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# Dimensions of geographical access to health in the COVID-19 pandemic in the Amazonas territories, Brazil

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## **Abstract**

This is a study of geographic access to health during pandemic of COVID-19's setting in the Amazonas areas. The objective of this paper is to reveal the lack of public health systems in the state. The methodological procedures included a survey information about COVID-19 and physical resources of municipals areas from Amazonas. The quantitative data analysis was organized, processed and imported into geoprocessing software. The obtained results indicated that is important to make a geographic model for health according to Amazonian areas. It has been considered their physical characteristics and the urge to implement a productive-technological health structure based on the pattern of local morbidity and mortality. Therefore, it is an imperative matter to plan the health system of Amazonas under suitable health locations. This issue have a link to the others levels of care based on the networks and the causality of the health situation supported by the singularities of its territories. The state may explain how the geographic access to health is contradictory

## **Keywords**

Access, Geography, COVID-19, Amazonas.

## **Introduction**

The first forms of geographical access to health in Amazonas, Brazil, occurred by indigenous practices, exclusive up to the deployment of the Real Hospital de Capitania de São José do Rio Negro in the eighteenth century, located in the current municipality of Barcelos and later transferred to the city of Manaus, following the health expeditions in the state (Schweickardt, 2011).

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The need for geographical access to health became more evident in Amazonas during epidemics such as smallpox, measles, and cholera, among others, providing visibility to the absence of public policies directed at the health of the traditional populations of the state. These diseases found an environment with anomalous climate and dense forests, characteristic of the Nature Domain in the Amazon, revealing the limited river and land access at different times of the year. The Physical Geography of the region was associated with the lack of resistance from the indigenous population to "white man diseases" and the lack of hospitals, especially in the state interior (Loureiro, 2004).

Three centuries after the implementation of the first hospital in Amazonas, the problem of geographical access to health persists. Currently, the city of Manaus concentrates over 80% of the health equipment and physicians offered in the state, with the exclusive offering of high-complexity services, while the other municipalities gather only the medium and low-complexity health services (CNES, 2020; Amazonas, 2020a).

The population living in the other Amazonas municipalities often resorts to the state capital in search of high-complexity health services, not obeying the current territorial health planning, which leads to the overload of health establishments in the city of Manaus (Anjos, 2018; Amazonas, 2020a). Added to the long distances and duration of trips from the state interior to the capital, which influence the high costs of the displacements, this health situation in the state characterizes a picture of health iniquities in the Amazonas territories.

Considering this context, this work aims to present a Health Geography study, highlighting the concept of geographical access to health devised by Anjos (2018) and employed in the Amazonas territories, revealing the problem of this access during the COVID-19 pandemic, which made evident the shortfall of the public health system in the state in the twenty-first century.

## Methodology

The methodological procedures involved surveying secondary data and geoprocessing techniques. We used the COVID-19 lethality rate up to November 11, 2020, extracted from the Health Surveillance Bulletin (2020) of the Health Surveillance Foundation (FVS, from the Portuguese *Fundação de Vigilância Sanitária*), the number of respirators, and the complexity of the health care at the municipality scale and Health Region scale, retrieved from the National Registry of Health Establishments (CNES, from the Portuguese *Cadastro Nacional de Estabelecimentos de Saúde*) (CNES, 2020).

The quantitative data were organized and processed in Excel spreadsheets and later imported into the QGIS 3.0 software with the purpose of spatializing the data in the shapefile format. The union of the numerical data with the shapefiles resulted in the elaboration of choropleth maps and proportional symbols.

Choropleth maps "are used to describe relative or normalized quantities". In this work, the values of the variable "lethality rate" of COVID-19 for the Amazonas municipalities and the differentiation of the Health Regions were considered. In proportional symbols maps, the weights 1, 2, and 3 were used to represent the low, medium, and high-complexity levels, respectively. The data from the epidemiological bulletins were spatialized and contextualized with the theoretical background regarding the geographical access to health and news articles of the COVID-19 scenario in the Amazonasterritories.

## Geographical access to health as an assumption of territorial health planning

To Santana (2005) and Anjos (2018), the geographical access to health results from the combination of various characteristics that compose the Geography of places, with emphasis on the geographical barriers and use of health supplies in a timely manner by health service users regardless of the particularity of the territory.

Research on geographical access to health precedes the institutionalization of Geography as a science, evinced primarily in the works by Finke, in 1792, in pre-unified Germany, when he proposed the Geography of medical care in the performance classification triad, being consecrated the pioneer in health service Geography studies (Mazetto, 2008). In this context, Foucault (1986) highlighted that Finke's work represents the first step in creating a social medicine, i.e., a State medicine. However, Mazetto (2008) clarified that most health services made available by the State up to the nineteenth century were reserved for those wounded in war, not reaching the other social classes.

The health services inserted at the core of social issues "[...] would only take shape at the end of the nineteenth century with the socialist revolutions and the organization of the proletariat in class entities" (Mazetto, 2008, p. 24). To Santana (2014), the circulation and concentration of people in cities from the eighteenth and nineteenth centuries revealed more significant contrasts of social and economic differences, indicating poor results in health, primarily due to the considerable numbers of avoidable deaths due to cardiovascular diseases, malignant tumors, and accidents involving transport.

The epidemiological transition of infectious diseases to chronic-degenerative diseases changed the way of understanding health beyond the ecology of diseases, boosting the need to plan health care directed at the general population (Guimarães, 2015). The demographic and epidemiological transition that occurred since the great revolutions instigated the deployment of new themes and methodologies in the discussions of Health Geography, mainly due to the growth of the urbanization process and new spatial models of occupation.

In this sense, since the 1960s with the change in the morbimortality pattern in different continents, the discussion of the access to health care in Geography received the influence of Theoretical Geography through quantitative analyses influenced by spatial models and the diffusion theory by physician Jacques May (Catão, 2019), the Central Place Theory by Walter Christaller (Dory, 1990), the locational analysis in Human Geography by Haggett (1977), and the influence of behaviorism (Nogueira, 2008), configuring as landmarks that contributed to the understanding of health studies connected to locational theories (Pyle, 1969).

In this context, it is worth stressing that the post-war world revealed the social inequalities among central and peripheral countries, especially health care, indicating the emergency of health awareness to achieve development in different places and the hunger issue\* (Santana, 2016). The emergence of a new rereading of health in space inserted different actors into the discussion on the right to health, such as sociologists, economists, historians, anthropologists, geographers, jurists, and representatives of the organized civil society (Guimarães, 2015), the interdisciplinarity of which played an essential role in international conferences aimed at the health of populations, namely the Alma-Ata Conference

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\*In Brazil, around the 1950s, the work by Josué de Castro entitled "Geografia da Fome" managed to gather geographical and health knowledge, presenting the regional inequalities in access to food.

(1978) and the Ottawa Conference (1986) organized by the UN, which initiated the discussions about the concepts of public policies and intersectoral action for health aimed at access to health.

From the acknowledgment of the importance of space and technique in the health and disease situation, one verifies the problem of geographical access to health services, starting from the geographical principle of the "location" of the health establishments and their association "[...] with phenomenon related to health inequities, concretely to the causal multiplicity of the patterns of disease and 'avoidable' deaths, and also to the relationship among health, well-being, and development [...]" (Santana, 2014, p. 16).

The determination of the importance of territory in the ordering of geographical access to health inspired studies on territorial health planning in different parts of the world from multiple areas of knowledge. In the Northern Region of Brazil, studies by geographers Oliveira and Shor (2013), Anjos et al. (2019), Anjos (2018), and Aleixo et al. (2017; 2020) stand out.

It should be highlighted that the Northern Region covers over half of the Legal Amazon in its territory, with Amazonas being the largest state in territorial extension and indigenous and rural population in the country, with the population dispersed in its territory. In this sense, the human occupation pattern, associated with the physical aspects of the state and the concentration of health establishments in the capital due to spatial selectivity, produces networks of geographical access to health and marginalized territories, evincing singularities and contradictions in the Amazonas territories.

### **The networks of geographical access to health in the Amazonas territories: singularities and contradictions**

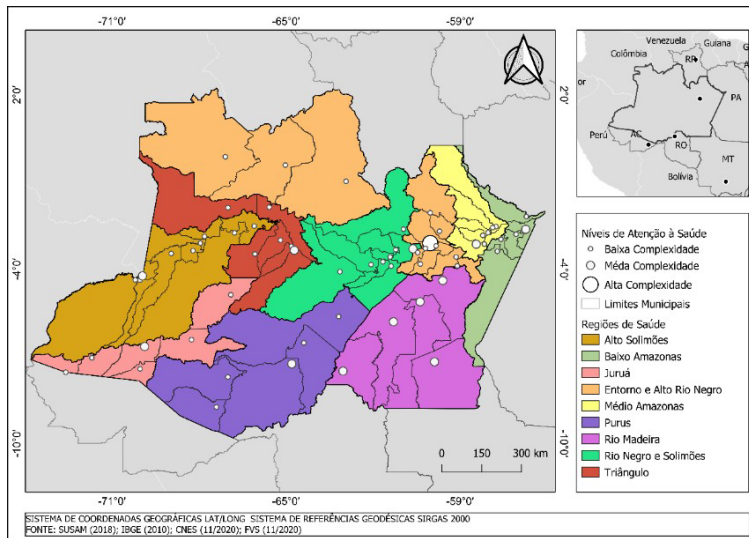
The conception of territory is related to the appropriation of a fragment of the geographical space by the power relations, formed by different economic, political, and cultural structures; by lines, denominated networks; and by points (nodes) designated as "place" (Raffestin, 1993). According to Dias (2000), the connections are present in the networks, while the points (nodes) represent the places with attraction power functions.

The understanding of the territory and networks may be articulated in the studies on geographical access to health from investigations of the Health Care Networks. Health Care Networks are organized in different health structures, covering places that offer Primary Health Care services, considered the entryway to the Unified Health System (SUS, from the Portuguese *Sistema Único de Saúde*), followed by spaces that offer the medium-complexity services and places that offer high-complexity services, representing the most considerable technical diversity of the network.

The accommodation of the productive-technological health structure at unequal points in the territory produces different places of attraction for those seeking health care, producing multi-territorialities of access to health (Haesbaert, 2002). To Santos (1996), the power relations may be distinct, fragmented, and inscribed at different scales according to the techniques deployed in the territory, resulting from the heterogeneity from the intensity and differentiation of the productive-technological structure.

This productive-technological structure heterogeneity pointed out by Santos (1996) and Haesbaert (2002) occurs in the health system of the state of Amazonas. The 62 municipalities that compose the state are organized into nine Health Regions, grouping three health care complexity levels (Figure 1).

The state capital covers all levels of care and exclusively the high-complexity services, such as the Amazonas Oncology Center Foundation (FCECON, from the Portuguese *Fundação Centro de Oncologia*



**Figure 1.** Health Regions of Amazonas, Brazil

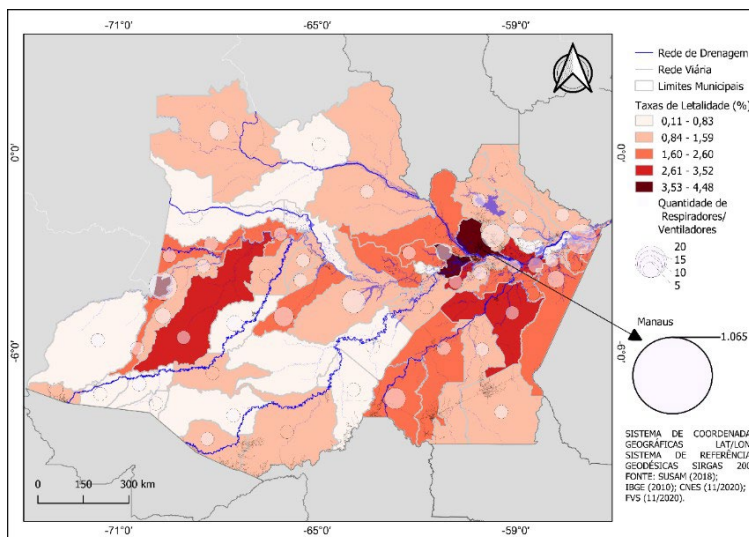
The health users who reside in the municipalities that offer low-complexity health services need to dislocate to the medium-complexity "nodes" of the Health Region they are part of or to the state capital if the health situation requires specialized care, originating different networks of geographical access to health, as highlighted by Anjos (2018).

It is worth noting that over 80% of the health equipment is concentrated in the municipality of Manaus, according to the National Registry of Health Establishments (CNES, 2020). Besides the equipment, about "[...] 93.1% of the physicians are in the capital, Manaus [...]". Of the total 4,844 physicians of Amazonas, 4,508 are in the capital, and 336 (6.9%) serve 61 municipalities scattered through an area of 1.57 million square kilometers (Scheffer et al., 2018).

This lack of structure of the health system was crystallized during the COVID-19 pandemic, placing the state capital among the four epicenters with the highest number of deaths caused by the virus (G1, 2020a). This situation is related to the low offer of health resources, and, according to Noronha et al. (2020), the lowest offer of beds and mechanical ventilation devices during the first wave of the pandemic was in Amazonas. The precariousness of the health system of the state was disseminated in all media at the national and international scale, especially due to the hospital Intensive Care Unit (ICU) beds being at capacity and the patient dependence on mechanical breathing, besides the increase in the waiting queue for the emergency services and the collapse of the burial system of the city of Manaus.

The 4,699 deaths<sup>†</sup> caused by COVID-19 in Amazonas could have been avoided if the hospitals were located closer to the population and had physical and human resources to care for the patients appropriately. However, it is observed that, after the chaotic picture that the state underwent in April and May 2020, the health planning directed at COVID-19 care, especially for patients in critical condition, is not prepared for a possible "second wave" of COVID-19.

In this scenario, it should be highlighted that, among the 1,241 respirators/ventilators available in Amazonas, over 88% are concentrated in the Manaus, Entorno, and Alto Rio Negro Region, with around 1,095 respirators/ventilators, followed by the Alto Solimões Region, with 41 respirators/ventilators and the Baixo Amazonas Region, with 29 respirators/ventilators (Figure 2). The health regions with the lowest number of respirators/ventilators are the Purus and Juruá Regions, with three and nine respirators/ventilators, respectively.



**Figure 2.** Lethality rate of COVID-19 and the number of respirators in the Health Regions of Amazonas, Brazil

Besides the necessary technical availability to care for the COVID-19 patients in critical condition, the lethality coefficient also serves as an indicator of the geographical access to health since it measures the proportion between the cases and deaths due to the disease, according to the Department of Health Surveillance (SVS, 2003). In this sense, the absence of physical and human resources to care for COVID-19 patients in critical condition increases the possibility of death and, consequently, the lethality rate.

Examining Figure 2<sup>‡</sup>, one may observe that Manaus has the highest lethality rate of about 4.48%. Under such a circumstance, the high-complexity establishments located in the municipality of Manaus

<sup>†</sup> Deaths counted up to November 16 by the Health Surveillance Foundation (FVS).

<sup>‡</sup> Municipalities that did not update the information on the COVID-19 cases: Carauari, Barcelos, Iranduba, Eirunepé, Benjamin Constant, Santo Antônio do Iça, Alvarães, Tapauá, Beruri, Uarini, Novo Aripuanã, Borba, Tonantins, Juruá, Careiro da Várzea, and Apuí.

served a population of over 2,182,763 people, besides receiving patients from the state interior due to the lack of infrastructure, primarily of respirators/ventilators, resulting in the strangulation of the health services in the city of Manaus, increasing the COVID-19 lethality rate.

Besides the capital, the municipalities of Tabatinga (Alto Solimões Region), Manacapuru (Manaus, Entorno e Alto Rio Negro Region), Santo Antônio do Iça (Alto Solimões Region), Manaquiri (Manaus, Entorno e Alto Rio Negro Region), Itacoatiara (Médio Amazonas Region), and Borba (Rio Madeira Region) disclosed high lethality rates of about 4.23%, 3.83%, 3.52%, 3.48%, 3.20%, and 3.06%, respectively.

It should be highlighted that the municipalities of Tabatinga, Tefé, Manacapuru, Parintins (Solimões River Channel), and Itacoatiara (Middle Amazon River Channel) encompass the medium complexity of the health system, i.e., besides being located at the bed of the main river, they offer closer health services to the population of the other municipalities that cover the low complexity of the health structure, justifying the high COVID-19 lethality rates.

The World Health Organization (OMS, 2020) estimates that the COVID-19 lethality rate is under 0.6%, i.e., far below the rate presented by the Amazonas municipalities. It should be noted that the municipalities that present lethality rates below 0.6% only have the low-complexity services, namely Anamá (0.11%) and Atalaia do Norte (0.28%), located in the Rio Negro and Solimões Region, Japurá (0.20%), established in the Triângulo Region, Envira (0.21%), Eirunepé (0.42%), and Ipixuna (0.49%), in the Juruá Region, Pauini (0.28%) and Tapauá (0.55%), established in the Purus Region, distant from the capital and at the state extremities.

These data suggest different interpretations: the first is related to the possibility of a low flow of people seeking assistance for COVID-19 in the said municipalities, given they are distant and of difficult access; the second perspective is associated with the undernotification of data and, consequently, the rise in cases of ill-defined deaths[2]; and the third understanding refers to the effectiveness of the health surveillance actions at the ports of the municipalities.

Regarding the first interpretation, it is interesting to stress that the networks of geographical access to health occur over a hermetic environment that covers the largest river basin on the planet and prominent biodiversity, the complexity of which is related to the location of the Amazon Forest near the Equatorial Line, where it receives a high incidence of solar radiation during the year, influencing a low thermal amplitude, characteristic of the equatorial climate (Fisch et al., 1998). Therefore, according to the physical characteristics of the state of Amazonas, associated with the large extension of the municipalities, unique geography is created, with specificities of the river access (Oliveira & Shor, 2013);

In this sense, Situba and Lacerda (2020) stated that the rivers established themselves as the leading contamination network for the most isolated cities in Amazonas. According to Noronha et al. (2020), Amazonas was the state that drew the most attention because of the distance that health service users need to travel to have access to assistance for COVID-19 in its severe form, with an average of 615 km traveled.

Anjos (2018) stressed that the Cartesian distance did not apply to the geographical access to health in Amazonas, given that the climatic and hydrographic conditions influenced the time and distances of the "come and go" of populations in search of health, namely the flood and drought events of the Amazon rivers. In dispersing from the state capital to the peripheral cities, COVID-19 also moves away from the "node" that covers the more significant availability of technical and human resources to a "node" that was

already precarious before the pandemic, without any capacity to receive a patient with the severe case of the disease.

For such, the municipalities that presented lower lethality rates have large proportions of rural populations diffuse in the territory and distant from cities, a geographical situation that could have corroborated to a negligible search for health services in the said municipalities, resulting in possible "deaths due to ill-defined causes", creating "subspaces of epidemiological silence".

The subspaces of epidemiological silence are created from the undernotification of data, especially the absence of physical and human resources at the health establishments (Anjos, 2017), a fact that contributes to the second interpretation, considering that the said municipalities are at the low-complexity level of health services hierarchy, except for Eirunepé, which establishes a "node" of medium complexity in the network.

The third understanding refers to the effectiveness of the health surveillance actions at the ports of the municipalities in fighting against the diffusion of the disease. According to the State Contingency Plan for Human Infection by the New Coronavirus 2019-nCov (Amazonas, 2020b), it is necessary to "articulate together with the state and municipal health surveillance the support to carry out activities in areas of ports, airports, and borders so to supplement the tackling of human infection by COVID-19, and that they use the same recommendations of the GIMTV/GGPAF/ANVISA Technical Notes in effect" (Amazonas, 2020c, p. 19). Besides the surveillance measures at the ports, the State Government suspended the river transport of passengers through State Decree No. 42087/2020 of March 2020, with the purpose of reducing the circulation of people on the rivers of Amazonas to prevent the interiorization of the virus (Amazonas, 2020c).

However, the municipal and state health surveillance actions did not prevent the arrival of COVID-19 to the Amazonas state interior, resulting in 102,785<sup>§</sup> confirmed cases of the disease, i.e., over 60% (102,785) of the COVID-19 cases in Amazonas affected over 47% of the population (1,961,834 inhabitants) distributed in 61 Amazonas municipalities. To Aleixo et al. (2020), the arrival of the virus was related to "[...] the infrastructure connected to the fluidity in the territory such as airports, highways, and ports, in the diffusion process of the disease. The airports and ports in the mentioned cities enable the disease to 'jump geographical scales'".

The failure of the municipal and state actions in fighting against the interiorization of COVID-19 is associated with the insufficiency of the inspection of river transport, influencing the emergence of clandestine transportation on the rivers of Amazonas (G1, 2020b) that took passengers from Manaus to the state interior without any prophylactic measure. According to Aleixo et al. (2020, p. 347), "[...] the large distances and limited access infrastructure that could hinder the diffusion of COVID-19 in the state contrasted with the way the disease expanded by river and air". Therefore, for the third understanding, which refers to the effectiveness of the health surveillance actions at the ports of the Amazonas municipalities, one may claim they were insufficient to prevent the 102,785 confirmed cases of COVID-19 in the state interior and the high lethality rate.

Given the interpretations of Figure 2, it is found that the precarious infrastructure of the health services, especially in the state interior, and the overload of the system in the city of Manaus justify the deaths that could have been prevented with appropriate geographical access to health for the Amazonas territories. We underscore that the precariousness of the public health system of the state of Amazonas precedes

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<sup>§</sup>The DATASUS data are out of date, with the comparison of the data above not being possible.



the COVID-19 pandemic (Anjos, 2017, 2018, 2019); however, the pandemic moment gave visibility to the social inequality and the difficulty to enter the health network, especially in remote areas due to their smaller technical apparatus and the overload of the search for access to health services in the state capital. In this context, the subspaces of epidemiological silence were echoed by the COVID-19 pandemic, giving visibility to the shortfall of health services in all nodes of the health care networks available in the state.

## Final Considerations

The discussion relative to the geographical access to health in Amazonas does not end with this discussion, far from it; it is the continuity of the debates about the theme – especially those started by geographers of the region, such as Oliveira and Shor (2013), Anjos (2018), and Aleixo et al. (2020) –, besides being the prelude to the elaboration of a geographical model for health planning substantiated by the Amazonian territories, considering their physical characteristics and the need to implement a productive-technological health structure from the local morbidity and mortality pattern.

In this conjecture, Santana (2005) and Guimarães (2015) emphasized the need to develop methodologies with the purpose of proposing solutions for health planning aimed at the different multi-territorialities, especially the health exclusion territories (Haesbaert, 2002). For this proposition, Health Geography is the branch of Geographical Science that has methods and techniques of interdisciplinary nature with conditions to create paths to elaborate solutions for geographical access to health in Amazonas, contributing to the territorial health planning of the state.

It should be noted that Geography is not the destination for solving the current problems, as mentioned by Gallup et al. (2007, p. 21), but it cannot be ignored "in the face of the numbers, indications, and difficulties that draw attention to its permanent connection with development". To Sanguin (2014, p. 28), "the location will continue to structure the relevance and role of geography", a situation unveiled by the COVID-19 pandemic in 2020.

By planning the health system of Amazonas considering the appropriate location of health establishments, their connection with the other levels of care through the networks, and the causality of the health situation based on the singularities of its territories, the state may explain the contradictions of geographical access to health, as well as meet Article 196 of the 1988 Constitution, reducing and/or eliminating the subspaces of epidemiological silence and preventable deaths in Amazonas, such as the deaths caused by COVID-19.

## References

Aleixo, N. C. R.; FREITAS, S.R.; SILVA NETO, J.C.A (2017). Saúde e Ambiente no Interior do Amazonas: In: MAGALHÃES, S. C.; PEREIRA, M. P. (Orgs.). *Pesquisa e extensão em Geografia da Saúde: entre teoria e prática*. Monte Claros: Unimonte.

AMAZONAS, Secretaria de Desenvolvimento econômico, Ciência, Tecnologia e Inovação (2020<sup>a</sup>). *Vulnerabilidade social e COVID-19 na cidade de Manaus*. Nota técnica covid-19 n. 0006 25/05/20. SBPC: Manaus.

AMAZONAS, Governo do Estado (2020b). *Plano de Contingência Estadual para Infecção Humana pelo novo Coronavírus 2019 n-Cov*. Fundação de Vigilância em Saúde do Amazonas: Manaus.

ANJOS, L. C. C.; ALBUQUERQUE, A.R.C; RAMALHO, A.T.Q; SILVA, R.B.G (2017). Mapeamento dos subespaços de silêncio epidemiológicos nas regiões de saúde do Amazonas (BR). *Espaço e Geografia*, v. 20, n. 2, p. 355-382.

ANJOS, L. C. C. (2018). *Acesso geográfico à saúde na Região Metropolitana de Manaus (RMM)*. 2018. 202 f. Dissertação (Mestrado em Geografia). Universidade Federal do Amazonas: Manaus.

ANJOS, L. C. C.; ALBUQUERQUE, A. R. (2019). O acesso geográfico à saúde no triângulo fluvial do setor central da Amazônia. *Confins* [En ligne], n. 43.

CARTA DE OTTAWA, Primeira Conferência Internacional Sobre Promoção da Saúde. Ottawa, novembro de 1986. Disponível em: <[http://bvsmms.saude.gov.br/bvs/publicacoes/carta\\_ottawa.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/carta_ottawa.pdf)> Acesso em 25.11.2020.

CATÃO, R. C. (2019). Complexos Patogênicos na atualidade. In: GURGEL, H.; BELLE, N. (Orgs.). *Geografia da Saúde: Teoria e Método na Atualidade*. Brasília: Universidade de Brasília.

CNESNet, Secretaria de atenção à Saúde (2020). *Consulta serviços especializados*. DATASUS, Cadastro Nacional de Estabelecimentos de Saúde, Ministério da saúde. Brasília: s/d. Disponível em: [http://cnes2.datasus.gov.br/Mod\\_Ind\\_Especialidades.asp?VEstado=13&VMun=130002&VComp=00&VTerc=00&VServico=00&VClassificacao=00&VAmbu=&VAmbuSUS=1&VHosp=&VHospSUS=1](http://cnes2.datasus.gov.br/Mod_Ind_Especialidades.asp?VEstado=13&VMun=130002&VComp=00&VTerc=00&VServico=00&VClassificacao=00&VAmbu=&VAmbuSUS=1&VHosp=&VHospSUS=1) Acesso em: 08 de Nov. 2020.

DECLARAÇÃO DE ALMA-ATA. (1978). *Primeira Conferência Internacional sobre Cuidados Primários de Saúde*. In: OMS; UNICEF, p. 6-12, set.

DORY, D. (1990) La géographie de la santé: questions théoriques. *Revue Belge de Géographie*, Bruxelles, v. 4, n. 114.

FOUCAULT, M. (1986). *Microfísica do poder*. Rio de Janeiro: Graa.

GALLUP, J. L; GAVIRIA, A.; LORA, E. (2017). *Geografia é destino?: lições da América Latina*. Trad. Fernando Santos. São Paulo: Editor UNESP.

G1, Jornal Nacional. *Barcos clandestinos espalham a Covid-19 pelo estado do Amazonas*, 2020. Disponível em: <<https://g1.globo.com/jornal-nacional/noticia/2020/05/15/barcos-clandestinos-espalham-a-covid-19-pelo-estado-do-amazonas.ghtml>> Acesso em: nov. 2020b.

GUIMARÃES, R. B. (2015). *Saúde: Fundamentos de Geografia Humana*. São Paulo: Editora Unesp Digital.

HAESBAERT, R. (2002). *Territórios alternativos*. Niterói: Eduff; São Paulo: Contexto.

LOUREIRO, A. J. S. **História da Medicina e das doenças no Amazonas**. Manaus: Gráfica Lorena, 2004.

MAZZETO, F. A. (2008). Pioneiros da Geografia da Saúde: Séculos XVIII, XIX e XX. In: BARCELLOS, C. (Org.). *A Geografia e o Contexto dos problemas de saúde*. Rio de Janeiro: ABRASCO: ICICT: EPSJV.

NOGUEIRA, Helena. (2008) *Os lugares e a saúde*. Coimbra: Imprensa da Universidade de Coimbra.

NORONHA, K. V. FERREIRA, F.M (2020). Pandemia por COVID-19 no Brasil: análise da demanda e da oferta de leitos hospitalares e equipamentos de ventilação assistida segundo diferentes cenários. *Caderno de Saúde Pública*, Rio de Janeiro, v. 36, n. 6, p. 1-17.

RAFFESTIN, C. (1993). *Por Uma Geografia do Poder*. São Paulo: Ática.

SANTANA, P. (2005). *Geografias da Saúde e do Desenvolvimento. Evolução e Tendências em Portugal*. Coimbra: Almedina.

SANTANA, P. (2014). *Introdução à Geografia da Saúde: Território, saúde e bem-estar*. Coimbra, Portugal: Imprensa da Universidade de Coimbra.

SANTANA, P. (2016). Ambientes e sujeitos sociais no mundo globalizado: a geografia da saúde e as demais áreas do conhecimento. In: OLIVEIRA, J. A.; SOUZA, G. A. (Orgs.). *Geografia da Saúde: ambientes e sujeitos sociais no mundo globalizado*. Manaus: EDUA.

SCHEFFER, M; CAESSENTE, A; GUERRA, A. GUILLOUX, A.G.A; BRENDAO, A.P.D; MIOTTO, B.A; ALMEIDA, C.J.A; GOMES, J.O; MIOTTO, R.A (2020). *Demografia Médica no Brasil 2020*. Departamento de Medicina Preventiva, Faculdade de Medicina da USP. Conselho Regional de Medicina do Estado de São Paulo. Conselho Federal de Medicina. São Paulo.

SANTOS, M. *A natureza do espaço: espaço e tempo: razão e emoção*. 3 ed. São Paulo: HUCITEC, 1996.

SIOLI, H. (1990). *Amazônia: fundamentos da ecologia da maior região de floresta tropicais*. 2. ed. Petrópolis, RJ: Vozes.

SITUBA, N. S; LACERDA, K. C. (2020). Fluidez no território: análise geográfica do coronavírus no Amazonas. *Revista Ensaios de Geografia*, Niterói, v. 5, n. 9, p. 130-135, mai.

SVS, Secretaria de vigilância em Saúde. *Curso de Vigilância Epidemiológica: medidas em saúde coletiva e Introdução à Epidemiologia Descritiva*. Módulo II. Unidade I. Brasília, 2003. Disponível em: <[http://bvsmms.saude.gov.br/bvs/publicacoes/curso\\_vigilancia\\_epidemiologica\\_modulo\\_3.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/curso_vigilancia_epidemiologica_modulo_3.pdf)> Acesso em nov. 2020.

R7, Portal de Notícias. (2020). *OMS estima que taxa real de letalidade da covid-19 seja de 0,6%*. 2020. Disponível em: <<https://noticias.r7.com/saude/oms-estima-que-taxa-real-de-letalidade-da-covid-19-seja-de-06-03082020>> Acesso em: nov. 2020.

OLIVEIRA, J. A; SHOR, T. (2013). Saúde na Floresta, nos rios e nas cidades da Amazônia Brasileira. In: OLIVEIRA, J. A. (Org.). *Espaço, Saúde e Ambiente na Amazônia: Ensaios de Geografia da Saúde*. São Paulo: Outras Expressões.