

Spatial Issues and Covid-19 Dispersion in Small Cities of The Amazon River Delta

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Abstract

The COVID - 19 virus emerged in China and has spread to all areas in Brazil, including the Amazon River Delta, where the population lacks essential services. Thus, this article aims to characterize the dispersion of COVID-19 in the small municipalities of the Amazon River Delta, which have fewer than 50,000 inhabitants, detailing the towns' situation. Covid-19 data provided by the health departments of the states of Amapá and Pará, and census data from the IBGE, were used to create maps of the disease for the Delta's municipalities. The virus circulated rapidly to the smallest localities, where the health service and sanitary conditions are precarious, leading to a severe contamination rate. Together with other known aspects, this is yet another opportunity to show the regional needs and the importance of public policies for this population.

Keywords: Small Cities, Delta, COVID-19, disease dispersion, public politics.

1. INTRODUCTION

The COVID - 19 pandemic poses a massive challenge to the world. Until recently, there was little awareness of the disease and the new pandemic's consequences as it spread worldwide. According to Lu *et al.* (2020), laboratory studies of case samples of a hitherto unknown pneumonia in a Chinese province led to the discovery of the virus responsible for the disease, preliminarily called 2019-nCoV. The discovery and genetic sequencing of the virus by Chinese researchers, and its dissemination to the international scientific and health community in early January 2020, was essential for the global alert of tests and measures to fight the disease in other countries (CHAVES; BELLEI, 2020).

The first cases that emerged in China occurred among visitors to an open market of live and dead seafood and wild animals. Due to the speed at which the virus spread, the WHO (World Health Organization) issued a global alert on January 30, 2020. According to the WHO, on December 31, 2019, the first cases appeared in the Chinese city of Wuhan, where approximately 7,834 cases were registered; however, little was known about the disease and its magnitude. With the rising number of infected people and the detection of the virus in other countries, migration was observed in the export of cases. According to Santos *et al.* (2020, p.2),

The rapid rise in the number of deaths makes COVID-19 the deadliest infectious disease in the world, overtaking tuberculosis (TB), which killed approximately 4,000 people a day in 2018, according to the World Health Organization (WHO)¹.

Almeida, Leão, and Barros (2020) affirm that people and goods' mobility, particularly internationally, easily and rapidly covered the distance between the continents, and they recognize the role of "imports" in infection's spread. By April 1, 2020, 4,800 deaths had been reported, rising to 8,385,440 cases and 450,686 deaths worldwide on June 19, 2020 (WHO, 2020). In Brazil, the first case of COVID-19 was confirmed on February 26, 2020, in São Paulo

¹ The rapid rise in the number of deaths makes COVID-19 the deadliest infectious disease in the world, overtaking tuberculosis (TB), which killed approximately 4,000 people a day in 2018

city². According to the Ministry of Health (BRASIL, 2020), by June 23, 2020, 1,145,906 cases and 52,645 deaths caused by the virus had already been confirmed.

Santos *et al.* (2020, p.2) explain that the pathogen's biological characteristics, such as a high capacity for infection, associated with its occurrence in a wholly susceptible population, given the territories' heterogenous living conditions, indicate the different risk of COVID-19 occurrence. The groups most at risk of developing the severe form of the disease are the elderly, those with respiratory conditions and weakened immune systems, and densely populated groups. In this context, cities are more susceptible to the spread of the virus, and this is also the case for Brazilian cities, which have structural problems regarding the population's access to basic infrastructure and health services.

According to Pires *et al.* (2020, p.1), "(...) because of the abysmal levels of income inequality and access to services in Brazil, there is n

o shortage of reasons to expect a disproportionate effect of COVID-19 among the most vulnerable in the country." The authors mention that the poor infrastructure of dwellings, especially on the outskirts of cities, increases the risk of contagion and spread of respiratory infections. In addition to the base of the social pyramid being more likely to need hospitalization, in case of contamination by COVID - 19, other factors make low-income populations more vulnerable to the public health crisis and economic collapse associated with the current pandemic (PIRES *et al.*, 2010, p.3).

Santos (2020, p.10) aptly explains the gravity of the planet's situation concerning COVID-19 when he states out that

Our time's cultural, political, and ideological debates have a strange opacity that stems from their distance from the daily lives experienced by the vast majority of the population, ordinary citizens – "*la gente de a pie*"³, as Latin Americans say.

Frances *et al.* (2020, p.3) mention that the Brazilian situation is more complicated due to its marked social inequalities.

In Brazil, a significant portion of the population lives in precarious housing conditions, in overcrowded dwellings with few rooms, which impedes the population's effective isolation (infected or not). The absence of basic sanitation and limited access to treated water makes it difficult or impossible to comply with recommendations such as frequent hand washing. Other problems related to poverty and poor income distribution also aggravate the disease's spread and its effects on society (FRANCÊS *et al.*, 2020, p.3).

Various articles have shown how the disease has behaved in different parts of the country (PEREIRA *et al.*, 2020; SOUZA; FERREIRA JR, 2020, PIRES *et al.*, 2020, IPEA, 2020; SANTOS

² <https://covid.saude.gov.br/>

³ "the man/woman on the street"

et al., 2020, SILVA *et al.*, 2020, SPOSITO; GUIMARÃES, 2020). Undoubtedly, cities in the poorest countries, such as Brazil, are worrying environments in the current pandemic scenario. It is a "chronicle of a death foretold" as the precarious situation of Brazilian cities and their population's access to basic services such as health and education that would guarantee a minimum quality of life has long been under debate. Thus, an analysis of the results of Covid-19's advance in Brazilian cities comes as no surprise, given the production of knowledge on this topic. However, it is crucial to give this situation visibility and clarify the lack of services and infrastructure that these cities offer to their residents.

Beyond the epidemiological situation, like other cities in the country, the Amazon River Delta's small cities are extremely socially vulnerable because of their poor infrastructure, income, health, and demographic structures. There is an urgent need to identify those spaces with a greater susceptibility to the disease to prevent its severe form. This sub-region is formed by 49 municipalities, 40 in the state of Pará and 9 in the state of Amapá. This article characterizes the dispersion of COVID-19 in the municipalities of the Amazon River Delta that have a population below 50 thousand inhabitants. These urban areas are described based on a discussion about the disease's demands and the towns' shortcomings, which leave the population unprotected against possible waves of contagion.

Small cities need to be addressed and placed in the context of the pandemic to further our understanding of the Amazon, not because they are economically or politically noteworthy, but because their rhythm of life differs significantly from the characteristic and predominant urban pattern in other regions of Brazil (TRINDADE JR, 2010, 2013, OLIVEIRA, 2006, OLIVEIRA; SCHOR, 2008, TRINDADE JR *et al.*, 2008, COSTA *et al.*, 2012, COSTA; MONTOIA, 2020, MONTOIA; COSTA, 2020). They are unique cities that help us to explain the particularities of the urbanization process in the Amazon.

The population's participation helps to build more unique cities, transforming them into places of possibilities. Therefore, it is a social space, economic activities, family relationships, an existential relationship that, despite recognizing the exogenous, has a dynamic marked by peculiarities that must be considered in the context of regional development (...). Thus, the urban riverine has an existential relationship that includes the river, in its various aspects (...) it is an identity that does not deny the exogenous but has a life project linked to its place (COSTA; MONTOIA, 2020, p. 5).

Presenting the theme of the COVID-19 situation in the Delta's small cities evidences an acknowledged situation in Brazil, namely, this population's precarious access to the most basic services, such as health. Furthermore, it is an opportunity to give voice to a condition of urban life to the riverside, which is the riverine city's identity, making it strong in the face of the State's manifest absence.

2. THE STUDY AREA - THE SMALL MUNICIPALITIES OF THE AMAZON RIVER DELTA

Small towns are at the heart of the urban area in the Amazon. According to Oliveira (2006, p. 27),

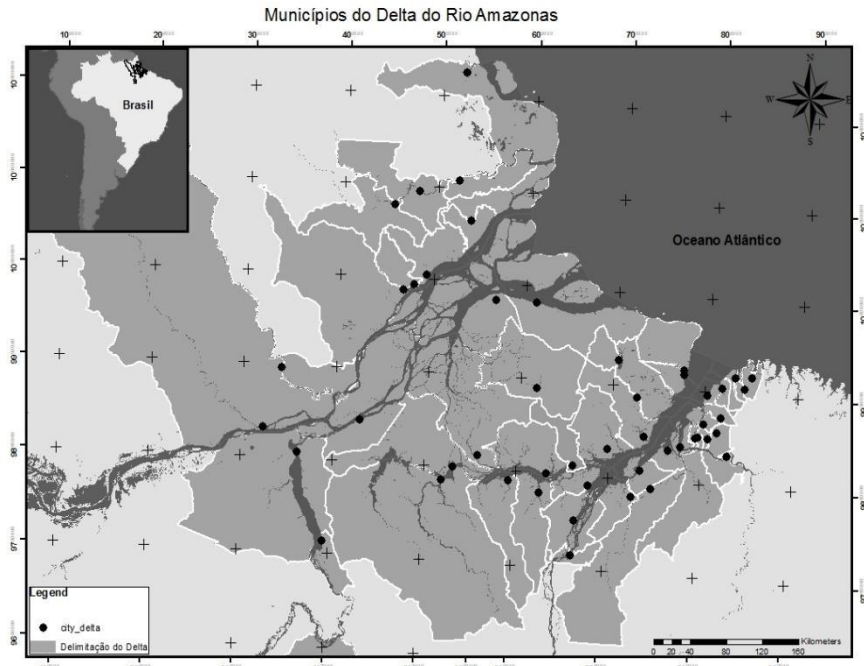
Small cities need to be addressed to understand the Amazon further, not because they are economically or politically noteworthy, but because their rhythm of life differs significantly from the characteristic urban and predominant pattern in other Brazil regions.

Small towns are among the numerous urban areas in the Amazon Region that go unnoticed, at least by public policies. According to IBGE data (2020), small cities with less than 20 thousand inhabitants predominate in the Legal Amazon (more than 80%), even though over 70% of the urban population lives in medium and large cities. In this context, a diversity of small towns have been analysed from different academic angles (TRINDADE JR, 2010, COSTA *et al.*, 2012, BRONDIZIO, 2016, OLIVEIRA, 2006, OLIVEIRA; SCHOR, 2008). These analyses highlight that these cities are not similar spaces with limited possibilities; instead, they are singular with their own historical specificities.

This article discusses the characteristics of the dispersion of COVID-19 in the Amazon River Delta (Figure 1). As mentioned, the region comprises 49 municipalities, each with its respective administrative municipal seat. Of this total, approximately 70% are considered small cities, with fewer than 21 thousand inhabitants. At the start of the pandemic, of these 34 cities, data on the infected person's place of residence were only available from the state of Amapá. The state of Pará also only releases data by municipality. As this article's objective is to address the theme of small cities, it was decided to study the small cities of Amapá, which make up the Delta. These small towns are unique and are transformed by their residents into places of possibility.

Thus, it is social space, economic activities, family relationships, an existential relationship that, without denying the exogenous, has a dynamic marked by peculiarities that must be considered in the context of regional development (COSTA; MONTOIA, 2020, p. 5).

Figure 1 - Municipalities of the Amazon River Delta



Source: Prepared by the authors (2020), based on spatial data provided by IBGE.

3. METHODOLOGY

This research uses data from multiple sources, collected on different institutional websites providing information on the Coronavirus, including the Federal Ministry of Health (BRAZIL, 2020), the Secretariat of Public Health of the State of Pará (PARÁ, 2020), and the Government of the State of Amapá (AMAPÁ, 2020). These data are arranged by the total number of confirmed cases, municipality, the patient's age and gender, any comorbidity, and whether the patient has died. Data from the state of Amapá also provides the patient's neighborhood, permitting the distinction between cases in rural and urban areas, and enabling the production of specific maps of the cities in the Amapá Delta.

Using IBGE (2020) data on the total and urban population of the Amazon River Delta municipalities, the indicators of contamination and deaths were calculated, which relativized the incidence of COVID-19 in the study area and allowed comparisons to be made.

To this end, the COVID-19 incidence rate (TI) in the Delta was calculated by considering the absolute number of confirmed transmissible cases (NC), in the population residing in the municipalities considered (REDES, 2008, p.38), per 100 thousand inhabitants. Thus, the formula

$$TI = \frac{n^{\circ} \text{ of confirmed cases}}{\text{Total resident population}} \times 100,000$$

These data were tabulated, and graphs and maps were designed to show:

- The incidence rate of Covid cases in Delta municipalities

- Urban occupation density

The spatial data interpolation method was adopted to spatialize the data and create the demographic density and COVID-19 case density maps, which allowed a more detailed view of the Amazon River Delta region's demographic intensity and the density of confirmed COVID-19 cases in cities in the state of Amapá. The approach made it possible to identify the main areas of spatial concentration of the "Demographic density" and " COVID-19 case density" variables. Of the different interpolation methods provided by Geographic Information Systems (GIS), Inverse Distance Weighting (IDW) recognizes the distance from the closest sample points and differentiates them from more distant points; that is, it estimates the values within cells, averaging the values of the sample points in the neighborhoods. Therefore, the closer the points, the more homogeneous and the greater the weight in processing the average.

4. COVID AND THE SMALL CITIES OF THE AMAZON RIVER DELTA

In his paper, *The Cruel Pedagogy of the Virus*, Santos (2020, p.15) states that the current pandemic is particularly difficult for some social groups, who suffer from "a special vulnerability that precedes the quarantine and is worsened by it," which he calls the South, which designates a "political, social and cultural space-time" (SANTOS, 2020, p.15). Like so many others, the small towns of the Delta, or its residents, belong to this group. Neglected by public policies, their vulnerability has been evidenced by the COVID-19 pandemic.

The small cities of the Delta have several shortcomings, such as a very fragile transformation economy, low competence to offer the population basic services, predominantly public sector formal employment, and an urban economy based on local activities (OLIVEIRA, 2006; COSTA *et al.* 2012; TRINDADE JR. *et al.*, 2008). However, these cities play an essential role in the local urban network, offering services, which, many times, can only be accessed in the metropolises, far from these realities. In the regional urban network, these local cities (SANTOS, 1982, p.71) are nodes performing functions and are responsible for meeting "the minimum, real or created vital needs of an entire population, a task that implies a life of relationships".

Between 1984 and 2010, in the Delta, these small cities were responsible for 34% of the urban area's growth (COSTA; ROSA, 2017). Although they are inadequate, as shown by their very low Human Development Indexes (HDI), they act as small poles of attraction, which leads to the issue of their behaviour during the COVID-19 pandemic.

Despite their resilience, being spaces that reinvent themselves in different crises or predicaments, the pandemic has posed a challenge for these communities. The spread of COVID-19, combined with their deficiencies, mainly concerning what the health system offers these cities, signals that existing local problems have been exacerbated. The Coronavirus pandemic has shown the country's health system's fragility, as a minimum care service infrastructure is required. Therefore, our examination of the problem of COVID-19 in the Delta region, particularly in municipalities with small cities, aims to contribute to the discussions on public policies aimed at these realities. Sensitively, Santos (2020) comments that

for residents of the world's poorest peripheries, the current health emergency comes on top of many other emergencies. (...) in addition to the health emergency caused by the pandemic, residents face several other emergencies. This is the case of the health emergency resulting from other epidemics (...). It is also the case of the food emergency because people are going hungry in the neighborhoods (...). SANTOS (2020, p.19)

Recent data, available on the Fiocruz website (2020), indicates that in its initial stage in the country, in March 2020, the disease was concentrated in large cities along the Brazilian coast. From April onwards, it moved inland, reaching the smaller cities and locations of greater social vulnerability. The dispersion pattern of the disease followed the Brazilian highways and roads. However, the data for the Delta has an alternative dispersion pattern. If we consider the rivers and the forest as barriers, the virus spread from the big cities of Belém and Macapá, despite the long distances and physical obstacles between locations and the difficulties of population displacement, as many of these places are accessed only by boat.

From the data collected on the platforms made available by the State Governments of Pará and Amapá (PARÁ, 2020; AMAPÁ, 2020), we observe that in the Delta, over 55% of the infected people are women, while for the country, 60% are men and 40% women. Meanwhile, more men have died, in a ratio of 70% to 30%. As noted by Santos (2020, p. 16), women "continue to be exclusively or mostly in charge of caring for families." The higher rate of females' contamination is because they leave their domestic units to perform outside activities. During the same period, many men, who work as fishermen or açai harvesters, are at home, as their activities are in the closed fishing season or between harvests. Thus, women may be more exposed to the disease than men.

When the contamination data is relativized, the contamination indicator calculation is used instead of the absolute numbers, showing the probability of contaminated people in a population of 100 thousand inhabitants; the result is much more consistent data. Figure 2 shows the numbers of people in the Delta contaminated with COVID-19 on May 27, 2020, focusing only on municipalities with towns with less than two thousand inhabitants. It is evident that Amapá has a high contamination rate, but a low case fatality rate compared to municipalities in Pará, which have a low contamination rate. When taking the resident population into account, the rates are high in all the municipalities.

With rates above 600 per 100 thousand inhabitants, the municipalities of Soure, Ponta de Pedras, in Pará, and Amapá, in Amapá, stand out. Access to infrastructure is a possible explanation of the contagion rates, as reflected in these municipalities' health conditions. In 2010, around 6% of urban households in small towns in the Delta had their domestic effluents collected through the sewage network. It is noteworthy that none of these municipalities has a sewage treatment system and access to potable water is not absolute. It has been established that washing hands with soap and water is one of the prophylactic measures adopted to combat Coronavirus transmission. Due to their inadequate infrastructure the populations of small towns do not have universal access to water. Research data obtained at site of the Instituto Trata Brasil (2020) show that, in Amapá, 62.9% of the population does not have access to water, 93.4% has

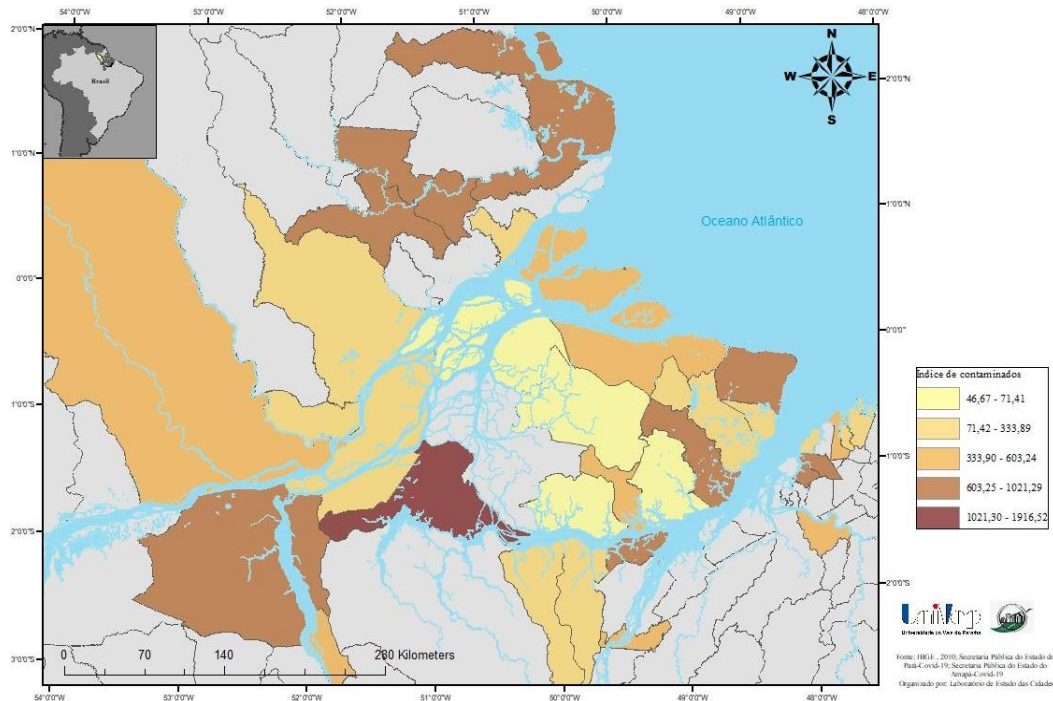
no sewage collection, and 13.0% of the sewage is treated upstream from consumed water. In Pará, 54.7% of the population has no access to water, 93.7% is without sewage treatment, and 4.4% consume water downstream from treated sewage.

Costa and Rosa (2017, p.98) state that investments in basic infrastructure did not accompany the growth of small towns in the Delta; this lack of investment meant the urban infrastructure was unable to "meet the progressive demand for this service." Mansur *et al.* (2016, p.637) surveyed 41 cities in the Delta and observed that the unevenness of providing public services and access to infrastructures, such as drinking water, sewage collection, and appropriate waste disposal, increases the risks for the population health.

The graph in Figure 3 compares the number of urban inhabitants and the case fatality rate in the Delta. This dispersion graph shows that locations with the lowest urban populations have the highest contagion rates as they are less equipped with health services. Overall, the health system in the region is deficient, which, associated with the long distances between places, and difficult access to hospitals with ICU-COVID beds, aggravates the pandemic in the region and puts patients' treatment at risk.

Brazil has a case fatality rate of around 6%, rising to 7% in Amapá and Pará. In the Delta's 49 municipalities, the rate is about 6.2%. If only municipalities with an urban population below 21 thousand inhabitants are considered, this amount drops to almost 4%. In other words, the municipalities with the worst health services have the highest survival rates. According to information from residents of three cities in the Delta (Afuá, Ponta de Pedras, and Mazagão), isolation measures worked at the beginning of the pandemic, and although many people are contracting the disease, this is unconfirmed by tests.

Figure 2 - Confirmed cases of COVID-19, in the municipalities of the Delta, with an urban population below 21 thousand inhabitants (May 27, 2020).

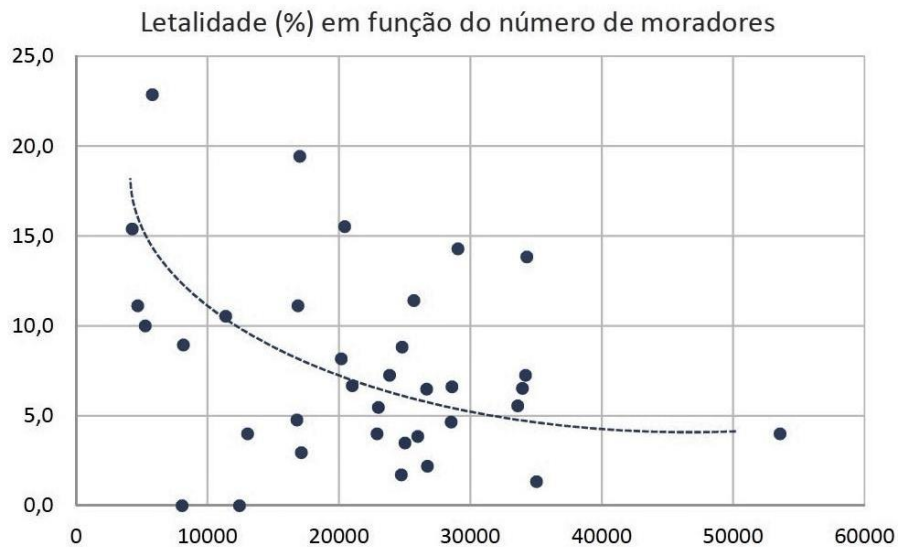


Source: Prepared by authors, based on data from the State of Pará Health Department (2020) and the State of Amapá Health Department (2020).

However, some municipalities have very high mortality rates. For example, Ferreira Gomes and Mazagão, both in Amapá, have a case fatality rate of almost 20%, which is due to the long distances that people must travel to receive care. This is evident from the concentration of the principal locations offering specific COVID-19 ICU services. In the state of Amapá, these ICUs are concentrated in Macapá, and the surrounding area.

The inadequate access to health care and low availability of public facilities, including ICUs (Table 1), in these municipalities, interferes with the treatment of suspected and confirmed cases of the virus. This stark reality impels these small towns' residents to travel to the state capitals, including Belém and Macapá, for better health care.

Figure 3 - Dispersion Graph: case fatality as a function of the number of residents



Source: Elaborated by Paulo Barja, based on data from the states (PARÁ, 2020; AMAPÁ, 2020) and data from the IBGE (2020).

Table 1 - Number of Hospital Beds

Beds	SUS		Non-SUS	
	Hospitalization	ICU	Hospitalization	ICU
Total	1346	0	35	0
Average / Inhabitants	1.8	0	0.05	0

Source: Datasus (2020)

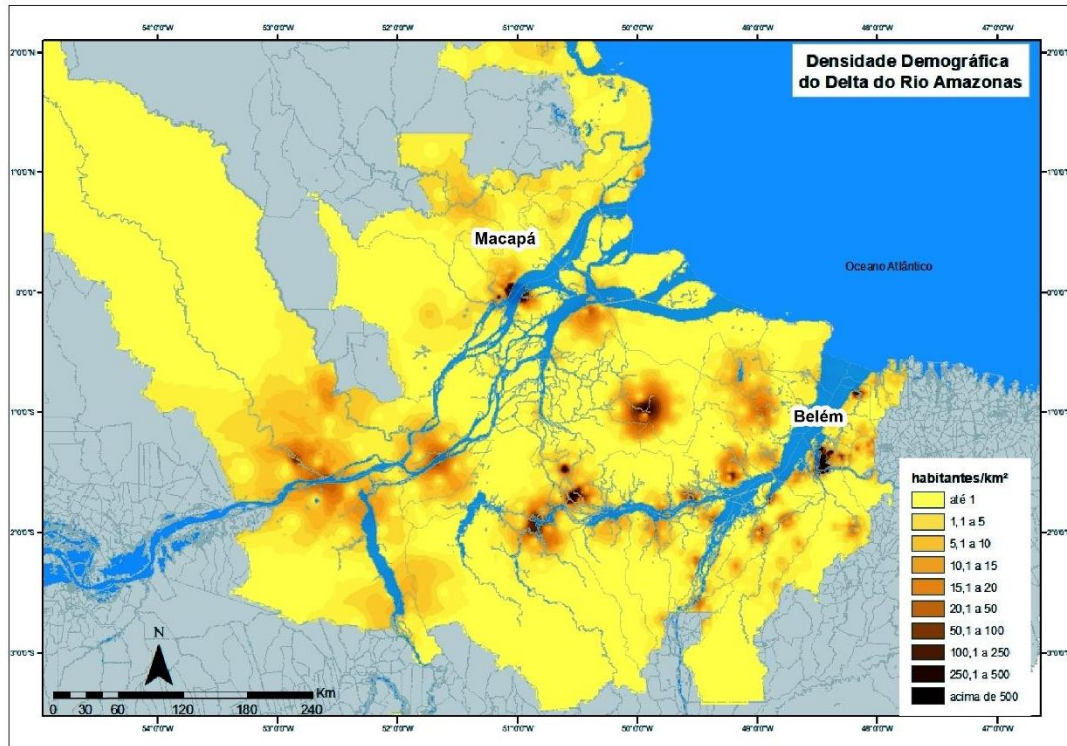
The region's characteristic long physical distances are a vital factor in access to health care for rural riverine communities, who depend on logistics to cross the river and receive primary health care. Thus, the movement of residents is a complicated and nonviable alternative, given the obstacles imposed on health care. This is added to the Coronavirus pandemic, which often requires rapid assistance to minimize the population's symptoms or loss of life. Furthermore, many residents' economic situation is another impeding factor. As the equipment for more advanced diagnostic tests is in the capital cities, patients need to have the means to travel and meet other expenses, such as food.

4.1. COVID, Living Conditions and Public Policies

Cities are the locations in the Delta with the highest occupancy density, as shown in the population density map for the Delta in Figure 4. The points with the warmest hues are the areas with a higher population density, such as Macapá and Belém, and their metropolitan areas; the smaller dots represent the other cities. In the Delta, the population density in all the

cities is 6,500 inhabitants / km², and 6,700 inhabitants / km², for small towns. If only cities with more than 21 thousand inhabitants are considered, the density decreases to approximately 5,900 inhabitants / km². Therefore, there are more people per square kilometer in the small towns of the Delta than in the medium and large cities. This is because the occupation pattern in these towns follows the floodplains, and the bayou, through the construction of stilt-houses, leading to a greater density of structures in a small space.

Figure 4 - Map of demographic density in the Delta (hab./km²)



Source: prepared by the authors, based on data from IBGE (2020).

The images in Figure 5 are photographs of different small towns in the Delta. They show the occupation along the floodplain and the densely packed houses on the same street, with very little space between one dwelling and another, a situation found in the cities of Afuá and Ponta de Pedras, located in Pará. Mazagão, AP is an exception to this scenario as the occupation process follows an orthogonal pattern, with wide streets and the lots allow a greater distance between the households.

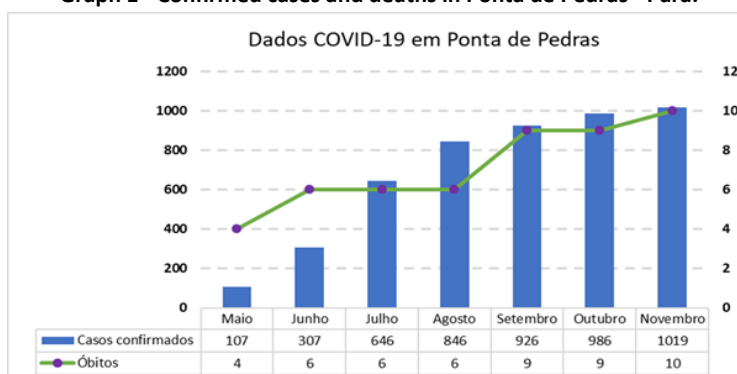
As already discussed, this spatial distribution is linked to the towns' infrastructure. The uncertain access to sewage treatment and the water supply system, combined with the houses' architecture, make these small towns conducive to the spread of COVID-19. Graphs 1 and 2 show the number of COVID_19 cases in the municipalities of Afuá and Ponta de Pedras. It is evident that the number of cases increased after May for both cities. In both cases, the failure rate is less than 1% for Ponta de Pedras and 0.63% for Afuá.

Figure 5 - Photographs of some small towns in the Delta



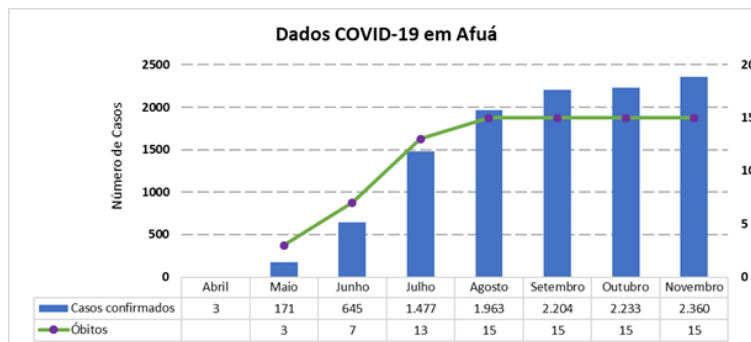
Source: Photographies obtained during Fieldwork.

Graph 1 - Confirmed cases and deaths in Ponta de Pedras - Pará.



Source: Prepared by the authors, based on data from SESPA (2020) and Ponta de Pedras City Hall (2020).

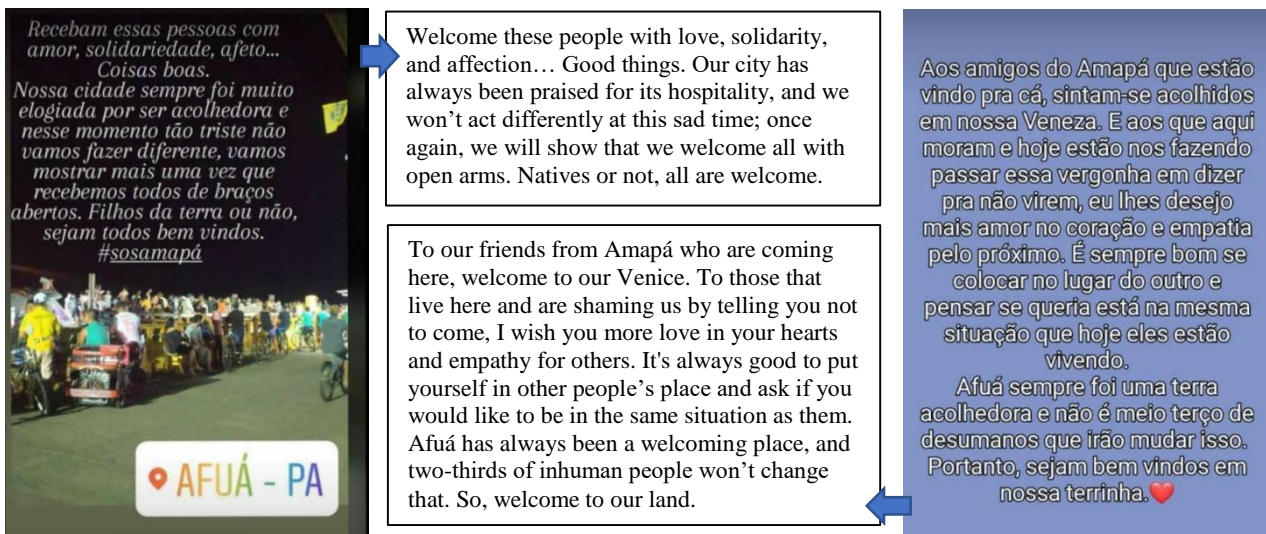
Graph 2 - Confirmed cases and deaths in Afuá - Pará.



Source: Prepared by the authors, based on data from SESPA (2020) and Afuá City Hall (2020).

At the beginning of the pandemic, there was a significant increase in the number of cases in all the cities. In the case of Afuá, this increase led the authorities to interrupt boat trips between Macapá and the town. However, the extended failure of the electricity supply in the capital of Amapá caused Afuá's population to open their homes to their friends and relatives as an act of solidarity. Figure 6 shows some material posted by the local residents on social media. Solidarity is part of these residents' lives, the riverside way of being (MONTIOIA; COSTA, 2020).

Figure 6 - Social media posts supporting solidarity in the city of Afuá due to the blackout in Amapá.



Source: available on Instagram of Afuá residents

Our findings for the small cities of the Delta, in the state of Amapá, indicate a dispersion pattern of the contamination index remarkably similar to that observed by Silva *et al.* (2020). The cities of Mazagão and Amapá had a 65% and 85% increase in the number of cases between June and October 2020, respectively. Mazagão has a 50-minute road connection with Macapá, and people continued to commute to Macapá, contaminating themselves and their family members. According to the authors, in Bahia, "the scenarios of metropolization, which is

the functional conurbation between municipalities (...), is associated with greater demographic density", explaining the COVID-19 dispersion process (SILVA *et al.*, 2020, p. 5). The health care, basic sanitation, and occupation density of these cities raises concerns about actions to reduce the number of cases and the virus's contamination rate. Figure 7 shows the spatial form of the city of Afuá. The proximity of the dwellings restricts social distancing and, consequently, the implementation of public policies to reduce the disease's spread.

The inadequate infrastructure of many small cities is well known, placing intense pressure on the hospital care and hospital bed occupancy provided by the state capitals. Given this situation, the predicament of this population in this pandemic is disheartening. As mentioned at the beginning of this article, a "criticism of a death foretold."

Figure 7 - Images of the city of Afuá, showing: (a) distribution of urban lots (PMA, 2019); (b) drone image of the urban area, showing the density of households; (c) photographs of the city of Afuá, which shows the density of households on the city streets.



Source: Prepared by the authors, based on data from fieldwork and Afuá City Hall (2019)

5. FINAL REMARKS

The discussions in this article raise questions regarding the fate of the population of these municipalities. Both urban and rural residents have long been destitute. The truth is that these places and their many problems have remained invisible to public policies.

The analyses here indicate that Covid-19 has merely demonstrated the local realities, including the precariousness or lack of basic infrastructure and health services in these small Amazonian cities. When added to comorbidities and other existing health conditions, diseases such as COVID-19 tend to exacerbate the neediest population's vulnerability. One of the

guidelines emphasized in combating the disease's transmission is washing hands with soap and water. Although many of these small towns are in the largest hydrographic basin in the world, most of the population does not have guaranteed access to potable water. Even though it is essential to improve health conditions, basic sanitation is usually undervalued by administrators. The pandemic has made these problems explicit. The study area's municipalities and citizens depend heavily on solidarity to reinvent themselves, which is the source of their resilience.

Within the context of solidarity, initiatives are being proposed to show possibilities and views regarding these problems. Among the numerous difficulties faced, the distances to specialized medical care make these residents' position chaotic. The Marajó Vivo Network (O LIBERAL, 2020) was created as a vehicle to publicize the health situation in the municipalities of Marajó. The objective is to create a solidarity network to help these municipalities' residents, offering an alternative to the crisis. It is worth mentioning that although this region's data are alarming, considering the inadequate local health care and social vulnerability, the situation could be much worse.

We hope that these discussions will shed light on the social problem of the towns of the Amazon Delta and reinforce the need to propose public policies that address the local reality. Who knows, a challenge such as the COVID-19 virus may contribute to making that happen.

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