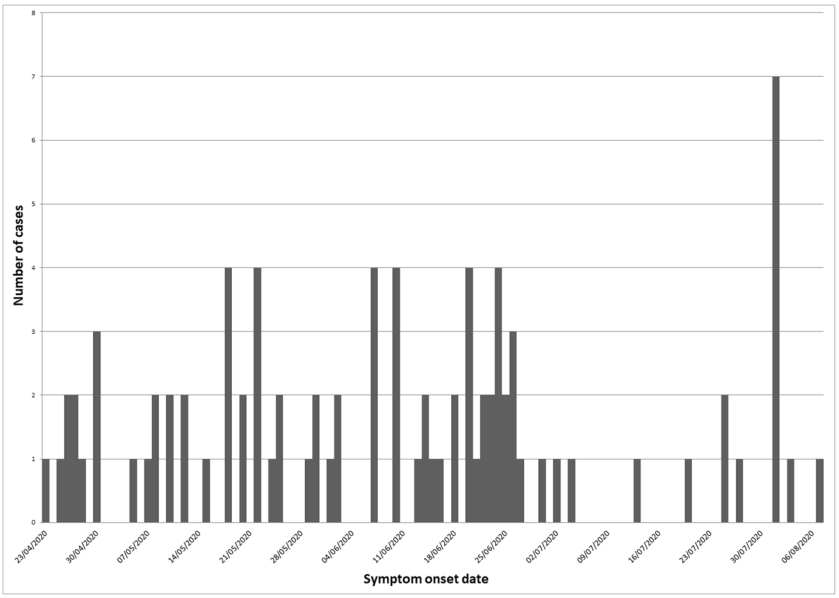


Fig. 1 Distribution of confirmed cases of COVID-19 from the Nova Itália Base Pole by date of symptoms onset, March to August 2020 ($n = 89$)

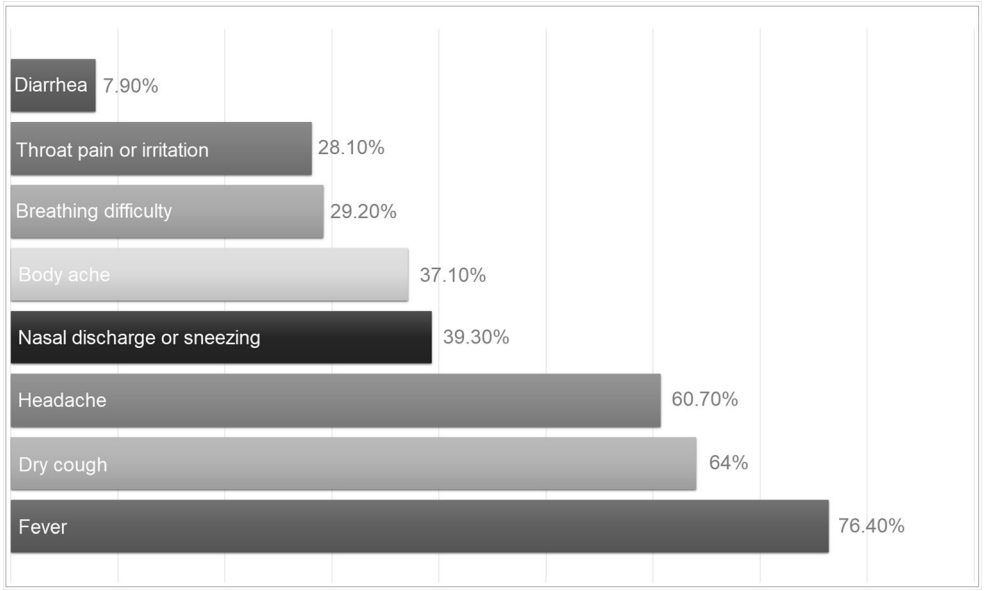


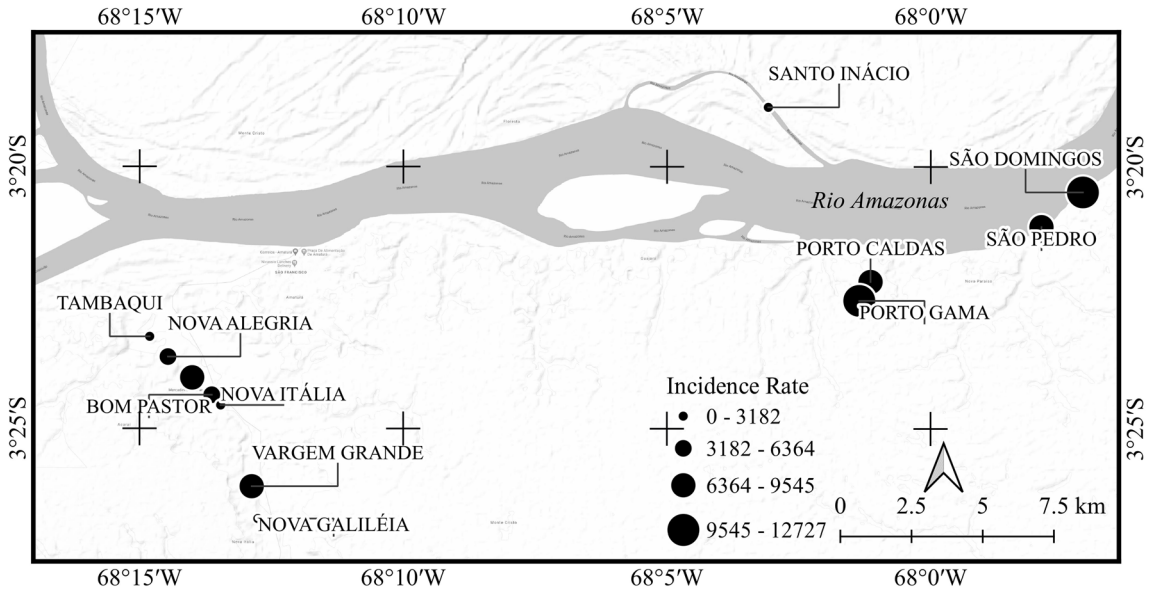
Fig. 2 Frequency of symptoms presented in the confirmed cases of COVID-19 at the Polo Base Nova Itália (n = 89)

216.90/100,000. Finally, New Galilee, Santo Inácio, and Tucum had no confirmed cases from January to August 2020.

Discussion

In Brazil, a total 29,008 cases ofCOVID-19 in indigenous populations were confirmed between February 26, and August 28, 2020. The national incidence of the disease during the same period was 3546.40 cases, and the Northern Region had the highest incidence rate (5664.40/100,000), followed by the Midwest (3135.00/100,000) [11]. During the pandemic, gold-diggers and loggers continued to explore indigenous lands. In addition, a number of roads cross those lands, and contact between indigenous people and truck drivers is frequent [12], facilitating communities' contamination.

In this study, 89 indigenous individuals from the Alto Rio Solimões DSEI, based in Nova Itália, municipality of



VILLAGE	INCIDENCE RATE	VILLAGE	INCIDENCE RATE	VILLAGE	INCIDENCE RATE
BOM PASTOR	4432	NOVA ITÁLIA	2204	SÃO PEDRO	9091
CANIMARU	217	PORTO CALDAS	8333	TAMBAQUI	2222
CORDEIRO DE DEUS	6780	PORTO GAMA	12631	VERGEM GRANDE	7692
NOVA ALEGRIA	5000	SANTO INÁCIO	0		
NOVA GALILÉIA	0	SÃO DOMINGOS	12727		

Fig. 3 Incidence rate (×100,000) of COVID-19 cases at the Polo Base Nova Itália geographically distributed according to the indigenous communities

Amaturá, were diagnosed with COVID-19 during the period January to August 2020, an incidence of 310/100,000. The first cases in the region were reported in April, almost 2 months after the first case confirmed in the country [5].Thus, in the region assessed, the frequency of COVID-19 confirmed cases was similar to that of other regions of Brazil. The peak of cases in July was also consistent with the national data [13]. However, despite the immunological, social, and cultural vulnerabilities, the disease's evolution in this population was positive, with only three hospitalizations and no record of deaths during the investigation period. Until the beginning of August, in Brazil, 1433.5 cases per 100.000 inhabitants had been recorded, with a mortality rate of 47.8/100.000 inhabitants. The Northern region had the highest incidence and mortality rates in the country, reaching 2567.90 and 81.20 per 100.000 inhabitants, respectively, in the State of Amazonas [14]. In the Polo Base Nova Itália, mortality rates were different not only from those of the country but also from the other DSEIs, since, during the period covered by the study, no deaths occurred. At the same time, in the 34 DSEIs, a total of 380 deaths occurred, according to SESAI [8]. These results were different compared to the evolution of the disease observed in other indigenous communities abroad, like in Mexico [15, 16], Colombia [17], and Peru [18]. This zero mortality rate in Brazil can be due to a multifactorial genesis, such as the geographic isolation of the villages, the non-use of potential iatrogenic and doubtful drugs, longitudinal and individualized comprehensive care, the use of traditional medicines, and the health promotion and inspection work carried out by the indigenous health community agents.

Similar to the results found in other Brazilian studies, most patients were young and of the female gender [19, 20]; the gender rate can be explained considering the proportion of men and women in Brazil. According to the PNAD data (Continuous National Household Sample Survey), the Brazilian population is made up of 48.2% males and 51.8% females [21]**.** Still, it may be that the youngsters population, considered to be at least risk, was the one that was most exposed, circulating in the region while keeping the elderly and people with comorbidities distanced. Regarding ethnicities, 66.7% of the study participants were Ticunas, who make up the most numerous indigenous people in this State, and in the Polo Base Nova Itália [22].

Typical cultural behaviors of the indigenous communities, such as sharing gourds and other household items, in addition to collective housing, justify the current concern that COVID-19 may spread in these communities [23, 24]. However, there is a contrast with the results presented here since only 13.5% of the patients reported having had contact with positive cases during the 14 days before their diagnosis. The same applies to the number of cases by community, where the highest confirmed rate was 12.73%, a possibly low number when considering the condition of shared housing and utensils. Although 89.9% of the infected individuals reported having completed isolation for 14 days, it is important to note that the quarantine practiced by these indigenous people probably was different from what was recommended by the health authorities. Because their dwelling huts have only one large space, the complete isolation of the patient was difficult. In most cases, the infected individual was laid on the hammock that was furthest away from the other residents, and he/she would always wear a mask. Only in a few situations, it was possible to transfer temporarily uncontaminated residents to close relatives' homes, thus managing to leave the infected patient totally isolated.

Despite a few reports of contact with others infected people, all patients mentioned a recent trip, which confirms the concern about the dissemination through the socioeconomic relations of the communities with non-indigenous people [24]. Commercial activities in cities to acquire supplies for the tribes without proper protective measures and the proximity of villages to cities where the virus had already spread can explain the speed up COVID-19 infection among indigenous people [23]. Therefore, it is possible to understand why São Domingos had the highest incidence rate (12.72/100,000). It is known that the population of this village is composed exclusively of riverside dwellers, traditional inhabitants of the banks of the rivers, belonging to the Kokama ethnic group. They live in the conditions offered by nature itself, adapting themselves to the rainy season [25]. They have already lost some indigenous traits due to their strong link with the trade through the fish supply to nearby cities. Still, the impression obtained by health professionals in the region is that this ethnic group has a greater power of sociability compared to others ethnic groups, as they speak Portuguese, thus having greater contact with other individuals from nearby locations. These facts, added to the fact that such indigenous people demonstrated resistance in the use of masks and the fulfillment of social distancing, are possible reasons for the São Domingos village having experienced the highest incidence of COVID-19 confirmed cases among the communities assessed.

On the other hand, Nova Itália — the most populous community of Amaturá, with 1497 individuals — had one of the lowest incidence of cases (2204.40/100,000). Due to Nova Itália hosting the Polo Base, a place where health professionals work, it is assumed that it was possible to obtain a better control of COVID-19 cases in that village. Precautionary measures were easier to be applied, such as isolating patients, promoting the use of masks, and giving informative presentations. In contrast, other communities did not receive health professionals' visits as often as necessary for a stricter control of new cases. This is due to geographic peculiarities — some communities are 3 h away by boat from the Base Polo — and to the work overload resulting from being the only

health center to serve the 14 communities in the region. Thus, the community with the largest total population was the one where the virus control was most effective, demonstrating that the closer and more accessible the health services are, the more effective is the COVID-19 spread control.

On the other hand, in the communities with no confirmed cases during the period assessed (Nova Galileia, Santo Inácio, and Tucum), this fact is probably due to the entry prohibition of individuals not belonging to the villages; therefore, no contagion occurred. This may signify that social distancing plays an important role in preventing the virus's proliferation; and hence, its relevance [26].

As for the treatments, azithromycin was prescribed only to patients who had signs or symptoms that would lead to the doctor's interpretation of a possible pneumonic condition. The other positive cases were not treated with antibiotics because, to that date, there was no evidence of any medication that would positively influence the course of the disease, thus potential iatrogenic procedures were avoided.

It was found in this study that, especially among older indigenous people, it was decided to use traditional local medicine, in the following way: at dawn and dusk, beehives were burned, and the smoke dispersed throughout the huts and alleys of the communities to prevent the disease, and also people would intake traditional preparations (a mixture of white pitch, lemon, different leaves, and smashed garlic) to improve the immune system and\or to cure the disease. Nevertheless, it is important to consider that only the Ticuna ethnic group, which represents about 90% of the indigenous population of Amaturá, used this medicine. The use of herbal medicine to prevent and treat COVID-19 has been already reported in other communities [27].

Reports from local health professionals indicate that there is some resistance from younger individuals to use the traditional medicine, often choosing not to use any medication at all or just using painkillers. It is assumed that part of this resistance comes from the unpleasant taste of these preparations and the loss of traditional habits due to contact with city dwellers.

It is also important to emphasize that the 26 cases where patients received only expectant treatment and general guidelines were treated so because of lack of significant symptoms. However, all were monitored by health professionals on a daily basis. Besides, the symptoms that occurred most frequently are in line with those reported in the rest of the world population (fever, dry cough, and headache), although with different frequencies [28].

This study has some limitations because it analyzes secondary data drawn from the local medical care records. Therefore, it is not possible to obtain further details of the cases concerning the comorbidities presented and the recovery time, as well as the measures taken at the hospital for cases that required hospitalization. In any case, it is important to highlight the favorable evolution of these cases, even without the use of advanced support measures or the use of different medications widely disseminated during the pandemic. Furthermore, more comprehensive studies involving different ethnic groups are required in order to have a broader picture of the real situation in which these people stand when facing COVID-19.

Final Considerations

The occurrence of COVID-19 cases in these populations indicates that indigenous people are also vulnerable to the epidemics. Because of their exposure and conditions, public policies to combat the pandemic must closely consider these people, and their characteristics and traditions.

It should also be considered that indigenous cultural habits linked to medicinal practices can interfere, at different levels, in the patient's response to diseases. Thus, there are questions about the beneficial and harmful effects of social distancing of those living in indigenous villages and, to what extent, this characteristic influences these populations' health and quality of life.

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Code Availability Not applicable.

Author Contribution Material preparation and data collection were performed by Pablo Michel Barcelos Pereira and Williams Ferreira Portela; data analysis were performed by Betine Pinto MoehleckeIser, Marina Goulart da Silva, and Bruna MuraroVanassi. All authors reviewed and discuss the data according to the theoretical framework. The first draft of the manuscript was written by Marina Goulart da Silva and Guilherme Cabreira Daros and all authors commented on the previous versions of the manuscript. All authors read and approved the final manuscript.

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Data Availability Not applicable.

Declarations

Ethics Approval This study complied with the ethical precepts of research and specific Brazilian resolutions. Data were used in an aggregated manner without identifying individuals and causing any constraint to them.

This study was approved by the National Research Ethics Committee (CONEP), acceptance number 4.265.105.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

Conflict of Interest The authors declare no competing interests.

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