

Physical/functional rehabilitation in Brazil: spatiotemporal analysis of the offer in the Public Healthcare System

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Abstract *The complex epidemiological profile of Brazil, the aging population and the proportion of individuals with disabilities have led to a substantial increase in the demand for rehabilitation. The spatiotemporal distribution of the offer of physiotherapy, speech therapy and occupational therapy in the Brazilian public healthcare system from 2007 to 2019 was analyzed for the five macro-regions of the country. Data from the National Register of Health Establishments and census estimates from the Brazilian Institute of Geography and Statistics were used. Indicators of the offer of professionals in these fields services and relative changes in the offer were calculated. The spatial distribution of the relative change in the offer was also determined. A regression model with inflection points was adopted for the analysis of the temporal trend. A growing temporal trend was found in the offer of the three professionals in Brazil as a whole and in all regions of the country, but with a slowdown in growth. Differences were observed in the offer among the regions of the country, revealing healthcare inequality that needs to be overcome. The present findings can assist in planning to expand access to rehabilitation services in the country.*

Key words *Physiotherapy, Speech therapy, Rehabilitation, Public Healthcare System, Occupational therapy, Time series studies*

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Introduction

Rehabilitation is an interdisciplinary, integrated, coordinated process with an individualized approach considering physical, psychological, social and occupational aspects¹. It is directed at individuals with total, partial, temporal or permanent loss of functioning as well as medium-term or long-term abnormalities².

In Brazil, the National Health Survey conducted in 2019 revealed that 17.3 million Brazilians two or more years of age had disabilities related to at least one of their functions³. Moreover, the increase in comorbidities, the burden of chronic uncommunicable diseases⁴, the aging of the population⁵ and external causes⁶ in the last decade have led to a substantial increase in the demand for rehabilitation, with a tendency to increase in the upcoming years⁴. Thus, ensuring permanent access to health actions and services is essential⁷.

Policies in the country that guide the structuring of rehabilitation services proposed the organization of such services in a network with different levels of care.⁸ Primary care is considered the main gateway to the public healthcare system and was expanded with the inclusion of several services, such as physiotherapy, speech therapy and occupational therapy, through Ordinance n° 154/2008, which instituted Family Health Support Centers. After the revision of the National Primary Care Policy in 2017, these services were denominated Expanded Family Health and Primary Care Centers⁹. This was an important tool for expanding access to and the problem-solving abilities of rehabilitation actions in the public healthcare system⁸.

The National Plan for the Rights of Disabled Persons ("Living without Limits" Plan) instituted in 2011 proposed the expansion of the offer of rehabilitation and was instituted with the purpose of promoting the full, equitable exercise of the rights of disabled persons through the integration and articulation of policies, programs and actions¹⁰. The creation of the Disabled Persons' Care Network in 2012 also drove this growth, especially with the organization and regionalization of Specialized Rehabilitation Centers in primary care networks¹¹. Despite the implantation of policies, the structuring of the care network and the increase in the offer and coverage of rehabilitation services, inequality remains in the distribution of these services and disparities are found among the different regions of the country¹².

Given the importance of the subject, the World Health Organization drafted joint commitments in 2017 with the aim of meeting the need for global actions that strengthen rehabilitation in healthcare systems¹³. According to data from the United Nations,² 80% of individuals with disabilities reside in developing or emerging countries, such as Brazil.

Despite all the advances and persistent inequalities, no studies were found that measure the magnitude of this expansion in Brazil or examine differences among the regions of the country. As the concept of rehabilitation involves multiple dimensions and presupposes an organization based on interdisciplinarity, the aim of the present study was to analyze the spatiotemporal distribution of the professionals who offer services of physiotherapy, speech therapy and occupational therapy in the public healthcare system between 2007 and 2019 in Brazil as a whole as well as in the five macro-regions of the country. This distribution analysis will enable reflections on the potential offer of these services in the country and indicate paths that can ensure equitable access to such services.

Methods

This study was conducted in accordance with the ethical precepts stipulated in Resolution n°510/2016 of the National Board of Health. As the data analyzed are in the public domain, approval from a human research ethics committee was not required. All sources of data are reported.

A mixed ecological study was conducted. The units of the spatial analysis were the five regions of Brazil and the units of the temporal analysis were the years corresponding to the period from 2007 to 2019. The choice of the period of interest was based on the incorporation of the 2002 Brazilian Classification of Occupations in 2007 and the fact that 2019 was the last year with available data during the data collection process of the present study.

The healthcare providers considered in this study were physiotherapists, speech therapists and occupation therapists registered as employees of the public healthcare system in the National Register of Health Establishments, as these occupations are considered fundamental for the representation of physical/functional rehabilitation.

The quantity of professionals in the three categories of interest was collected using records

related to the registration of healthcare providers in the month of December of each year¹⁴ available from the site of the Information Technology Department of the Health Ministry (DATASUS). These data were processed using the Tabwin software program, version 3.2.

Registrations of the Brazilian Classification of Occupations with multiple Physical Person Registration were considered to ensure the incorporation of the number of employment positions per professional and enable a more reliable determination of the potential offer of the services in the public healthcare system. The following codes were considered: physiotherapy – 223605, 223625, 223630, 223635, 223640, 223650, 223655 and 223660; speech therapy – 223810, 223815, 223820, 223825, 223830, 223835, 223840 and 223845; occupational therapy – 223905 and 223620. For information on the residents of each region, the census estimates for 2007 and 2019 were considered. These data were obtained from the Brazilian Institute of Geography and Statistics as well as the DATASUS site.¹⁵

The concept of potential offer was adapted from Costa, Barreto and Sampaio¹⁶, who consider that the presence of a given healthcare service is characterized by the potential offer of this service independently of knowledge regarding its actual need. Thus, data from the National Register of Health Establishments on healthcare providers employed in the public healthcare system were considered for the determination of the potential offer of the three services of interest.

Indicators of the potential offer of the three services in the public healthcare system were calculated for each of the years of the period of interest (2007 to 2019) for Brazil and the five regions of the country. The relative change in the offer in the period in the country and different regions was also calculated, considering the initial year of the series (2007) as the reference for the calculation of proportional change. These calculations were performed with the following formulas:

$$\frac{\text{Offer of professional x in public healthcare}}{\frac{\text{N}^\circ \text{ of professional x in year x in region x}}{\text{Total residents in year x in region x}}} \times 10^5$$

$$\text{Relative change in offer of professional x} = \left[\left(\frac{\text{offer of professional x in public system in 2019}}{\text{offer of professional x in public system in 2007}} \right) - 1 \right] \times 100$$

For the spatial analysis, maps were created for the indicator of the offer of each rehabilitation service in 2007 and 2019 and the indicator of relative change according to the regions of the country using the Terraview program, version 4.2.2, developed by the National Institute of Spatial Research.

The *Joinpoint* regression model was used for the temporal trend analysis. This model tests whether a multi-segmented line is statistically better for describing temporal changes in data than a straight line or less segmented line. This analysis enables detecting the trend of the event studied as stationary, increasing or decreasing and the points of change in the trend as well as calculating the annual percent change and (APC) and average annual percent change (AAPC) with $\alpha = 5\%$. The *Joinpoint* program, version 4.5.0 was used for this analysis and the results are presented in figures.

Results

In 2007 (first year of the study), 36,776 physiotherapists, speech therapists and occupational therapists were registered in the National Register of Health Establishments affiliated with the public healthcare system. Proportionally, 61.5% were physiotherapists, 23.0% were speech therapists and 15.5% were occupational therapists. The total number of these professionals nearly tripled in 2019 (99,703 records proportionally distributed as follows: 68.4% physiotherapists, 20.3% speech therapist and 11.3% occupational therapists) (Table 1).

Regarding physiotherapy (Figure 1 A, B and C), the North region had the smallest offer throughout the years studied. The Southeast had the highest proportion in 2007 and the South had the highest proportion in 2019. The offer in the Northeast increased by 237.7% in the period, which was the highest increase among the different regions of the country. The lowest increase occurred in the Southeast, which went from 14.1 to 32.4 professionals for each 100 thousand residents, corresponding to an increase of 129.7%.

Table 1. Distribution of professionals registered in National Register of Health Establishments as employees of Brazilian public healthcare system according professional category and region of country, 2007/2019.

Category	Region											
	North		Northeast		South		Southeast		Midwest		Brazil	
	N	%	N	%	N	%	N	%	N	%	N	%
2007												
Physiotherapy	1035	66.4	5200	65.5	3770	62.0	10998	58.5	1612	66.9	22615	61.5
Speech therapy	308	19.8	1407	17.7	1448	23.8	4749	25.3	554	23.0	8466	23.0
Occupational therapy	216	13.9	1333	16.8	861	14.2	3043	16.2	242	10.0	5695	15.5
Total	1559	100.0	7940	100.0	6079	100.0	18790	100.0	2408	100.0	36776	100.0
2019												
Physiotherapy	4041	70.0	19449	72.2	10749	66.7	28665	65.9	5302	72.2	68206	68.4
Speech therapy	1131	19.6	4789	17.8	3552	22.0	9349	21.5	1431	19.5	20252	20.3
Occupational therapy	601	10.4	2717	10.1	1820	11.3	5495	12.6	612	8.3	11245	11.3
Total	5773	100.0	26955	100.0	16121	100.0	43509	100.0	7345	100.0	99703	100.0

Source: Authors.

A similar pattern was found for speech therapy (Figure 1 D, E and F), with lower proportions of professionals registered in the North. The Southeast had the highest proportions in the country in 2007 and the South had the highest in 2019. The highest growth rate among the regions occurred in the Northeast, going from 2.7 to 8.4 speech therapists per 100 thousand residents, corresponding to an increase of 207.4%. The lowest increase in the period studied occurred in the Southeast region (73.5%).

For occupational therapy (Figure 1 G, H and I), the North had the lowest proportions and the Southeast had the highest. Proportionally, the North had the highest growth in the period studied (121.1%). The lowest growth occurred in the Southeast, which went from 3.9 to 6.2 occupational therapists for each 100 thousand residents, corresponding to an increase of 59.1%.

The *Joinpoint* regression analysis revealed a positive average annual percent change (AAPC), with an increasing temporal trend ($p < 0.01$) in the offer of the three professional categories in the public healthcare system in Brazil and the different regions of the country between 2007 and 2019. For the country as a whole, the AAPC was 8.3% for physiotherapy, 6.2% for speech therapy and 4.4% for occupational therapy ($p < 0.01$). In the analysis per region, the AAPC for physical therapy and speech therapy (Figures 4 and 5) was

respectively 10.6% and 9.6% for the Northeast and 6.9% and 4.6% for the Southeast.

However, growth rate was not constant for any of the services or regions. The *Joinpoint* regression model revealed important reductions in these rates throughout the period studied (Figures 2, 3 and 4). Regarding physiotherapy (Figure 2), the growth rate of the offer was greater between 2007 and 2009 in Brazil and all regions, except the Midwest, for which the period of greatest expansion was from 2007 to 2011 ($p < 0.01$). Between 2007 and 2009, the offer of physiotherapy in the public healthcare system had a growth trend of 20.38% in the country, with an APC similar to that found in the North (21.31%) and Northeast (25.44%). After this period, the growth rate diminished in all regions ($p < 0.01$).

For speech therapy (Figure 3), the growth rate of the offer was greater between 2007 and 2010 in Brazil, with an APC of 13.54% for the country, 19.43% for the North and 19.23% for the Northeast ($p < 0.01$). After this period, the growth rate diminished continually in all regions ($p < 0.01$).

For occupational therapy (Figure 3), the growth rate of the offer was greater between 2007 and 2010, with an APC of 10.62% for the country, 18.85% for the Midwest, 10.33% for the Northeast and 10.43% for the Southeast ($p < 0.01$). After this period, the growth rate diminished continually in all regions ($p < 0.01$).

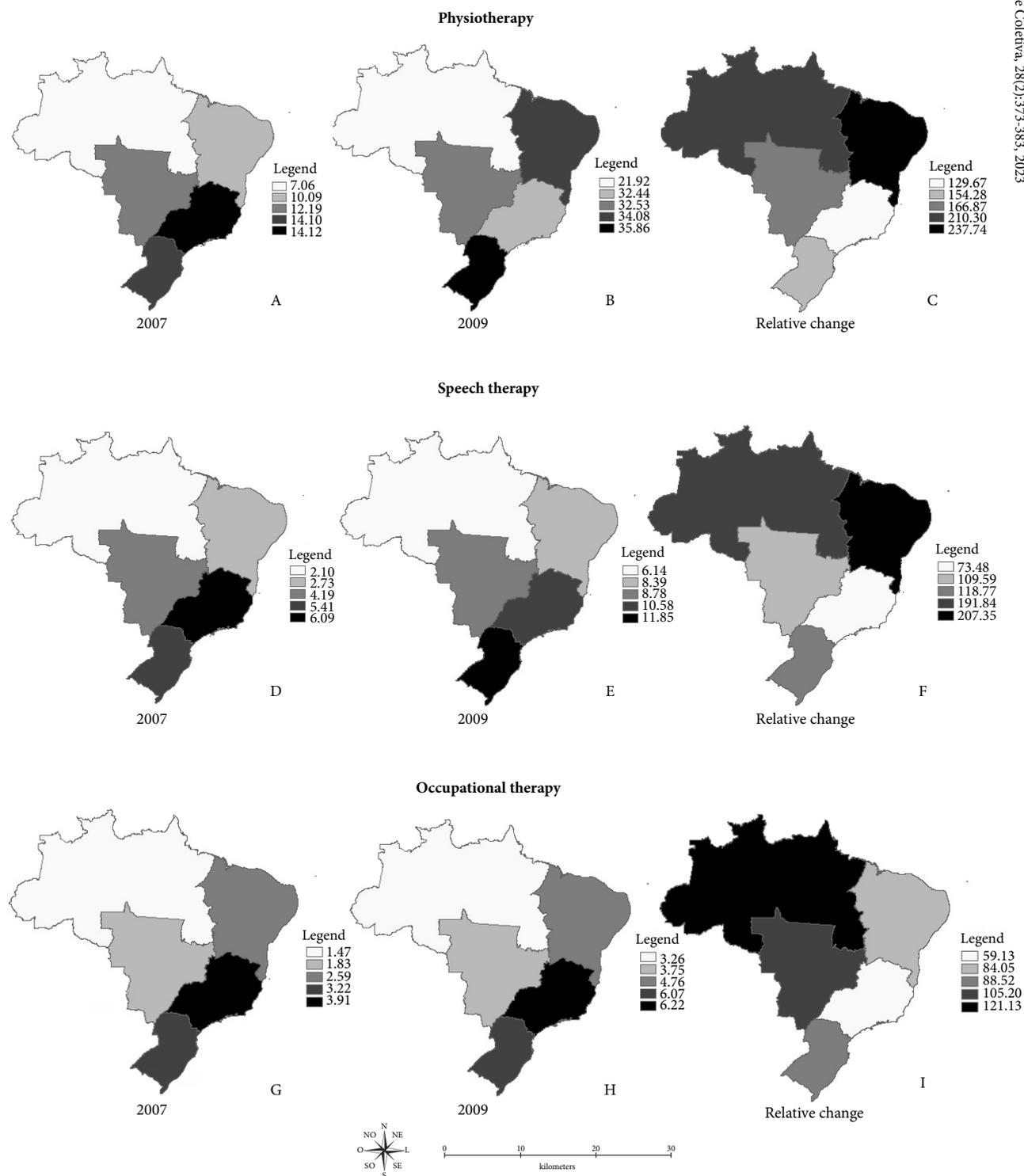


Figure 1. Spatial distribution of offer of physiotherapists, speech therapists and occupational therapists in Brazilian public healthcare system according to region of country, 2007/2019.

Legenda: A) Offer of physiotherapists per 100,000 residents in 2007; B) Offer of physiotherapists per 100,000 residents in 2019; C) Relative change (%) in offer of physiotherapists, 2007-2019; D) Offer of speech therapists per 100,000 residents in 2007; E) Offer of speech therapists per 100,000 residents in 2019; F) Relative change (%) in offer of speech therapists, 2007-2019; G) Offer of occupational therapists per 100,000 residents in 2007; H) Offer of occupational therapists per 100,000 residents in 2019; I) Relative change (%) in offer of occupational therapists, 2007-2019.

Source: Authors.

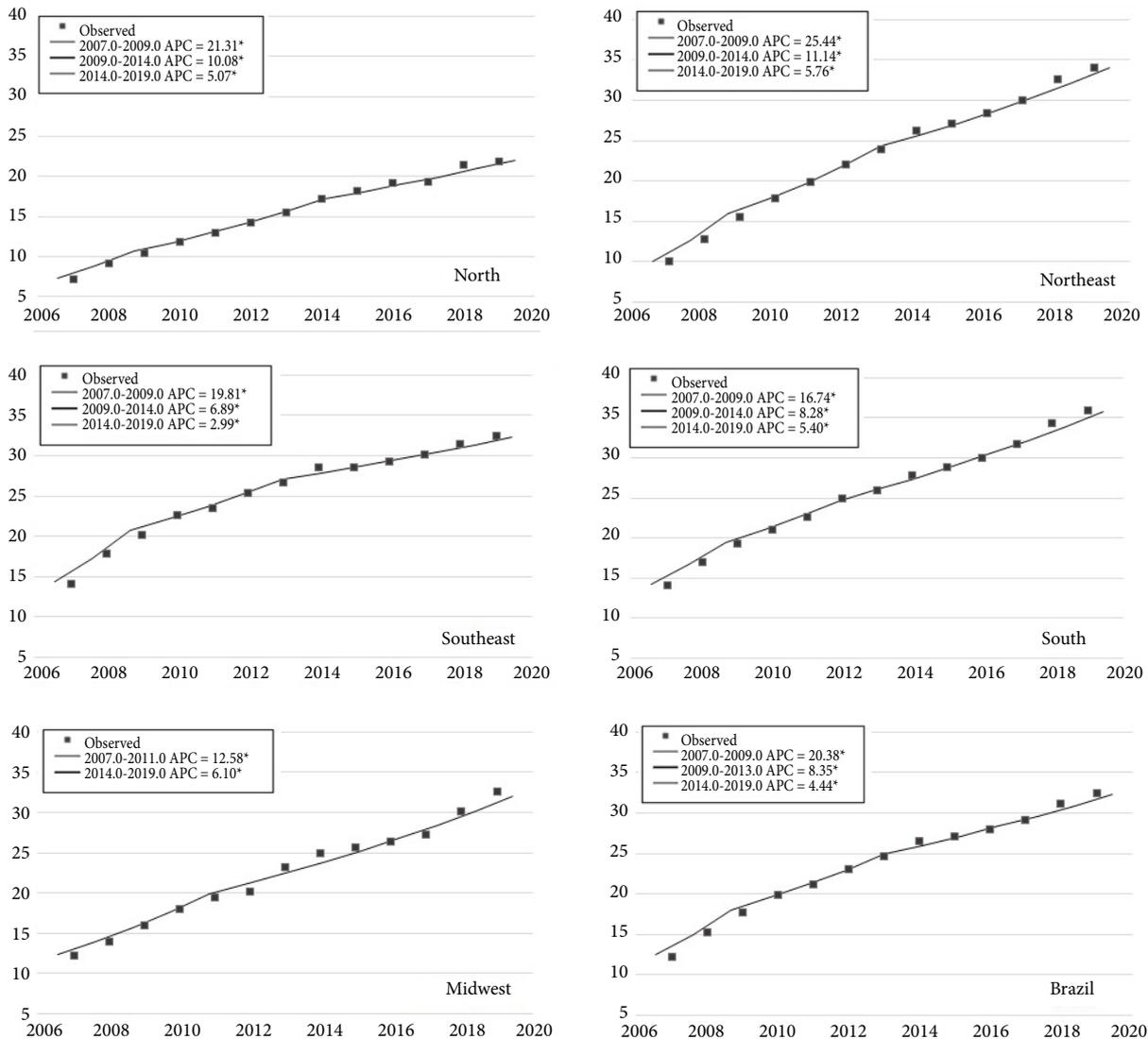


Figure 2. Temporal trend in physiotherapists in Brazilian public healthcare system according to region of country, 2007-2019.

Note: *p-value < 0.01. Average annual percent change (AAPC) – regions: North (9.7); Northeast (10.6); Southeast (6.9); South (7.9); Midwest (8.2); Brazil (8.3).

Source: Authors.

Discussion

The results of the present study reveal a growing trend in the offer of physiotherapists, speech therapists and occupational therapists in the Brazilian public healthcare system throughout the 13-year period analyzed. A study conducted by Carvalho et al.¹⁷ analyzing the growth rate of

14 health professionals attributed the increase in some categories to the organizational dynamics of the National Primary Care Policy through the teams of the Family Health and Primary Care Centers. Moreover, the implantation of the “Living without Limits” Plan and Disabled Persons’ Care Network is believed to have directly and significantly contributed to this expansion. This

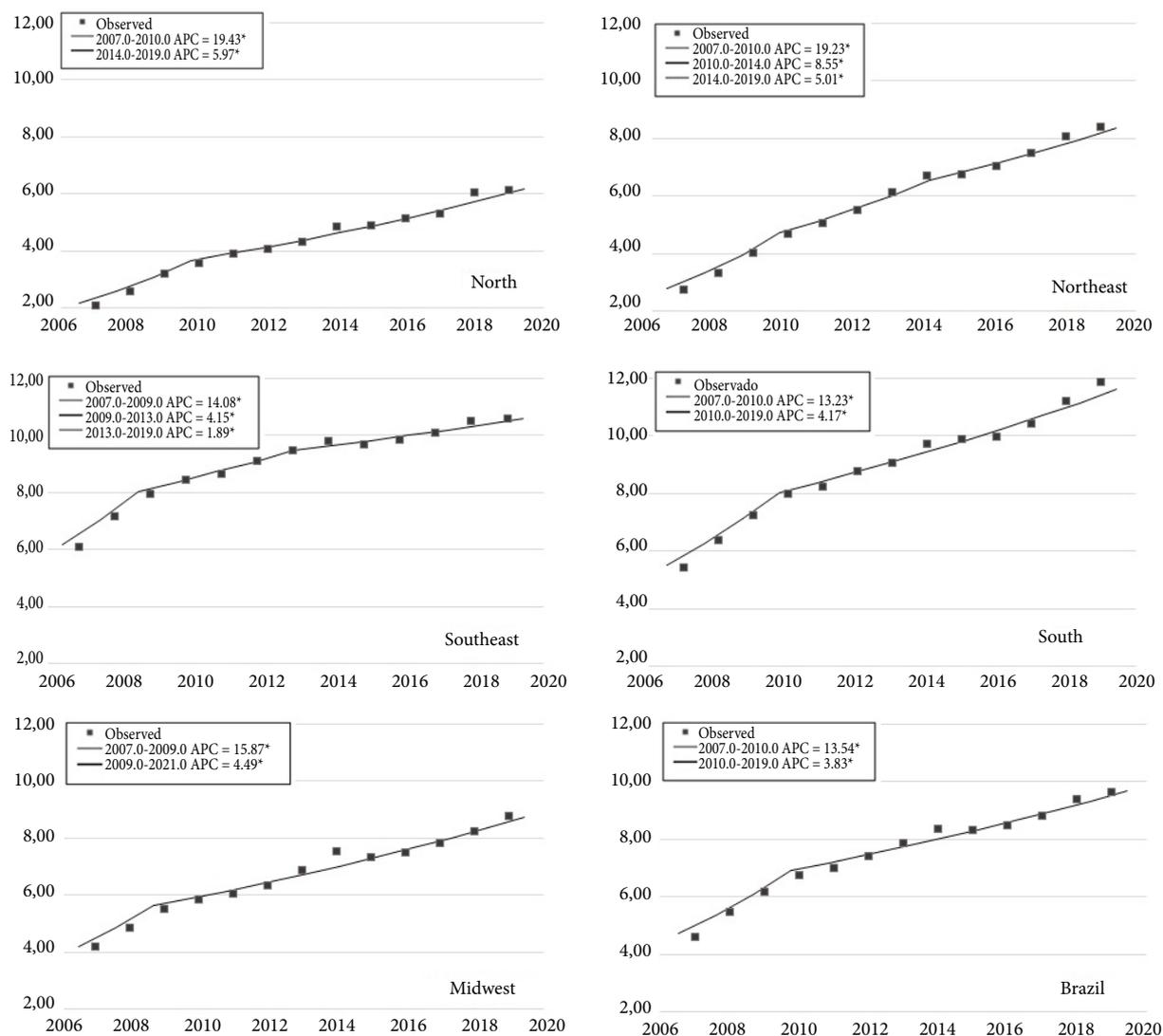


Figure 3. Temporal trend in speech therapists in Brazilian public healthcare system according to region of country, 2007-2019.

Note: *p-value < 0.01. Average annual percent change (AAPC) – regions: North (9.2); Northeast (9.6); Southeast (4.6); South (6.4); Midwest (6.3); Brazil (6.2).

Source: Authors.

result is related to the political scenario, which favored the implementation of social programs that ensured the expansion of access to health actions and services, including those related to rehabilitation.

The National Health Survey conducted in 2019³ by the Brazilian Institute of Geography and Statistics revealed that 8.4% of the population of the country had some type of disability,

which is an increase in comparison to the data from the 2010 census. Thus, an increase in the offer of health professionals is necessary to meet this demand.

Among other challenges, regional inequalities persist in the offer of healthcare services, as also identified by Garnelo et al.¹⁸ In the period studied, the North region presented considerable growth in the offer of the three rehabilitation ser-

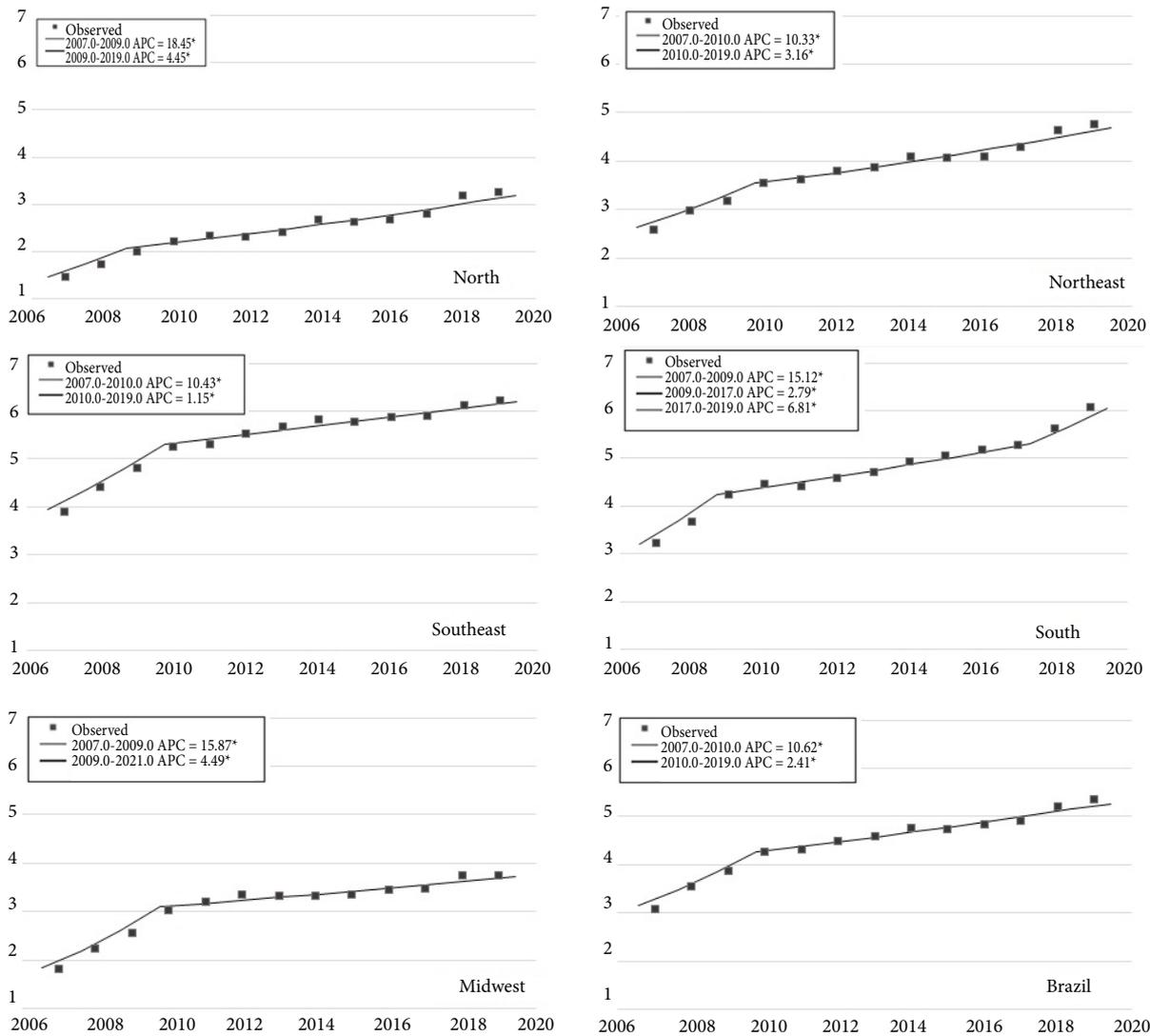


Figure 4. Temporal trend in occupational therapists in Brazilian public healthcare system according to region of country, 2007-2019.

Note: *p-value <0.01. Average annual percent change (AAPC) – regions: North (6.7); Northeast (4.9); Southeast (3.9); South (5.4); Midwest (6.0); Brazil (4.4).

Source: Authors.

vices, especially occupational therapy. However, this region had the lowest offer among all regions in both 2007 and 2019. A previous study revealed that limitations in the organization and offer of healthcare services, along with factors such as population dispersion and large geographical distances, constitute barriers regarding access to and the use of healthcare services that particularly penalize river populations¹⁸. Moreover, the

North region had the lowest indicators because these professionals are concentrated in metropolises¹⁹. The present results reveal that investments in the expansion of this offer in the period studied were not sufficient to change the *status quo* and this reflects differences that characterize the offer of care in the country.

Fundamental aspects exert an influence on the offer and distribution of health professionals

in the healthcare system. There is a considerable challenge regarding the management of human resources characterized by the chronic absence of policies that ensure health professionals for the services studied as well as precarious employment ties, which hinder the permanence of health professionals at public services, especially in municipalities distant from metropolises and areas of greater social vulnerability. This situation also reflects the dispute between the public and private sectors represented by the diversity and inequality of employment positions in the offer of courses for the education of health professionals at higher education institutions.

The Northeast is considered the poorest region of Brazil²⁰, which has direct implications for the health conditions of the population and, consequently, the distribution of health services and professionals, including those in the field of rehabilitation. Despite this, the Northeast was the region that most progressed in the offer of physiotherapy among the five regions of the country in the period studied. Part of this growth may be explained by the fact that the region concentrates the largest number of teams implanted at Family Health and Primary Care Centers in the country, corresponding to 44.4% of the teams implanted in 2017²¹.

Moreover, the Northeast occupies the second position in the offer of undergraduate courses in physiotherapy, accounting for 23% of such courses in the country in 2022²². The growth of the categories may also be attributed to the actions of health professionals in mobilization for the growth of the profession²³. According to Bispo Júnior²⁴, this development began in 1969 at the height of the military dictatorship in the country, which was a turbulent time in Brazilian society, when health conditions of the population were aggravated due to epidemiological burden and deficiencies in the Brazilian healthcare system.

The Northeast region also had the greatest relative growth in the offer of speech therapy. According to Cabrera et al.²⁵, the greater inclusion of this service was favored by public policies that guided these professionals in developing intersectoral and interdisciplinary practices considering the collective and individual levels with attention directed at families and the community. Moreover, the period studied also corresponds to a time of expansion and the consolidation of speech therapy courses at public universities. The Northeast also increased in the offer of occupational therapy in the period. The good performance in the relative growth of the Northeast is compatible with

data described by Albuquerque et al.²⁶, who found that, despite the difficulties affecting this region, improvements occurred in socioeconomic development and the offer of healthcare services.

The South is one of the regions with the fewest barriers to access to healthcare services in Brazil²⁷ and was one of the regions with the best percentages in the offer of the three categories of rehabilitation therapists in both 2007 and 2019, despite not having a substantial change in the offer over time. The growth in the offer decelerated in the region, which was one of the smallest in terms of relative change for the three rehabilitation categories of interest. Nonetheless, the South continued to have one of the best offers of these services in 2019.

In 2007, the Southeast presented the greatest offer of the three services among the five regions of the country, but had the lowest growth rate for the three professions throughout the study period. This result is surprising, as according to Oliveira et al.²⁸, the Southeast has the greatest access to healthcare services and the highest probability of use. One explanation may be the fact that the offer of these services in the region preceded the main policies mentioned above.

The Midwest had the lowest offer of speech therapy and occupational therapy in both 2007 and 2019, despite being the region with the second largest relative change in the offer of occupational therapy in the period. This may be explained by the population dispersion in the region and the difficulty in locomotion to healthcare services, especially on the part of the rural population, as stressed by Garnele et al.¹⁸

In general, expansion occurred in the offer of physiotherapy, speech therapy and occupational therapy in the public healthcare system in Brazil as a whole and all regions of the country, with the largest growth proportions found for physiotherapy, followed by speech therapy. Despite these advances, Rodes et al.⁸ report that access to rehabilitation professionals remains difficult, with an unequal offer that is insufficient for the promotion of the precepts of the universality, accountability and integrality of care.

Moreover, deceleration occurred in the growth rate of these three rehabilitation categories in the public healthcare system in Brazil and the five regions. This finding constitutes a warning sign that had previously been pointed out by Rodes et al.⁸ The indicator of the offer of rehabilitation professionals studied here has presented a reduction, despite the growth in the offer throughout the country.

The methodological limitations of the present study regard the use of the database from the month of December as the basis for the representation of the potential offer of the three categories of rehabilitation professionals and the use of secondary data. The choice of the month of December enables the reproducibility of the study in the future considering the difficulty in obtaining the complete database from the DATASUS site. Regarding the use of secondary data, studies of this type enable identifying flaws in information systems, which can assist in improving such systems, as occurred with the Mortality and Live-births Information System²⁹.

Future studies should perform an in-depth analysis of the offer of health professionals that work in the field of rehabilitation in the Brazilian public healthcare system, such as physiotherapists, speech therapists and occupational therapists, and compare the offer in the two health subsystems that coexist in Brazil, with the inclusion of other professionals who work in the field of rehabilitation as well as temporal trends in rehabilitation needs in each field and sociodemographic inequalities. Together with the present investigation, such studies have considerable potential to provide data that can assist in the planning and organization of healthcare services in the field of rehabilitation.

The expansion of the potential offer of health professionals who work with rehabilitation in the public healthcare system should go beyond the

issue of the availability of professionals. Issues with a broader scope should also be the object of other studies, such as strategies for the qualification of the work process as well as the provision and permanence of health professionals in places where the offer is scarce. There is also a need to organize public services to reduce geographic and organization barriers regarding access to rehabilitation.

Conclusion

An increasing trend was found in the offer of physiotherapists, speech therapists and occupational therapists in the Brazilian public healthcare system in all regions of the country. However, substantial deceleration in the growth rate occurred throughout the period studied. The persistence of inequalities in the offer among the regions of the country was also found, which underscores the need to increase governmental efforts to overcome inequities in access to healthcare services.

The deceleration in the offer points to a worrisome future with regards to access to rehabilitation considering the complex epidemiological profile, aging population, the increase in the proportion of individuals with disabilities in the country and the more recent increase in demand resulting from post-COVID-19 syndrome or “long COVID-19”.

Collaborations

The authors participated in all stages, from the conception of the article, its design, analysis and interpretation, to its final writing and critical analysis.

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