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Article

Health regionalization in the brazilian Amazon: Challenges of Territorial Management

Regionalização da saúde na Amazônia brasileira: desafios da gestão territorial

Regionalización de la salud en la Amazonía brasileña: desafíos de la gestión territorial

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Abstract

Objective: To analyze the regionalization of healthcare in the state of Amazonas, considering the inequalities related to the vast territorial extension, population dispersion, and socioeconomic complexity of the region, understanding how healthcare relates to the current regional design, according to the perception of municipal managers. **Methodology:** A cross-sectional, quantitative, and descriptive-analytical study was conducted using structured interviews applied to 97% of the municipal health secretaries of Amazonas. The study investigated transportation modes, the presence of support centers, referrals for specialized exams and treatments, access to emergency services, knowledge about regional centers, and intra- and inter-regional regulation mechanisms. **Results:** A strong concentration of medium and high complexity services was observed in Manaus, responsible for more than 70% of medium complexity referrals and approximately 85% of high complexity referrals. About 60% of

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managers reported logistical difficulties in transportation; 55% pointed to the absence or insufficiency of support centers; 68% identified obstacles in accessing exams; 72% mentioned weaknesses in regulation; and 47% were unaware of the completeness of services available in regional centers. The findings highlight regional inequalities associated with geographic distances, dependence on river and air transport, and the historical concentration of specialized care in the capital. **Conclusions:** The regionalization of health in the Amazon requires public policies adapted to territorial specificities, supported by strengthened regional governance and continuous investments in infrastructure and sanitary transport, contributing to greater equity in access to health services.
Keywords: Health Regionalization; Access to Health; Public Policies.

Resumo

Objetivo: analisar a regionalização da saúde no estado do Amazonas, considerando as desigualdades relacionadas à vasta extensão territorial, dispersão populacional e complexidade socioeconômica da região, compreendendo como a assistência à saúde se relaciona com o desenho regional vigente, segundo a percepção dos gestores municipais. **Metodologia:** estudo transversal, quantitativo e descritivo-analítico, realizado com entrevistas estruturadas aplicadas a 97% dos secretários municipais de saúde do Amazonas. Investigaram-se os modais de transporte, a presença de casas de apoio, os encaminhamentos para exames e tratamentos especializados, o acesso aos serviços de urgência e emergência, o conhecimento sobre os polos regionais e os mecanismos de regulação intra e inter-regional. **Resultados:** Observou-se forte concentração dos serviços de média e alta complexidade em Manaus, responsável por mais de 70% dos encaminhamentos de média complexidade e cerca de 85% da alta complexidade. Cerca de 60% dos gestores relataram dificuldades logísticas no transporte; 55% apontaram ausência ou insuficiência de casas de apoio; 68% identificaram obstáculos no acesso a exames; 72% mencionaram fragilidades na regulação; e 47% desconheciam a completude dos serviços disponíveis nos polos regionais. Os achados evidenciam desigualdades regionais associadas às distâncias geográficas, à dependência de transporte fluvial e aéreo e à concentração histórica da assistência especializada na capital. **Conclusão:** A regionalização da saúde na Amazônia requer políticas públicas adaptadas às especificidades territoriais, sustentadas por governança regional fortalecida e investimentos contínuos em infraestrutura e transporte sanitário, contribuindo para maior equidade no acesso aos serviços de saúde.
Palavras-chave: Regionalização de saúde; Acesso à Saúde; Políticas Públicas.

Resumen

Objetivo: Analizar la regionalización de la salud en Amazonas, considerando las desigualdades territoriales y socioeconómicas según la percepción de los gestores municipales. **Metodología:** Estudio transversal y descriptivo-analítico con entrevistas estructuradas al 97% de los secretarios de salud de Amazonas sobre transporte, apoyo, derivaciones y regulación. **Resultados:** Se observó una fuerte concentración de servicios de complejidad media y alta en Manaus, responsable de más del 70% de las derivaciones de complejidad media y aproximadamente el 85% de las derivaciones de alta complejidad. Alrededor del 60% de los administradores reportaron dificultades logísticas en el transporte; el 55% señaló la ausencia o insuficiencia de centros de apoyo; el 68% identificó obstáculos en el acceso a exámenes; el 72% mencionó debilidades en la regulación; El 47% desconocía la exhaustividad de los servicios disponibles en los centros regionales. Los hallazgos resaltan las desigualdades regionales asociadas a las distancias geográficas, la dependencia del transporte fluvial y aéreo, y la concentración histórica de la atención especializada en la capital. **Conclusiones:** La regionalización requiere políticas adaptadas al territorio, gobernanza fortalecida e inversión en infraestructura y transporte sanitario para promover la equidad en el acceso.
Palabras clave: Regionalización de la salud; Acceso a la Salud; Políticas Públicas.

Introduction

The effective management of universal and equitable health systems requires an understanding of territorial dynamics, with regionalization standing out as a fundamental strategy for organizing services and reducing inequalities in access[1]. In Brazil, the Unified Health System (SUS), grounded in the federal pact, adopts regionalization as the structural framework for organizing care, seeking to rationalize resources, integrate care networks, and ensure universal and equitable access for the population[2].

The regionalization process gained momentum starting in the 1990s and was consolidated in the following decades through regulatory instruments that defined responsibilities among the three levels of government. Basic Operational Norm (NOB) 01/1991 established the National Health Council and the Interagency Committees, launching the process of decentralizing the SUS[3]. Subsequently, NOB 01/1993 defined the Health Regions and the Bipartite and Tripartite Interagency Committees[4], while NOB 01/1996 established rules for the transfer of financial resources and the strengthening of regionalization[5]. The Operational Norm for Health Care (NOAS 01/2002), in turn, detailed guidelines for the organization of service networks, regulation of access, and management standards[6].

In this historical context, the Health Pact, established in 2006, reaffirmed regionalization as a structural guideline for the SUS[7], and Decree No. 7,508/2011[8] regulated Law No. 8,080/1990[9], establishing criteria for the creation of Health Regions and the organization of healthcare networks. Regionalization thus came to represent not only an administrative tool but also a political-organizational strategy aimed at inter-federative integration and the expansion of comprehensive care[10].

In the state of Amazonas, however, the regionalization of health care takes on unique characteristics due to its geographical, demographic, and logistical features. With a land area of 1,559,255.881 km² and an estimated population of 3,941,175 inhabitants spread across 62 municipalities, the state faces significant challenges in organizing and providing health care services. The concentration of medium- and high-complexity services in the capital, Manaus, creates significant inequalities in access, requiring long commutes for residents of the interior and overburdening the capital's healthcare network[11,12,13].

The state system is organized into nine health regions: Upper Solimões (Alto Solimões), Lower Amazonas (Baixo Amazonas), Manaus. Surrounding Area and Upper Negro River (Manaus e entorno/Alto Rio Negro), Juruá (Juruá), Middle Amazon (Médio Amazonas), Purus (Purus), Madeira River (Rio Madeira), Negro and Solimões Rivers (Rio Negro/Solimões) and Triangle (Triângulo), grouped into three macro-regions, in accordance with CIB/AM Resolutions No. 118/2018 and No. 059/2011[14,15]. These regions are defined primarily by river basins and characterized by vast territorial distances, low population density, and still fragile healthcare delivery systems, which are heavily constrained by logistical limitations and the historical concentration of specialized care in Manaus.

The decentralization of services, particularly in the North region, is an essential mechanism for reducing inequalities in access to health care in vast and heterogeneous territories such as the Brazilian Amazon. This strategy aims to redistribute resources among municipalities, strengthen health infrastructure in outlying areas, and reduce dependence on large urban centers[16]. However, its effectiveness depends on coordinated planning, intergovernmental coordination, and regional capacity to respond to local and regional demands[17].

Access to healthcare in the Amazon is heavily influenced by geographic, social, and environmental factors. The so-called "Amazonian factor" encapsulates challenges related to great distances, seasonal river conditions, lack of infrastructure, endemic diseases, and socio-environmental vulnerabilities, making access to services an ongoing challenge[18]. Furthermore, logistics and medical transportation represent key obstacles to the consolidation of healthcare networks, since reliance on waterways and air travel combined with a limited road network compromises mobility and the continuity of care[19].

In this context, the organization of health services in the Amazon is also shaped by historical processes of territorial occupation and state-provided care, including initiatives developed by the Special Public Health Service (SESP) after the SESP Foundation aimed at extending health interventions into the interior of the Amazon region. More recently, the work of the Special Secretariat for Indigenous Health (SESAI) highlights the need for differentiated care and management strategies in territories characterized by great ethnic diversity, vast geographical distances, and difficulties in accessing medium- and high-complexity services. These factors underscore the complexity of health regionalization in the Amazon and the need for inter-federative and inter-institutional coordination to ensure comprehensive care[20,21].

In rural and remote regions of the Amazon, gaps persist in understanding how care flows are integrated into the current regional framework. The vast territorial expanse and the concentration of specialized services in Manaus generate intense patient flows from the interior to the capital, highlighting the operational limitations of regionalization and significant inequalities in the distribution of care[11]. Analyzing the day-to-day operations of health services in remote areas is therefore essential for understanding the challenges of consolidating the SUS in hard-to-reach territories.

Given these particularities, this study aims to analyze the regionalization of health care in the state of Amazonas, considering the inequalities imposed by the region's vast territorial extent, dispersed population, and socioeconomic complexity, and to understand how health care relates to the current regional structure, as perceived by municipal managers.

Metodology

This is a cross-sectional study with a quantitative approach and a descriptive-analytical nature, conducted with municipal health managers in the state of Amazonas. Quantitative studies make it possible to identify patterns, frequencies, and associations among variables related to the organization of health services, contributing to the understanding of complex phenomena in regional health care systems[22].

The data were collected through structured interviews conducted between January and May 2022 with municipal health secretaries from municipalities in Amazonas. The inclusion criteria were: (a) holding the position of municipal health secretary in a municipality in Amazonas at the time of the interview; and (b) voluntarily agreeing to participate in the study. Managers who were on leave, on vacation, or who refused to participate were excluded.

The interviews were incorporated into a database from a study linked to a master's thesis titled "The Regionalization of Health Care in Amazonas: An Analysis of Living Territories," funded by the Amazonas State Research Support Foundation – Fundação de Amparo à Pesquisa do Estado do

Amazonas (FAPEAM) –, which focused on analyzing regionalization and health care referral patterns in the state.

Subsequently, the data were organized into Microsoft Excel spreadsheets, enabling their consolidation and statistical analysis. The variables investigated included: a) types of medical transportation used (river, air, and land); b) the existence of support facilities maintained by municipalities to accommodate patients undergoing treatment away from home; c) referrals for specialized tests and treatments; d) referrals related to urgent and emergency care; e) managers' knowledge of the health infrastructure in the hub municipalities of the health regions; and f) knowledge of the mechanisms regulating services in the health regions.

To minimize potential analytical biases, the municipality of Manaus was excluded from the sample because it concentrates most of the state's supply of medium- and high-complexity services, serving as the primary healthcare referral center for Amazonas. Furthermore, the municipalities serving as headquarters for the health regions which are responsible for concentrating regional referral services were specifically excluded from analyses related to care referrals, due to their unique structural characteristics and their role in the organization of the regionalized network. Thus, the analyses regarding referral flows included 52 municipalities in the interior that do not serve as regional hubs, while the other variables included all 60 municipalities participating in the study.

Statistical analysis was performed using the open-source software Jamovi (version 2.3.28), applying the chi-square and Fisher's exact tests to assess associations between categorical variables and verify the statistical significance of the observed differences[23].

This manuscript was supported by an artificial intelligence tool for data organization and analysis, as well as for the review and textual refinement of the manuscript. It should be noted that the tool was used in a complementary manner, without replacing the critical analysis, theoretical interpretation, and validation of the results by the researchers, who retained full responsibility for the content, methodological consistency, and conclusions presented.

The research was conducted in accordance with established ethical principles and was approved by the Research Ethics Committee (CAEE 72774517.7.0000.0005), in accordance with Resolutions No. 466/2012 and No. 510/2016 of the National Health Council[24,25].

Results and Discussion

Data from municipal health secretaries in 60 municipalities (97% of the total of 62) in the state of Amazonas were analyzed. It was observed that 85% of the managers were natives of Amazonas, with 51% having been born in the very municipality where they worked, indicating a strong territorial connection and knowledge of local specificities and the population's healthcare needs. Regarding age, 91.7% of the managers were between 30 and 59 years old, while 8.3% were 60 years of age or older, highlighting a predominance of a relatively young profile in municipal management. As for gender, there was a balanced distribution between men (53.3%) and women (46.7%), with a slight male predominance in management positions. These aspects reveal the heterogeneity of the managers' profiles and point to career trajectories marked by local roots and experience in public administration and health services.

Analysis of the emergency referral flow (Table 1) revealed significant variations in the capacity to refer patients to the hub municipalities within the health regions.

In approximately 38% to 42% of municipalities, referrals for specialized treatment within the regional hub itself are not handled properly.

Table 1. Referral flow for emergency cases between municipalities and regional hubs in Amazonas, 2026

	Are patients referred to the referral municipality (hub municipality) in their region?			Are emergency referrals directed to the hub municipality in their region?		
Health Region	**No N (%)**	**Yes N (%)**	**p-value***	**No N (%)**	**Yes N (%)**	**p-value****
Upper Solimões	4(50%)	4(50%)		4(50%)	4(50%)	
Lower Amazon	1(25%)	3(75%)		1(25%)	3(75%)	
Juruá	4(80%)	1(20%)		5(100%)	0(0%)	
Madeira River	3(75%)	1(25%)		3(75%)	1(25%)	
Manaus. Surrounding Area and Negro River	3(27,3%)	8(72,7%)	0,049	3(27,3%)	8(72,7%)	<0,01
Middle Amazon	0(0%)	5(100%)		0(0%)	5(100%)	
Purus	3(75%)	1(25%)		4(100%)	0(0%)	
Negro and Solimões Rivers	2(28,6%)	5(71,4%)		2(28,6%)	5(71,4%)	
Triangle	0(0%)	4(100%)		0(0%)	4(100%)	
Total	20(38,5%)	32(61,5%)	52(100%)	22(42,3%)	30(57,7%)	52(100%)

Note: *p-value < 0.5; **p-value < 0.01, where Q = chi-square test, F = Fisher's exact test. Eight hub municipalities from the total number of health regions in Amazonas were excluded from this analysis.
Source: Own elaboration.

In the Upper Solimões region, half of the managers (50%) reported failures in patient referrals, while in the Lower Amazonas region, 75% stated that they carried out referrals, although operational difficulties persist. In contrast, the Middle Amazonas and Triangle regions showed 100% compliance, indicating greater functionality of the regional hubs. Juruá and Purus, on the other hand, stood out for the lower effectiveness of their care pathways. These statistically significant differences reveal inequalities in the coordination of healthcare networks and structural weaknesses related to geographic distances, poor infrastructure, and limited specialized services in rural areas. These findings are consistent with studies on regionalization in the Amazon, which indicate that the organization of healthcare networks remains constrained by territorial barriers, low technical capacity, and a heavy reliance on larger municipalities[11,13].

The fragmentation of healthcare flows highlights the limitations of decentralization in Amazonian contexts, where municipalities' capacity to respond is directly influenced by river logistics, the scarcity of specialized services, and difficulties in intergovernmental coordination[26,27].

An analysis of healthcare transportation and the patient support infrastructure reveals significant heterogeneity among health regions, as shown in Table 2. Regarding knowledge of the infrastructure of the hub, it was observed that 100% of managers in the Lower and Middle Amazon reported being familiar with the referral facilities, while only 60% in the Purus region reported the same. In total,

73.3% of managers stated that they were familiar with the hub's structure, suggesting formal recognition, though this does not always translate into effective regional integration practices.

These results reinforce the idea that formal knowledge of the regional structure does not necessarily guarantee the effectiveness of healthcare delivery, especially in territories characterized by great geographical distances, dependence on waterways, and persistent structural limitations. Studies on mobility and territorial organization in the Amazon indicate that rivers are not only transportation routes but also central elements in the social and health organization of these territories, influencing travel times, costs, and access to health services[28].

Table 2. Characterization of the use of health transportation and available support infrastructure in the health regions of Amazonas, 2026

	Number of transportation modes used					Are you familiar with the healthcare infrastructure of the hub municipality in your health region		Does the municipality have a health support center in Manaus	
Health Region	**2 types N(%)**	**3 types N(%)**	**Only 1 type N(%)**	**More than 3 types N(%)**	**p-value**	**Yes N(%)**	**p-value**	**Yes N(%)**	**p-value****
Upper Solimões	1(11,1%)	4(44,4%)	2(22,2%	2(22,2%)		6(66,7%)		8(88,9%)	
Lower Amazon	3(60%)	0(0%)	2(40%)	0(0%)		5(100%)		1(20%)	
Juruá	2(33,3%)	2(33,3%)	2(33,3%)	0(0%)		4(66,7%)		2(33,3%)	
Madeira River	2(40%)	2(40%)	1(20%)	0(0%)		3(60%)		2(40%)	
Manaus. Surrounding Areas and Upper Rio Negro	4(36,4%)	4(36,4%)	0(0%)	3(27,3%)	>0,05	7(63,6%)	>0,05	4(36,4%)	<0,01
Middle Amazonas	4(66,7%)	2(33,3%)	0(0%)	0(0%)		6(100%)		2(33,3%)	
Purus	0(0%)	1(20%)	1(20%)	3(60%)		3(60%)		0(0%)	
Negro and Solimões Rivers	2(25%)	2(25%)	3(37,5%)	1(12,5%)		5(62,5%)		3(37,5%)	
Triangle	1(20%)	3(60%)	1(20%)	0(0%)		5(100%)		5(100%)	
Total	19(31,7%)	20(33,3%)	12(20%)	9(15%)	60(100%)	44(73,3%)	60(100%)	27(45%)	60(100%)

Note: *p-value < 0.5; **p-value < 0.01
Source: Own elaboration.

Regarding support centers in Manaus, all municipalities in the Purus region reported having such facilities, whereas 80% of those in the Lower Amazon region do not. The absence of support centers indicates inequalities in care support services, especially in more remote regions. In the Middle Amazonas region, land access facilitates travel to the capital, whereas in the Purus region, distance and reliance on air and river transportation increase travel costs and time.

Regarding medical transport, it was observed that municipalities in the Middle Amazon predominantly used two modes of transport, while in the Triangle (Triângulo) region the use of three modes prevailed, and in the Purus region, more than three distinct types were used. It should be noted that this classification refers to the number of modes used by the municipalities in each region, with variability among them regarding the specific combination of modes employed, including boats, speedboats, air transport, ambulances, and vans. It is observed that the greater the distance from the state capital, the greater the diversity of modes of transportation tends to be, especially with the inclusion of air transportation, which is recognized as the most expensive and least available option.

In the Amazon, medical transport plays a structural role in the functioning of healthcare networks, since rivers constitute the main routes of circulation between municipalities[19,29]. Thus, reliance on multiple modes of transportation is not merely a logistical characteristic but reflects historical territorial inequalities that limit access to specialized services and increase the operational costs of health care[18,30]. However, logistical infrastructure and patient support remain uneven, compromising the effectiveness of regionalization and equity in access to specialized services.

With regard to interstate patient flow (Table 3), it was found that 73.3% of municipalities do not refer patients to other states, although 26% report sending patients for treatment outside Amazonas, primarily to Acre, Rondônia, São Paulo, Ceará, and Paraná, depending on the availability of referral centers. The Lower Amazon and Juruá regions stood out for frequently treating patients from neighboring states, such as Acre and Pará, revealing bidirectional care flows.

Table 3. Characterization of care flows from an interstate perspective in the health regions of Amazonas, 2025

	Are patients from your municipality referred to services in another state?			Do you receive patients from other municipalities in Amazonas or from another state?		
Health Region	**No N(%)**	**Yes N(%)**	**p-value****	**No N(%)**	**Yes N(%)**	**p-value**
Upper Solimões	7(77,8%)	2(22,2%)		3(33,3%)	6(66,7%)	
Lower Amazon	5(100%)	0(0%)		0(0%)	5(100%)	
Juruá	2(33,3%)	4(66,7%)		3(50%)	3(50%)	
Madeira River	2(40%)	3(60%)		3(60%)	2(40%)	
Manaus. Surrounding Area and Upper Negro River	9(81,8%)	2(18,2%)	<0,01	3(25%)	8(72,7%)	>0,05
Middle Amazon	6(100%)	0(0%)		1(16,7%)	5(83,3%)	
Purus	0(0%)	5(100%)		2(40%)	3(60%)	
Negro and Solimões Rivers	8(100%)	0(0%)		1(12,5%)	7(87,5%)	
Triangle	5(100%)	0(0%)		0(0%)	5(100%)	

Total	44(73,3%)	16(26,7%)	60(100%)	16(26,7%)	44(73,3%)	60(100%)

Source: Own elaboration.

In the Lower Amazon region, 100% of managers reported not referring patients to other states, but stated that they regularly receive patients from outside the region. In the Purus region, however, all managers stated that they refer patients out of the region, and only 60% receive patients from other states, indicating a more intense outflow and less interstate integration. The statistical result ($p<0.01$) reinforces the heterogeneity of patient flows and the fragmentation of the territorial and functional integration of healthcare networks.

Managers' perceptions regarding the effectiveness and strengthening of health regions also revealed significant contrasts (Table 4). Overall, 23.3% of managers reported dissatisfaction with the management of emergency patients and with regional strengthening, indicating disparities in response capacity among regions. Nevertheless, the majority expressed partial satisfaction, reflecting some degree of functionality in care flows, although insufficient to ensure regional cohesion.

Table 4. Distribution of managers' perceptions regarding the effectiveness of the current health region model in Amazonas, 2025

Considers the management of urgent and emergency patients:								
	Regarding effectiveness				Regarding the strengthening of health regions			
Health Region	Indifferent N(%)	Dissatisfied N(%)	Satisfied N(%)	p-value	Indifferent N(%)	Dissatisfied N(%)	Satisfied N(%)	p-value
Upper Solimões	1(11,1%)	2(22,2%)	6(66,7%)		1(11,1%)	5(55,6%)	3(33,3%)	
Lower Amazon	0(0%)	1(20%)	4(80%)		0(0%)	3(60%)	2(40%)	
Juruá	1(16,7%)	2(33,3%)	3(50%)		2(33,3%)	3(50%)	1(16,7%)	
Madeira River	0(0%)	2(40%)	3(60%)		0(0%)	4(80%)	1(20%)	
Manaus. Surrounding Area and the Upper Negro River	1(9,1%)	3(27,3%)	7(63,6%)	>0,05	1(9,1%)	3(27,3%)	7(63,6%)	>0,05
Middle Amazonas	0(0%)	2(33,3%)	4(66,7%)		0(0%)	2(33,3%)	4(66,7%)	
Purus	1(20%)	1(20%)	3(60%)		2(40%)	2(40%)	1(20%)	
Negro and Solimões Rivers	2(25%)	0(0%)	6(75%)		2(25%)	1(12,5%)	5(62,5%)	
Triangle	1(20%)	1(20%)	3(60%)		2(40%)	1(20%)	2(40%)	
Total	7(11,7%)	14(23,3%)	39(65%)	60(100%)	10(16,7%)	24(40%)	26(43,3%)	60(100%)

Note: There is no statistically significant difference.

Source: Own elaboration.

In the Upper Solimões region, 22.2% of managers expressed dissatisfaction with regulation and 55.6% with regional empowerment. In the Middle Amazon, 66.7% expressed satisfaction with both aspects, standing out as the best-performing region. The Lower Amazon showed mixed results: 80% of managers were satisfied with emergency care regulation, but only 40% were satisfied with regional strengthening, indicating that the perception of effectiveness does not necessarily imply institutional strengthening.

Overall, 40% of the state's managers expressed dissatisfaction with the strengthening of regionalization, demonstrating that specific advances in regulation and care pathways have not yet translated into a consolidated regional structure. The absence of statistically significant differences between problem-solving capacity and institutional strengthening confirms that managers' perceptions are heterogeneous, varying according to territorial, structural, and local management conditions.

There is a predominance of care flows directed toward the capital, and the reliance on river and air transportation underscores the significance of geographic barriers in the organization of the health system in Amazonas. This scenario highlights the need for strategies that strengthen regional governance and improve intermunicipal logistics, in order to enhance integration among services and reduce inequalities in access to specialized care. The literature on regional governance within the SUS emphasizes that the effectiveness of regionalization depends on the capacity for coordination among federal entities, intergovernmental agreements, and the existence of permanent mechanisms for regional coordination[27,31]. In the Amazonian context, these processes become even more complex given the territorial asymmetries and structural limitations that hinder the integration of healthcare networks.

The findings point to the urgent need for policies that recognize territorial diversity as a structural pillar of health management in the Amazon. Healthcare flows in the state of Amazonas reveal a marked centralization of medium and high complexity services in the capital, Manaus. This scenario highlights an unequal distribution of resources, with more advanced and specialized infrastructure concentrated in a single urban center. The lack of adequate infrastructure in inland municipalities creates a critical dependence on the capital, exacerbating regional inequalities[11,13].

Geographic distance becomes a determining factor in the organization of services, limiting the effectiveness of hub municipalities and the continuity of care.

The shortage of support facilities, identified in several regions, exacerbates the vulnerability of patients who must remain in the capital, overburdening hospitals, which frequently face demand exceeding their capacity[11,13].

Regionalization in Amazonas still faces the challenge of reconciling the normative rationality of healthcare networks with territorial realities and the complex logistics of the Amazon region, requiring differentiated strategies for governance, financing, and infrastructure adapted to local conditions. In this sense, regionalization in the Amazon challenges normative models built on urban-centric and territorially integrated realities, demanding policies that are sensitive to riverine dynamics, long intermunicipal distances, and the sociocultural specificities of Amazonian territories[18,27,29].

The traditional hospital model, guided by a hygienist approach, has limitations in meeting the population's needs, as it fails to take cultural and social specificities into account. To effectively meet

the needs of the Amazon region, it is necessary to adopt a humanistic hospital model that values the patient as a rights-holder and promotes care consistent with local realities[32,33].

In this Amazonian context, Small-Scale Hospitals (HPP) can be viewed as playing a strategic role, given the vast territorial expanse, scattered population, and difficulties in access. By serving as regional hubs and establishing referral pathways with primary care, they enhance problem-solving capacity and provide intermediate and emergency care to communities. Their proximity to communities reduces travel distances and ensures faster care, although they depend on ongoing investments in infrastructure and professional training[34].

Another crucial aspect is retaining health professionals, as difficulties in doing so impact the continuity of services. The combination of a vast territory, inadequate infrastructure, and adverse conditions makes it difficult to attract and retain these professionals. To mitigate this situation, local education and training policies tailored to regional specificities are essential, coupled with ongoing dialogue with educational institutions[35].

The results also highlight challenges in regulation, medical transportation, and support facilities. Managers demonstrate a lack of knowledge and dissatisfaction with regulatory processes, as well as partial skepticism regarding the current model of health regions. In some cases, these processes do not fully address the healthcare needs in the hub municipalities, compromising the system's efficiency. Although Manaus was excluded from the sample because it serves as a referral center for highly complex cases, the findings indicate that the current structure does not adequately support comprehensive care, revealing the need for a critical review of regionalization policies in the western Amazon.

This analysis also contributes to the debate on Brazilian federalism, in which the division of powers among the federal government, states, and municipalities poses challenges to the implementation of health policies. Decentralization allows policies to be adapted to local realities, but does not, in and of itself, guarantee equitable access. Power imbalances among federal entities limit negotiating capacity and generate regional inequalities. Intergovernmental relations, which oscillate between cooperation and conflict, directly influence the effectiveness of policies, with the activities of the Bipartite Interagency Committees (CIBs) being conditioned by socioeconomic development and geographic characteristics[26,36].

On the other hand, the decentralization enshrined in the 1988 Brazilian Constitution enabled states and municipalities to take on an active role in the management and organization of services, promoting a more efficient distribution of resources and regional investments. The minimum financial commitment ensured the system's sustainability and, combined with the hierarchical organization of care, ensured greater policy effectiveness. This process strengthened democratization and accountability, expanding access especially to primary care and contributing to improvements in health indicators[30,37].

The typology of health regions plays a crucial role in the planning and organization of services, allowing for the consideration of regional needs and promoting the effective integration of actions and resources. It also highlights socio-spatial inequalities, facilitating equitable and integrated public policies that combine economic, social, and health development, and strengthening regional governance[37,38].

Rethinking regional governance within the SUS is essential to strengthen integration and coordination among levels of government and management actors, promoting participation and

negotiation among entities with varying degrees of autonomy. This process involves monitoring and implementing policies through regionalized networks, ensuring social participation and collaborative planning. Modern governance organizes the participation of various stakeholders and supports intersectoral projects that generate innovative and synergistic solutions between regional and economic development[39].

The challenges for effective regionalization include integrating and organizing health regions, adequately planning the service network, developing care networks, coordinating the regional system, and addressing issues of financing and equity. These aspects highlight the complexity of the process and the need to strengthen it to ensure efficiency and comprehensiveness[27].

The success of regionalization, however, depends not only on the formal definition of referral pathways but also on shared governance and inter-federative coordination. In Amazonas, these processes remain constrained by vast territorial distances, limited existing infrastructure, logistical challenges, and inequalities among municipalities factors that undermine the consolidation of regional care networks[11]. In this context, it is observed that the organization of the system tends to occur through adaptive arrangements in response to territorial and institutional limitations, rather than through a fully consolidated regional network.

Final Considerations

The regionalization of healthcare in the Brazilian Amazon is progressing in a heterogeneous and uneven manner. There is a disconnect between operational functioning and the legal-political framework, revealing a model still in the process of consolidation, sustained more by local arrangements than by a solid regional structure. This process requires innovative approaches capable of addressing the challenges posed by the vast territorial expanse, socioeconomic inequalities, and the Amazon's unique geographical characteristics.

The centralization of resources and infrastructure limitations highlight the need for a regionalization model that recognizes and values local specificities, promoting efficient coordination among the different levels of care. A regionalization model adapted to the Amazonian reality must prioritize resilient and flexible care networks capable of connecting services and ensuring continuous and equitable access for the population.

The main finding of the study was the identification of inequalities in infrastructure and access to specialized services, which force patients to travel to larger urban centers, overburdening Manaus and imposing logistical and financial burdens on municipalities in the interior. By mapping care flows, the study helps fill gaps in the literature on health regionalization in the Amazon, providing empirical evidence for the formulation of more effective and territorially sensitive public policies.

The relationship between decentralization and the typology of health regions proved fundamental for aligning decisions with local realities, although it remains marked by system fragmentation and limitations in regional integration. Border regions, such as Purus and Juruá, stand out, where access to medium and high complexity services often occurs in neighboring states, constituting an adaptive strategy in the face of scarce local supply. This trend highlights inequalities in the problem-solving capacity of inland municipalities and reinforces the need for structural policies aimed at reducing territorial disparities.

The decentralization of services and the strengthening of infrastructure in smaller municipalities are essential for reducing inequalities and expanding regional capacity to address health needs.

Strategic interventions at key points in the network can optimize care flows and enhance the system's efficiency.

Amazonas depends on ongoing investments in infrastructure, medical transportation, and intergovernmental coordination, as well as on strengthening regional governance and interagency bodies. The effective implementation of the SUS in the Amazon requires viewing the region not as an exception, but as a territory that demands its own solutions — solutions that are sustainable and consistent with its geographic, cultural, and social conditions.

Among the study's limitations is its exclusive reliance on the perceptions of municipal health managers, which may not fully capture the experiences of system users and workers. Furthermore, the exclusion of Manaus from the comparative analyses limited a deeper understanding of the relationships between the capital and the interior in the functioning of healthcare networks. It is recommended that future studies incorporate qualitative approaches, analysis of users' treatment pathways, and an evaluation of regional governance in border regions, especially in areas with heavy interstate dependence for access to medium and high complexity care.

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M.C.R.F. Lima: conception/design of the article; data analysis and interpretation; writing the article; critical review of its content; and approval of the final version of the article.
M.C.P. Louvison: data analysis and interpretation; critical review of the content; and approval of the final version of the article.
C.S. Nobre: data analysis and interpretation; writing the article; critical review of its content; and approval of the final version of the article.
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