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COVID-19 IN THE LEGAL AMAZON

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Miguel Pacífico Filho [a*] - Thelma Pontes Borges [b] - Helga Midori Iwamoto [c]
Airton Cardoso Cançado [d]

(a) PhD in History. Professor at the Federal University of Tocantins, Araguaína (TO), Brazil.
ORCID: https://orcid.org/0000-0002-0316-2326. **LATTES:** http://lattes.cnpq.br/5949034927486529.
(b) PhD in Psychology. Professor at the Federal University of Tocantins, Araguaína (TO), Brazil.
ORCID: https://orcid.org/0000-0001-6073-8937. **LATTES:** http://lattes.cnpq.br/2159682210638946.
(c) PhD in Administration. Professor at the Federal University of Tocantins, Palmas (TO), Brazil.
ORCID: https://orcid.org/0000-0002-6527-7137. **LATTES:** http://lattes.cnpq.br/7968598733241516.
(d) PhD in Administration. Professor at the Federal University of Tocantins, Palmas (TO), Brazil.
ORCID: https://orcid.org/0000-0003-4698-1804. **LATTES:** http://lattes.cnpq.br/7076992579962891.

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(*) CORRESPONDING AUTHOR
Address: Av. campos Elíseos, 600, Setor Noroeste. Araguaína (TO), Brasil. CEP: 77824-060. Phone: (+55 63) 981311501.
E-mail: miguilim@uft.edu.br

Abstract

The work aims to demonstrate that the dependence on a local center like Xambioá (TO) in relation to two medium cities, namely, Araguaína (TO) and Marabá (PA), located in the Legal Amazon, offers serious consequences during the pandemic, because despite the city is outside the flow of capital, its proximity to the other two middle sized cities places it among the most affected cities in the state of Tocantins by COVID-19. To understand this context, theoretical discussions were held about the interrelationship between the three cities in the Amazon region and data from the epidemiological bulletins of the respective health secretaries and the Monitora-COVID (FIOCRUZ, 2020) were used. The results show that the spread of the virus in Xambioá behaved similarly to that of the city of Araguaína, with a high incidence and higher peaks than those of the other two bigger cities. The results alert to the seriousness of the situation, since the municipality does not have health equipment capable of meeting the demand caused by the complexity of the cases, calling for a debate about the reorganizations of the cities with a focus on improving the quality of life and the good living for people and the community.

Keywords: COVID-19. Legal Amazon. Xambioá-TO. Medium cities.

Resumo / Resumen

COVID-19 NA AMAZÔNIA LEGAL

O trabalho objetiva demonstrar que a dependência de um centro local como Xambioá (TO) de duas cidades médias, a saber, Araguaína (TO) e Marabá (PA), localizadas na Amazônia Legal, oferece consequências graves durante a pandemia. Nesse sentido, apesar do município se encontrar fora do fluxo do capital, sua proximidade com as outras duas cidades o coloca entre os mais afetados pela COVID-19 no estado do Tocantins. Para compreender tal contexto, foram realizadas discussões teóricas acerca da inter-relação entre as três cidades na região amazônica. Utilizaram-se dados dos boletins epidemiológicos das secretárias de saúde e do Monitora-COVID (FIOCRUZ, 2020). Os resultados mostram que a disseminação do vírus em Xambioá se comportou de forma semelhante à da cidade de Araguaína, com alta incidência e picos mais elevados que os das duas urbes de médio porte. Os resultados alertam para a gravidade da situação, uma vez que o município não dispõe de equipamentos de saúde capazes de atender à demanda provocada pela complexidade dos casos, chamando para um debate acerca das reorganizações das cidades com foco na melhoria da qualidade de vida e do bem viver das pessoas e da coletividade.

Palavras-chave: COVID-19. Amazônia Legal. Xambioá-TO. Cidades médias.

COVID-19 EN LA AMAZONIA LEGAL

El trabajo tiene como objetivo demostrar que la dependencia de un centro local como Xambioá (TO) en relación a dos ciudades medianas, a saber, Araguaína (TO) y Marabá (PA), ubicada en la Amazonia Legal, ofrece graves consecuencias durante la pandemia, porque a pesar de ella se encuentrar fuera del flujo de capital, su proximidad a las otras dos ciudades la hace entre las más afectadas por COVID-19 en el estado de Tocantins, Brasil. Para comprender este contexto, se llevaron a cabo debates teóricos sobre la interrelación entre las tres ciudades de la región amazónica y se utilizaron datos de los boletines epidemiológicos de los respectivos departamentos de salud y el Monitora-COVID (FIOCRUZ, 2020). Los resultados muestran que la propagación del virus en Xambioá se comportó de manera similar a la de la ciudad de Araguaína, con una alta incidencia y picos más altos que los de las otras dos ciudades. Los resultados alertan sobre la gravedad de la situación, ya que el municipio no cuenta con equipos de salud capaces de satisfacer la demanda causada por la complejidad de los casos, lo que llama a un debate sobre las reorganizaciones de las ciudades con un enfoque en mejorar la calidad de vida y el bien vivir de las personas y de la comunidad.

Palabras-clave: COVID-19. Amazon legal. Xambioá-TO. Ciudades medianas.

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INTRODUCTION

In late 2019, the world received news of a disease spreading rapidly in China, which subsequently escalated into a global health crisis. COVID-19's rapid transmissibility has required governments to organize preventive and remedial measures to contain and mitigate deaths. Despite being a new and little-understood disease, some issues are apparent in the process of the current pandemic, including political factors, economic capacity, health and prevention systems and supplies, and regional characteristics (FREITAS; NAPIMOGA; DONALISIO, 2020).

The advent of the geography of health has challenged the notion that disease is only linked to the biological field by showing that the emergence and dissemination of illnesses are related to physical local, climatic, social, and economic factors (JUNQUEIRA, 2009). During this international emergency, decreed by the World Health Organization (WHO), it is clear that ideological and geopolitical disputes occur in the sphere of relationships between countries, as they compete for research, inputs, and vaccines, demonstrating the extent of a virus' influence (VENTURA et al., 2020).

There is a crisis of contemporaneity and capital's domination of life evidenced by the pandemic, such as the difficulties of social isolation in peripheral areas, inadequate housing, lack of access to sanitation, and fragile educational standards, which hinder the incorporation of new health etiquettes. Thus, COVID-19 is a catalyst that condemns the social ills established by economic regulatory frameworks that allow goods and viruses to circulate, but not an equitable flow of wealth (SENO; POCHMANN, 2020).

From this perspective, Becker (2013) demonstrates that capital's regulation of the Amazon has structured a small number of key cities to control and exploit the region. Thus, Araguaína, in Tocantins, and Marabá, in Pará, are strategic for agro-mineral exploration, establishing themselves as medium-sized cities due to their size and functionality. Between the two is the city of Xambioá, in Tocantins, a local center with few economic and service attractions (IBGE-REGIC, 2020).

Guimarães's (2020) thesis about the pandemic in Brazil, which considers that the virus takes the same path as capital, would expect Xambioá to be off the virus' route and less affected by the health crisis. However, this is not the case as the city ranks third in the incidence of cases in the State of Tocantins, with the first being Araguaína and the second being the state capital, Palmas. Thus, we hypothesized that proximity and dependence on two medium-sized cities with vigorous economic activity have favored the virus' spread in the locality.

In methodological terms, data from the epidemiological bulletins of the State of Tocantins, the respective city halls, and the Monitora-COVID (FIOCRUZ, 2020) were used to verify the behavior of the pandemic in the two medium-sized cities (Araguaína and Marabá) and the local center (Xambioá). They were processed by statistical analysis, with a date-paired comparison between means of the number of new COVID-19 cases, the T-Test and a significance level of 5%, the standard for statistical studies in social sciences

In addition to the introduction and final considerations, there are three parts to the study. First, the analysis of the configuration and interdependence between the cities addresses their location and health infrastructure, followed by a debate about the city as a product of capital and the humanized city. The third part presents the research's results and discusses the urban hierarchy.

THE CONFIGURATIONS AND INTERDEPENDENCE BETWEEN CITIES

Urban network studies have a considerable theoretical and empirical trajectory, which intersects with bodies that support the development of public planning policies in Brazilian cities. Vieira (2011), Conte (2014), and Alvim (2017) refer to Christaller's (1933) Central Place Theory as one of the early milestones in the debate that Alvim (2017, p. 3) calls "an urban and regional theory, which allowed the identification of distinct levels of central places based on the relative importance of places in their region." The publication of the series on the Characterization and Trends of the Brazilian Urban Network (IPEA; IBGE; UNICAMP, 2001) strengthened the discussion about the network of Brazilian cities, facilitating the following definition:

> [...] an urban network in which it is possible to observe the existence of an urban hierarchy, after all, because some cities are better equipped and have a differentiated and more diversified functional structure, they occupy superior hierarchical positions, becoming a reference in the region. (ALVIM, 2017, p. 3)

The choice of the three cities for this research presupposes different hierarchical typologies. Araguaína (TO) and Marabá (PA) have estimated populations, for 2020, of 183,381 of 283,542 inhabitants, respectively. They are classified as medium-sized cities and Regional Capitals C (IBGE-REGIC, 2020) due to their population and their role in their respective regions. The third city, Xambioá (TO), is classed as a Local Center (IBGE-REGIC, 2020). It has 11,520 inhabitants and is 140 km away from Araguaína and 164 km from Marabá.

This study hypothesizes that although the urban hierarchy and regional dynamics imposed by the BR-153 highway, which cuts across the three cities, make Araguaína, the second most populous municipality in Tocantins, and Xambioá the twenty-third, according to the Tocantins Bulletins, they are ranked first and third respectively for COVID-19 contamination; the capital Palmas is in second place. This hypothesis strengthens the observations made by an IPEA study dedicated to urban networks that considers that road traffic "contributed to the creation and consolidation of new vectors of penetration and circulation in the interior and between regional spaces" (IPEA, 2001, p. 41).

The two medium-sized cities, Marabá and Araguaína, are on the mineral-agricultural frontier, which gives them regional prominence. It is worth mentioning that some of their dynamics result from the Program of Agricultural, Livestock, and Mineral Poles.in Amazonia, or POLAMAZONIA, implemented by the federal government in 1974, which reinforced the expansion of agriculture and mining to national and global markets, based on cutting-edge scientific parameters, as described by Santos (2000). Thus,

> [...] Brazil's new agricultural frontier is composed of the region formed by the States of Maranhão, Piauí, and Bahia, and the whole of the territory of Tocantins, known by the acronym MAPITOBA. This region has 31 microregions. In addition to this area, the Southeast of Pará has also been the focus of the country's agricultural expansion, which includes seven microregions on the border with Tocantins. (BECKMANN; SANTANA, 2019, p. 84)

The regional context gives these cities centrality, and Gomes Jr. (2014) makes the following observation about Araguaína:

> [...] we consider that the city of Araguaína, as well as exercising centrality in its region of immediate influence through processes linked both to the agricultural expansion of the frontier and processes related to services and trade, is also placed as this region's primary interconnection between the flows of other economic centers in Brazil and the world. (GOMES JR., 2014, p. 13)

In turn, Marabá has a central role due to the Grande Carajás Project or PGC, the large-scale mining projects implemented in the Amazon in the 1970s and 1980s. This policy resulted in the installation of the Companhia Aços Laminados do Pará, ALPA, and the population growth in the 1991, 2000, and 2010 demographic censuses, which exceeded state and national rates (CARVALHO; SOUZA, 2018; MONTE-CARDOSO, 2018; MONTEIRO, 2005).

Medium-sized cities occupy a relevant place in the Brazilian urban political order, and, according to the IBGE (2017), both Araguaína and Marabá give their names to immediate and intermediate geographical regions. Furthermore, IBGE (2018) measurements of population displacements in search of low and medium complexity health services show that Tocantins and, particularly, Araguaína have different dynamics from those observed in the Northern region of Brazil.

> The urban network of the North and Center-West Regions have equally high displacement averages (276 km in the North and 256 km in the Center-West) marked by the flow directed to the capitals, with almost no secondary poles. The exception is Tocantins, whose cities are attracted by both Palmas (TO) and Araguaína (TO) and the population arrangement of Imperatriz / MA, whose influence reaches the southwest of

Maranhão, northern Tocantins, and southeast of Pará. (IBGE-REGIC, 2018, p. 111)

Figure 1 shows the study area; the three cities are crossed by the BR-153 highway and are located at the convergence of the northern regions of the State of Tocantins and southeast of Pará.

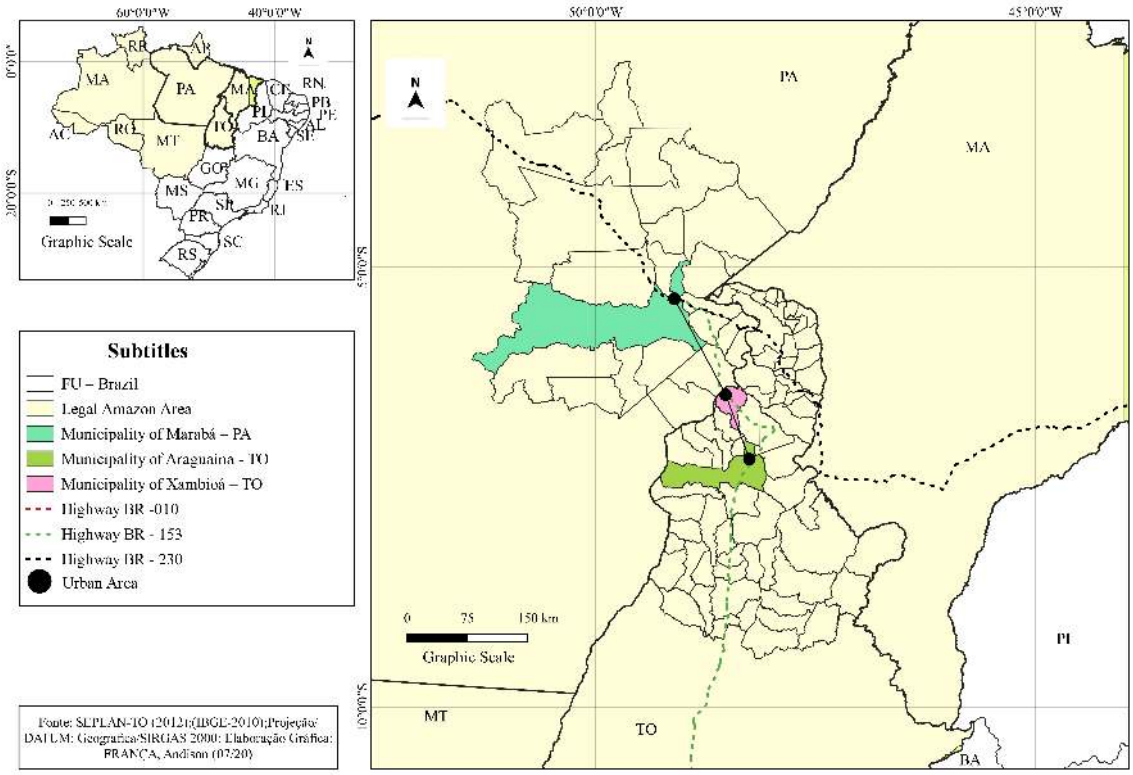

Figure 1 – Araguaína, Xambioá and Marabá in the BR-153 corridor.

In this context, on 06/06/2020, the public administration of Xambioá issued a statement to a local news portal attributing the 2,110% growth in COVID-19 cases in the city in less than 30 days to four factors. Two of them support our hypothesis. First, Xambioá borders the State of Pará and is intersected by the BR-153 federal highway, and second, Araguaína is the administrative center of reference for Xambioá's population (AFNOTÍCIAS, 2018). It is noteworthy that on the date of publication, Xambioá ranked third among the 139 municipalities in Tocantins for the number of cases of people infected with COVID-19.

To support our argument, Table 1 below shows the public health management in the State of Tocantins from Law 8080 (BRAZIL, 1990), which institutionalizes regionalization as one of the organizational axes of the Unified Health System.

Year	Action
1988	Creation of the State of Tocantins
2002	The first regionalization of health provision in the state, the Regionalization Master Plan – RMP, was defined. Two macro-regions, Araguaína and Palmas, and six microregions are structured.
2007	The regionalization of health services is redesigned: 15 health regions are created and Regional Management Collegiates are instituted.
2012	New restructuring of health regions: from 15 to 8.
2018	Two health macroregions are proposed and approved: Macrorregião Norte and Macrorregião Sul

Table 1 – History of health regionalization in the State of Tocantins. Adapted from the State Health Department of Tocantins (2020a).

Araguaína and Xambioá are part of the Middle North Araguaia Health Region, covering 17 municipalities, with the former city as a reference. In 2019, the IBGE estimated the region's population at 301,862 inhabitants, which corresponds to 19% of the State's population. The average distance to the regional health reference is 95 km (IBGE-REGIC, 2020), and the distance between Araguaína and Xambioá is 118 km, as shown on Figure 2:

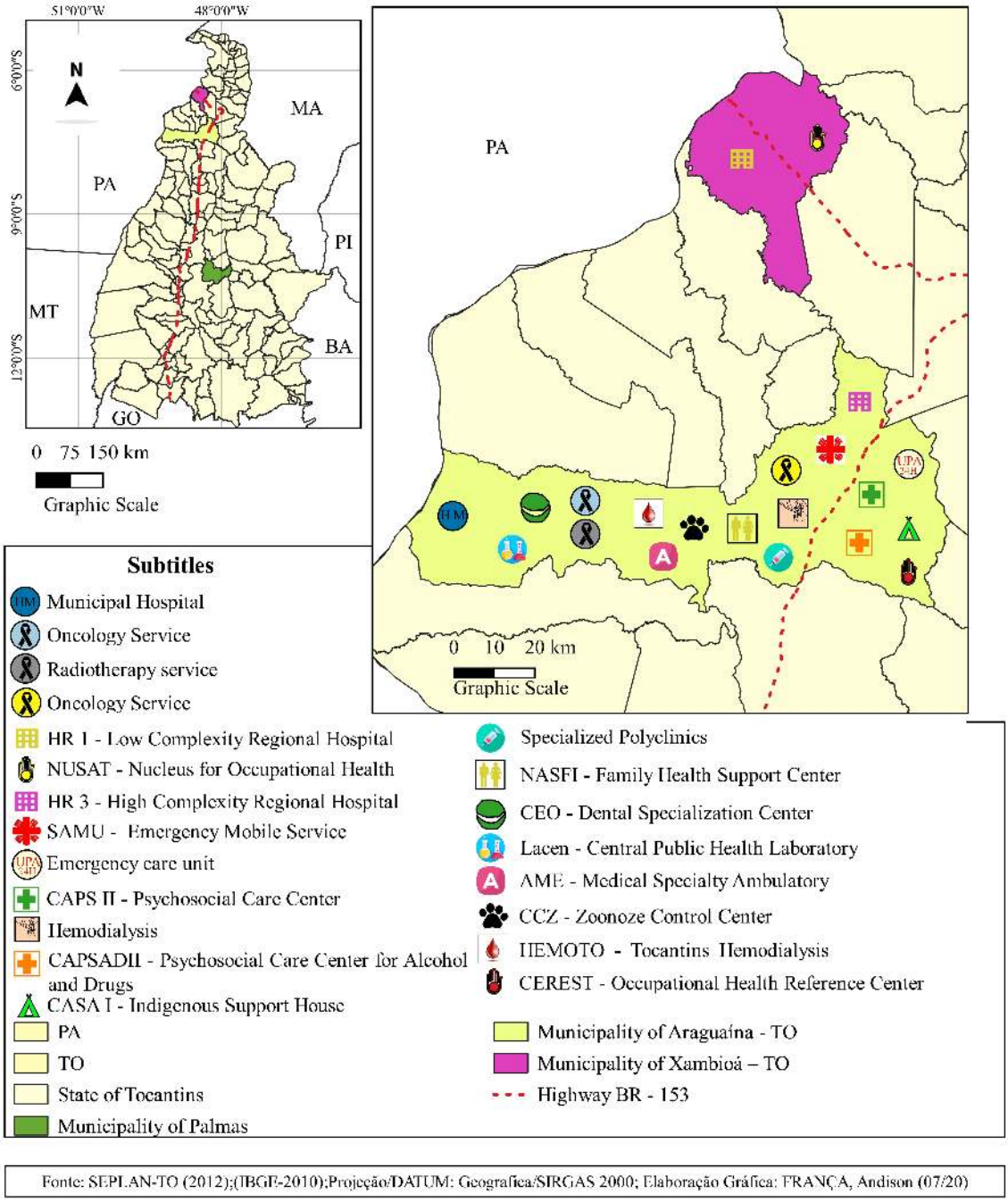

Figure 2 - Health facilities in Araguaína and Xambioá.

Medium and high complexity health facilities are concentrated in Araguaína. At the same time, Xambioá has only one 28-bed low complexity hospital and no ICU (SESAU-TO, 2020b), which has aggravated the population's lack of access to high-complexity beds during the pandemic. According to SESAU-TO (2020b), the Regional Hospital of Xambioá (HRX) provides services to the cities of Araguanã, Carmolândia, Piraquê, Wanderlândia, Darcinópolis, Angico, Cachoeirinha, and Ananás, as well as cities in Pará, such as São Geraldo and Piçarra. Acting as a health reference even for smaller

cities has worsened Xambio's public services' precarious situation. Thus, when these municipalities' population needs high complexity care, they resort en masse to the city of Araguaína.

Xambioá is considered a Local Center, so its influence is restricted to itself (IBGE-REGIC, 2020). Despite its pleasant appearance, the city has a high social vulnerability, and only 11.9% of the almost 12 thousand residents have an occupation (equivalent to 1,371 people); per capita income is half the monthly minimum wage. Located in the Amazon biome, afforestation is over 93%; however, only 1.1% of public roads have been urbanized (IBGE-CIDADES, 2018). It is a small city with few urban facilities, but in the current pandemic it is influenced by medium-sized cities that are strategic for capital.

HUMANIZED CITY X CAPITAL'S CITY

The COVID pandemic has concentrated the debate on the relativization of the supposed benefits of a liberal economy focused on free trade and the reduction of state mediation. There are several aspects to this discussion. Firstly, work is central to social relations; workers merely remaining at home is enough to cause a considerable economic crisis. Second, the current crisis' severity is due to the poor distribution of resources and not to the disease since the aggravating factors are most people's living conditions. Third, the market needs state regulation because paradoxically, it turns to the government for assistance in times like the current emergency. In other words, the health crisis is a moment for reflection on the need for capital to submit to politics, which in turn must submit to human life (OLIVEIRA; MACHADO; SORRENTINO, 2020; POLANYI, 2000 [1944]).

In this logic of capitalist contradictions, we should consider the vision of the city that we want. The debate revolves around the type of economic development needed at this crucial moment when neoliberal ineptitude is evident.

> The coronavirus has promoted the multiple failures of the capitalist system. The defensive wall for its actions has fallen. The need for reforms, cost-cutting, meritocracy, and entrepreneurship as alternatives to regulated and fair work, the lack of priority in combating inequalities, such as a public health system, are among the theses supporting hitherto "socialist" agendas like basic income and a strong and active state [...]. (CASTRO; SENO; POCHMANN, 2020, p. 8)

The result of neoliberal policies, illustrated on television by coffins being loaded on Italian army trucks, demonstrated what Castro, Seno, and Pochmann (2020) call "scorched earth" policies: The lack of investments in health and the impossibility of halting economic activities without disrupting the system, has shown that human beings are secondary in the economic process. Souza (2020) argues that it is precisely the poorest who are most affected by the coronavirus due to inequalities. Hence, it is necessary to differentiate between the city as a product to meet market interests and the humanized city.

National Integration Plans, like those implemented in the Amazon region during the civil-military dictatorship, were intended to create networks of strategic cities, attracting labor and companies through tax incentives. The State's selection of cities' locations and which companies would be established were part of the regime's control strategy. In the study region, this interference is apparent, since first there was a need to combat the Guerrilha do Araguaia (1972-1975) and then prevent new opposition groups to the regime emerging (CAMPOS FILHO, 2013).

Due to the need for territorial control and exploitation of wealth, the region that was initially occupied spontaneously now has substantial state control. Becker (2013) argues that an urban frontier is formed long before the agricultural frontier. The use of urban centers to exploit natural resources and their vigorous expansion led the author to call the region "urbanized forest" (BECKER, 2013).

Becker (2013) also contends that the work carried out by the original peoples, such as the indigenous tribes, of the use of the land and its resources, was appropriated by new arrivals in the region, who merely coupled new forms of exploitation and international exportation, generating the depletion of natural resources. Furthermore, it is noteworthy that even with the wealth produced, the urban centers remain poor since they are not organized to become independent of external products. "[…] historically, the economy of the nuclei has been dominated by economic monopoly and the public

power of the world economy's big cities" (BECKER, 2013, p. 39).

The characteristics of Amazonian cities and, specifically, the three cities studied here did not promote social justice or provide basic services, such as health, for most of the population. Although Xambioá does not have the necessary infrastructure required by capital it is not isolated. On the contrary, the city is part of the unequal flow of resource exploitation, in which its goods leave without returns to the resident population, and its access to services is hundreds of kilometers away, as it is for almost the entire Amazonian population. Local centers, such as Xambioá, have a high informal employment rate and, consequently, have high social vulnerability and dependence on resource transfers from the Union (BECKER, 2013).

During the pandemic, the virus followed capital's path (Guimarães, 2020), reaching Araguaína and Marabá with intensity. Both cities recorded their first COVID cases after the capital cities in their respective states. Araguaína ranks ahead of the capital Palmas in the pandemic, while although Xambioá is outside the main flow of capital, it has significant exchanges and flows with two nearby medium-sized cities and, consequently, has been strongly impacted by the coronavirus. Thus, the virus has affected everyone, but the differences between the cities mean they face it very unequally. In this context, the humanized city should be considered.

Maricato (2015) and Gehl (2015) promote the need to transcend urban planning restricted to meeting the demand of limited specific groups representing the elite. Instead, they defend a city for the people, in which some values are sovereign. The city cannot be a commodity to be sold to the forces of capitalism. It must be organized to promote life, based on structural urban transport, housing, and sanitation policies, added to agroecological transition policies that allow environmental sustainability (VENTURA, 2020).

Therefore, based on a global health structure that involves the objectives of city planning and the use of natural resources, we believe that it is possible to compose a society in which people and the environment come first.

THE URBAN HIERARCHY AS A DISSEMINATOR OF COVID-19

This section presents comparisons and possible causes for the high number of COVID-19 cases in Xambioá, based on data from Monitora-COVID (FIOCRUZ, 2020) and the municipal and state health departments.

Initially, Table 1 presents a date-paired comparison between the average numbers of new COVID-19 cases. In this case, the comparison is between absolute frequencies involving pairs with the three cities. The significance level of 5%, the standard for statistical studies in social sciences (HAIR et al., 2009), was the parameter employed to assess whether the averages are different or not.

City pairs	Significance probability (*p-value*)	Test result (at 5% significance level)
Araguaína-TO vs. Marabá (PA)	7363	Equal averages
Araguaína-TO vs. Xambioá-TO	3.5299×10^{-15}	Different Averages
Marabá-PA vs. Xambioá-TO	8.3298×10^{-9}	Different Averages

Table 2 – comparação entre médias (Teste-T para dados pareados) até 18/07/2020 – comparação de frequências absolutas.

Thus, Table 2 shows similarities between the numbers of new cases for the cities of Araguaína-TO and Marabá-PA. Possibly this is due to the functionality they both exert as Regional Capitals C and references for displacement in search of services, health, and education, as well as the national and international commodities flow.

Figure 3, below, shows the three series of new cases of COVID-19 compared in terms of absolute frequency.

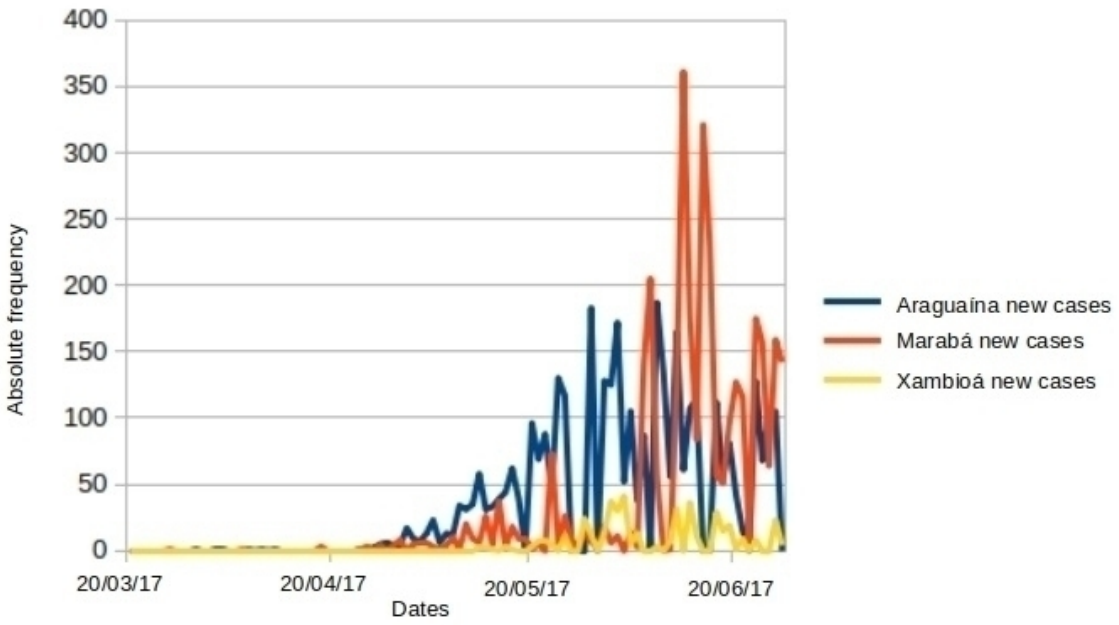

Figure 3 – New cases of COVID-19 - absolute frequency. Source: Research data

Figure 3 indicates that the peak of new cases was much higher in Marabá around the pandemic's eightieth day. One possible reason for this peak was the deficit of existing sanitation services in the municipality. According to the Brazilian Association of Sanitary Engineering (2020), Marabá ranked lowest for basic sanitation among Brazilian cities in the sample set of the survey, which involved 33.33% of the municipalities that provided all the necessary indicators to calculate the basic sanitation index.

In Table 2, below, the numbers of cases per 100,000 inhabitants in the three cities studied are compared in pairs by date.

City pairs	Significance probability (*p-value*)	Test result (at 5% significance level)
Araguaína-TO vs. Marabá (PA)	0.0013	Different Averages
Araguaína-TO vs. Xambioá-TO	0.0705	Equal averages
Marabá-PA vs. Xambioá-TO	0.0036	Different Averages

Table 3 – Comparison between means (T-Test for paired data) until 07/18/2020 - comparison of absolute frequencies

The table presents a closer relationship between Xambioá and Araguaína, as the proportional growth in the number of cases occurred at approximately the same pace in this pair. According to Guedes and Brito (2018), the city of Araguaína acts as an economic and logistical pole for its microregion, including Xambioá, validating our thesis that the cities' influence for capital is high in the relationship between the two municipalities.

Figure 4, below, shows the time series of new COVID-19 cases per 100,000 inhabitants since the beginning of the pandemic.

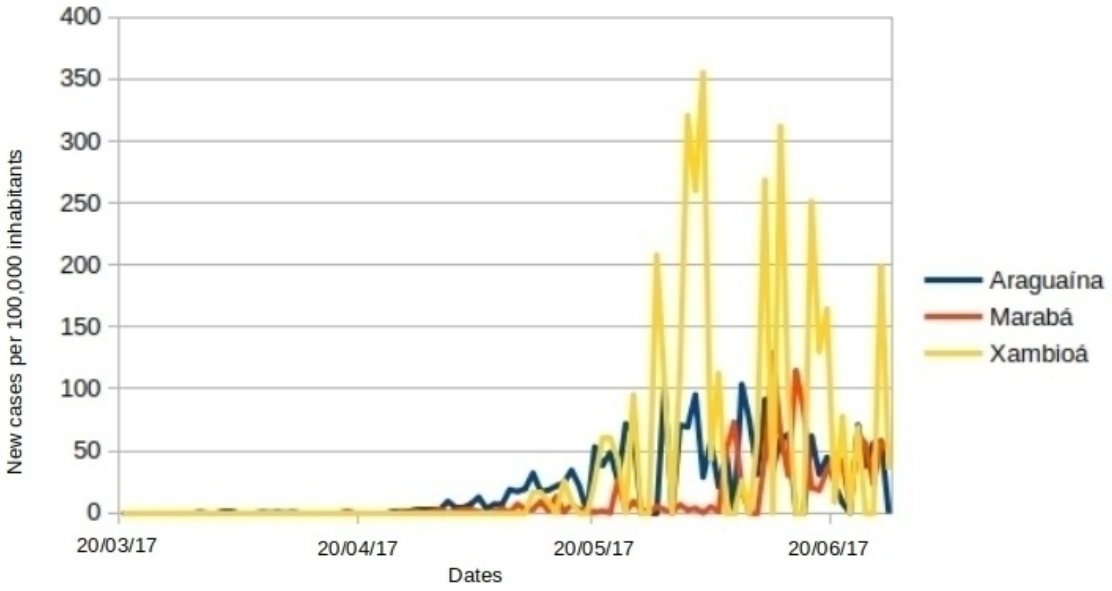

Figure 4 – New cases of COVID-19 per 100,000 inhabitants. Source: Research data.

PIt is evident in Figure 4 that, proportionally, Xambioá had a much higher peak in cases than the two medium cities in its vicinity, which is explained by several factors. In Xambioá's Municipal Human Development Index, the employment and income indicator is at the critical level of 0.3271, a significant drop from 0.5205 since 2006 (FIRJAN, 2018a). This fall has resulted in more precarious work relationships and informal occupations where effective social distancing is practically impossible. On the other hand, the municipal HDI's health indicator has been at a high level (0.6582) since 2014 (FIRJAN, 2018b), which may have cushioned the pandemic's impact in the municipality. The city of Xambioá is not included in the Brazilian Basic Sanitation Ranking of the Brazilian Association of Sanitary Engineering (ABES, 2020). However, a joint initiative by FIOCRUZ, FUNASA (National Health Foundation), UFMG, and the cooperative EITA (Education, Information and Technology for Self-Management) mapped basic sanitation indicators in small Brazilian municipalities.

The data collected can be found on the INFOSANBAS (Basic Sanitation Information) portal (2020) and indicates that 64.9% of Xambioá's population lives in the urban area. In terms of water supply, 35% of the rural population obtains water from wells or springs on their property, while 11% reported using an alternative source to the public supply network. According to Scorsafava et al. (2010), water supply by wells or springs does not have reliable water potability indicators, damaging health. Regarding waste collection, only 58% of garbage is collected from rural properties, indicating that 38% is burned inside the properties. According to Pereira et al. (2017), burning solid waste has harmful effects on the surrounding residents' health. In the same municipality, 5% of urban households and 18% of rural houses do not have a bathroom for their exclusive use. Also, sewage disposal occurs through rudimentary cesspits in 77% of urban and 65% of rural households. In urban households, 8% of the sewage was removed by ditches and 7% by septic tanks, while in rural households, the figures were 10% and 5%, respectively. Xambioá's fourteen schools also use septic tanks. According to Conforto (2000), adequate sewage systems are preponderant for disease prevention.

According to SESAU-TO (2020c), there were 552 accumulated cases in Xambioá on 07/31/2020, with a total of eight notified deaths so far. This mortality rate (1.4493%) is slightly higher than the death rate of notified worldwide (1.3825%) (WORLDOMETER, 2020), which may mean underreporting of COVID-19 in the municipality. Furthermore, there is evidence of low testing across Brazil, hampering timely action against the pandemic (BOMFIM, 2020).

CONCLUSION

This study's objective was to demonstrate that a local city like Xambioá (TO) suffered intense

impacts from the spread of the virus due to the influence of two nearby medium-sized cities. However, the data showed that its behavior only resembles that of Araguaína, evidencing its flows, exchanges, and dependence on a city with more urban facilities.

Although Marabá contributed to the spread of the virus in the municipality, as shown by the alarming peaks of the disease in Figure 4, in Xambioá and Araguaína the virus behaved similarly. The results indicate the consequences of Amazonian cities' organization based on networks serving capital. There are few thriving cities designed to serve local elites and the production chain's requirements, consequently aggravating the pandemic's effects. In the specific case of Xambioá, its proximity to Araguaína gravely exposed it to the pandemic, without the counterpart of generating improvements in living conditions and mitigating the city's fundamental problems.

The present crisis poses a contradiction: while capital only focuses on profit, it depends on "life production processes and institutions." It is subject to healthy human beings to work, who depend on housing, food, transportation, and other elements. On the other hand, capital needs to examine cities' organization, the locus of life and work, and think about their reorganization to guarantee the flow of production of surplus-value. It is impossible to deny capital's strength in organizing life, but a new hierarchy of priorities is necessary, prioritizing the right to a decent existence.

An extension of this research should include other cities along the BR-153 highway and cities where the pandemic took longer to arrive to observe the relationship with road transport. The relationship between local political decisions related to social isolation and their impact on the number of cases would also be worth studying.

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