Medical school expansion policies: educational access and physician distribution

Alexandre Medeiros Figueiredo,[1] Danette Waller McKinley,[2] Kenio Costa Lima[3] & George Dantas Azevedo[4]

INTRODUCTION Many countries are employing strategies intended to reduce maldistribution of health workers and inequities. The purpose of this study was to analyse the impact of expansion policies of medical schools on regional inequalities in the distribution of undergraduate class sizes, and the capacity to attract and retain doctors and to expand health facilities.

METHODS We conducted a descriptive analysis to compare the distribution of undergraduate places in 2007 and 2016 to determine the impact of targeted expansion policies on inequalities in access to medical education in Brazil. A group of municipalities with new medical schools (n = 54) and a control group without medical schools (n = 408) were compared to analyse impacts of expansion in the health sector. We compared the increase in the number of physicians per 1000 inhabitants and health establishments per inhabitants between 2007 and 2016 based on these two groups. We also analysed the relationship between geographic distance from the state capital and capacity to attract physicians.

RESULTS There was a decrease in the regional inequalities of undergraduate places in medical schools; the greatest increase in the places per 1000 inhabitants was in municipalities of between 50 000 and 100 000 inhabitants. Municipalities with new medical schools showed an increase in physicians per 1000 inhabitants and in health establishments per inhabitant ratio, demonstrating the potential to attract and retain doctors, as well as strengthening the health infrastructure. Municipalities more distant from state capitals showed a greater increase in physician : inhabitant ratio.

DISCUSSION Countries with health workforce shortages and inequalities in their distribution might consider public financing and regulation policies for expansion of medical schools as a strategy to attract and retain professionals. Early results in Brazil showed that such strategies could strengthen service networks in deprived areas, supporting implementation of Universal Healthcare Coverage.

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[1]Department of Health Promotion, Federal University of Paraíba, João Pessoa, PB, Brazil
[2]Research and Data Resources, FAIMER, Philadelphia, Pennsylvania, USA
[3]Department of Dentistry, Federal University of Rio Grande do Norte, Natal, Brazil
[4]Multicampi School of Medical Sciences, Federal University of Rio Grande do Norte, Caicó, Brazil

Correspondence: Alexandre Medeiros Figueiredo, Department of Health Promotion, Federal University of Paraíba, Campus I, Jardim Universitário, S/N, Castelo Branco, João Pessoa, PB, BR, 58051-900. Tel: 00 55 83 3216 7242;
E-mail: potiguar77@gmail.com

INTRODUCTION

Current epidemiological and demographic changes and the expansion of the health care labour market have caused an increase in the demand for doctors and a global deficit that hinders the implementation of Universal Healthcare Coverage (UHC) in many countries.[1–7] This shortage creates an inequitable distribution of physicians worldwide and varying consequences for populations.[1,2] Low-income countries report severe shortages in the number of qualified professionals, which limits access to health care and improvements in health care indicators, as defined in the Millennium Development Goals.[1,2] These countries have a low density of physicians and a high burden of disease, worsening health inequities.[1,2] Nations with large populations and economic growth in recent decades, such as China, Brazil and India, have difficulties in meeting the growing health needs of their populations and have a shortage of professionals.[8–11] Even countries with well-established health systems have regions with a lower number of physicians and these deficits may be addressed by doctors trained in other countries.[12–14] Additionally, there are difficulties in attracting and retaining professionals in rural and underserved areas. This situation is aggravated by the internal patterns of physicians migrating to locations with greater economic development, which increases regional inequalities in workforce distribution.[13]

Educational systems could influence the number and type of health professionals in the country.[1,15] Medical schools' expansion policies are important to guarantee an adequate number and distribution of medical graduates to address local and national shortages.[15] In most countries, medical schools are concentrated in larger and more developed cities.[2,10,16,17] Furthermore, most medical students come from more economically developed regions.[17] These factors, combined with an insufficient number of undergraduate places, significantly influence the composition and distribution of a medical workforce.[2,9]

The characteristics of curricula are also important to ensure social commitment and the development of professionals with the necessary competence to respond to the health care needs.[2,4,5,18] Although most health problems can be managed in primary care settings, most medical schools prioritise a model of hospital training in large urban centres.[17,19] The organisation of the labour market is an additional factor to consider, given that the structure of the service network, employment opportunities, working conditions, social status and qualification opportunities increase the possibility of attracting and retaining professionals.[15]

Many countries have expanded medical school enrolment in order to reduce shortages.[20] Australia, Canada and the USA have implemented regional campuses, rural schools and rural practice learning experiences to strengthen medical education in rural and underserved areas in order to reduce workforce maldistribution.[17,21–23] In Brazil, the national health care system supports efforts to expand the health care workforce and improve access to care through principles of universal access to comprehensive health care.[24] Despite improvements, Brazil still faces problems of access to health care services for a large portion of the population.[25] One of the obstacles has been the deficit of physicians, which is most prevalent in regions with the worst health indicators.[10] Brazil has public (maintained by federal, state or municipal governments) and private medical schools. The federal government is responsible for maintaining federal medical schools and for regulating the private sector. Most enrolments are in private medical schools (61.7%) and in the South and Southeast regions of the country.[10,16]

Beginning in 2007, the federal government implemented policies to expand access to higher education and reduce social inequities.[26] In 2013, the More Doctors for Brazil Programme (Programa Mais Médicos para o Brasil, PMMB) was created by a federal law, with the objective of expanding medical education to increase the number of primary health physicians in underserved areas. The expansion of medical education aims to increase medical undergraduate places, expand postgraduate (residency) programmes, reduce regional inequalities and ensure that the medical education curricula are based on community health needs.[27] This programme has the goal of increasing the physician : inhabitant ratio to 2.7 doctors for each 1000 inhabitants, creating approximately 11 500 new undergraduate places in medical schools.[27] The PMMB establishes criteria based on the shortage of physicians to determine the location of new federal and private schools. Accordingly, this new regulation prioritises the

opening of new medical schools in municipalities of health regions without medical schools.[16]

To examine the extent to which these directives assist schools in attending to the needs of underserved communities, the aim of this study was to analyse the impact of policies for expansion of medical schools on the reduction of regional inequalities in medical school access. We examined the association between changes in the location of medical school expansion, the increase in the physician : inhabitant ratio and number of health care establishments by comparing two time frames of policy implementation.

METHODS

We conducted a descriptive study to analyse the impact of education expansion policies in Brazil on the reduction of regional inequalities in the distribution of undergraduate medical places, comparing the period between 2007 and 2016. Official reports on the population and number of undergraduate medical places in Brazilian municipalities were obtained from the databases of the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatistica, IBGE), Ministry of Education and Higher Education Census of the National Institute for Educational Studies and Research Anísio Teixeira (Instituto Nacional de Estudos e Pesquisas Anísio Teixeira, INEP). The data were aggregated in a single database comprised of the following variables: population, region, gross domestic product (GDP) per capita, number of authorised undergraduate places, medical school ownership (public or private), year of authorisation of the medical school, municipality, and distance between the municipality and the state capital. The number of undergraduate places and the ratio of undergraduate places for every 100 000 inhabitants were calculated for the beginning (2007) and end (2016) of the analysis period. The municipalities were categorised according to population size, region and municipal GDP. The GDP variable was used as a proxy of the economic status of municipalities.

We conducted an evaluation to analyse the impact of medical schools' expansion on the capacity to attract and retain professionals and increase health care services between 2007 and 2016. The municipalities were divided into two categories: a group of municipalities with medical schools implemented from 2007 to 2016 ($n = 54$) and a control group of municipalities without medical schools during the same time frame ($n = 408$). The number of physicians per 1000 inhabitants and the ratio of health care facilities (including hospitals, community health facilities and doctors' offices) per 1000 inhabitants were calculated for all municipalities of the sample, comparing the years 2007 and 2016. The data concerning the number of doctors and the number of health care facilities were obtained in December 2017 from the National Register of Healthcare Establishments (Cadastro Nacional de Estabelecimentos de Saúde, CNES) database, available at the website of the Informatics Department of the Unified Health System (DATASUS), Ministry of Health, Brazil. This database registers all public and private health care facilities in Brazil and its health professionals. All Brazilian municipalities with populations between 50 000 and 500 000 inhabitants in 2007 were included in the analysis. Municipalities with medical schools opened before 2007 were excluded from analysis. Municipalities with <50 000 inhabitants were also not evaluated, as they are not eligible for the opening of new medical schools according to the educational regulations. The municipalities were also subdivided in relation to population size, region, municipal GDP per capita and physician : inhabitant ratio in the state in 2007, to identify the potential influence of these characteristics on the evaluated variables. The categorisation related to physician : inhabitant ratio in the state was obtained using the mean of the values derived from the physician : inhabitant ratio in each state of the federation in 2007.

To compare the groups of municipalities, an increase in physician : inhabitant ratio and increase in health care facilities : inhabitant ratio were calculated. The difference between the variables for 2007 and 2016 was compared. Medians and interquartile range of the variables were calculated and bivariate analysis using the Mann–Whitney test was conducted to determine whether there were statistically significant differences. A Spearman correlation was performed to analyse the existence of a relationship between the distance from the state capital (proxy of remoteness) and the increase in the physician : inhabitant ratio.

The research was approved by the ethics and research committee of the Universidade Federal da Paraíba, protocol no. 2.094.734/2017, CAAE 68502217.2.0000.8069.

RESULTS

Impact of medical school expansion on the distribution of undergraduate places

In 2007, most of the medical undergraduate places in the country were located in the richer municipalities (91.3%) and in those with more than 500 000 inhabitants (56.1%), as shown in Table 1.

During the analysed period, the greatest increase in the ratio of undergraduate medical places to 100 000 inhabitants was in municipalities with between 50 001 and 100 000 inhabitants (111.9%). This ratio increased in all regions of Brazil, particularly in the Northeastern (66.7%) and Central-West (47.1%) regions, suggesting decreased inequalities in access to medical schools. The undergraduate medical places per inhabitants showed a greater proportional increase in municipalities with GDP per capita lower than the national average (64.7%) when compared to municipalities with GDP per capita higher than the national average (39.8%). The expansion of medical schools in less developed regions is presented in Fig. 1.

Impact of medical schools' expansion on attraction and retention of doctors

The municipalities in which schools opened since 2007 were those where GDP per capita and the physician : inhabitant ratio in the state was below the national average (see Table 2). Most of the expansion to new municipalities occurred for public (government-funded) medical schools. The average time since medical school establishment is 4.5 years, and in 72.2% of municipalities establishment occurred in <5 years.

Table 3 shows the baseline median absolute number of physicians and the physician : inhabitant ratios for 2007 (baseline) and 2016. There are variations related to regional and socio-economic variables. The medians of the physicians per capita ratios in the municipalities where medical schools were more recently established were higher than 1.0

Table 1 Number of medical undergraduate places and undergraduate medical places per 100 000 inhabitants ratio by municipal population size, gross domestic product (GDP) per capita and Brazilian region in 2007 and 2015

	Medical undergraduate places		Undergraduate medical places per 100 000 inhabitants		
Municipality characteristics	**2007**	**2015**	**2007**	**2015**	**Increase (%)**
Population					
Up to 50 000 inhabitants	340 (2.3%)	380 (1.6%)	0.6	0.6	0
Between 50 001 and 100 000 inhabitants	910 (6.2%)	2176 (9.2%)	4.2	8.9	111.9
Between 100 001 and 500 000 inhabitants	5151 (35.4%)	9595 (40.7%)	11.6	18.0	55.2
Above 500 000 inhabitants	8164 (56.1%)	11 398 (48.4%)	15.2	18.6	22.6
GDP per capita in 2007					
Below the national average	1260 (8.7%)	2058 (8.7%)	1.7	2.8	64.7
Above the national average	13 305 (91.3%)	21 491 (91.3%)	11.8	16.5	39.9
Region					
Central-West	926 (5.5%)	1595 (6.8%)	7.0	10.3	47.1
Northeast	3270 (22.5%)	5933 (25.2%)	6.3	10.5	66.7
North	1220 (8.4%)	1825 (7.7%)	8.3	10.4	25.3
Southeast	7066 (48.5%)	10 727 (45.6%)	9.1	12.5	37.4
South	2203 (15.1%)	3469 (14.7%)	8.2	11.9	45.1
Total	14 565 (100.0%)	23 549 (100.0%)	8.0	11.5	43.8

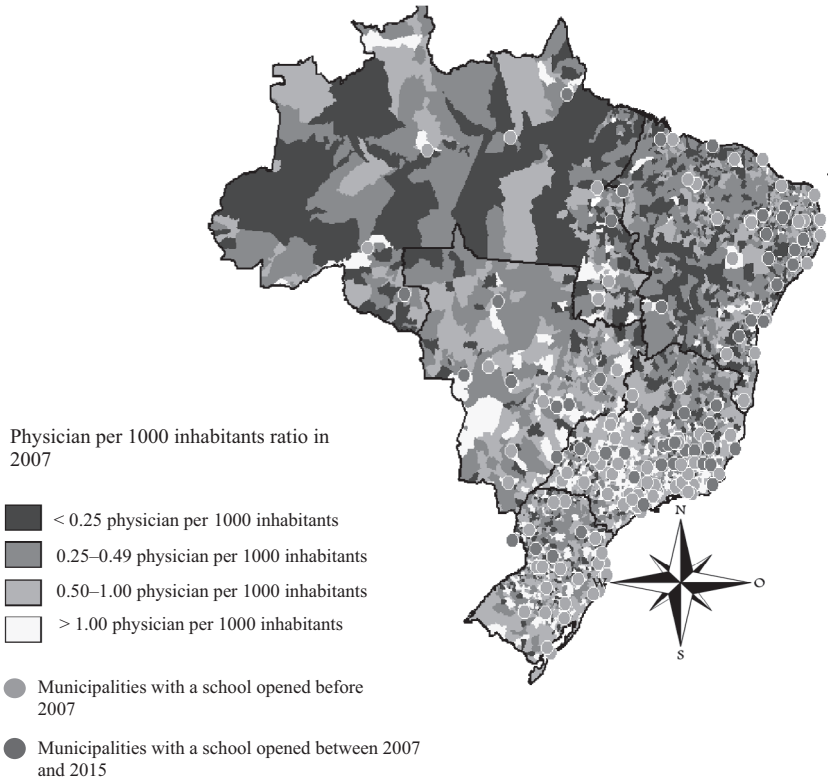

Figure 1 Distribution of medical schools and physician : inhabitant ratio by municipality in 2007

per 1000 inhabitants in all analyses of subgroups of municipalities.

Table 4 compares the increase in physician : inhabitant ratio by region, GDP per capita and population size in 2007 and 2016. During the study period, there were increases in the ratios in all evaluated municipality groups. The physician : inhabitant ratio increase was higher in the Central-West (0.1–0.5) and Northeast (0.2–0.5) regions when comparing those without schools and schools established in 2007 and later. Municipalities with new medical schools had a similar increase in the physician : inhabitant ratio based on GDP per capita below (0.2–0.5) and above (0.3–0.8) the national average, which did not occur in municipalities without a medical school (0.2 below and 0.3 above the national average). The increase in physician : inhabitant ratio was higher in municipalities with new medical schools (0.2 versus 0.6), with statistically significant differences in all analyses performed. Regarding population size, the municipalities with between 100 001 and 500 000 inhabitants attained a higher increase in physician : inhabitant ratio.

The absolute variation analysis of the health care facilities : inhabitant ratio between 2007 and 2016 demonstrates that the group of municipalities with new medical schools had increased more than the group of municipalities with no medical school (see Table 5). Similar to results based on changes in medical school establishment, health care facility ratios to inhabitants were higher in the Northeast region. The ratio was 0.2 for regions with no medical school versus 0.5 for those with medical schools established in 2007 or later and the Southeast region (0.5 versus 0.9, respectively). Statistically significant differences were also found for the municipalities with GDP per capita below the national average (0.3 for those without new schools versus 0.6).

Distance from state capital was used as a proxy for remoteness. The Spearman correlation analysis indicates that there is a positive correlation (r = 0.34; p = 0.014) between the geographic distance from the capital and the increase in physician : inhabitant ratio.

DISCUSSION

Many countries have been implementing processes to expand medical education and the number of physicians.[2,8,10,11,16,20,22,28] However, reduction of

Table 2 Distribution of new medical schools by municipality characteristics

Characteristics	Municipalities with medical school implemented since 2007	
	n	%
Region		
Central-West	10	18.5
Northeast	16	29.6
North	3	5.6
Southeast	21	38.9
South	4	7.4
Physician : inhabitant ratio in the state in 2007		
Below the national average	46	85.2
Above the national average	8	14.8
Gross domestic product per capita in 2007		
Below the national average	36	66.7
Above the national average	18	33.3
Population size in 2007		
50 000–100 000 residents	25	46.3
100 001–500 000 residents	29	53.7
Medical school ownership		
Public	35	65.0
Private	19	35.0
Total	54	100.0

regional inequalities regarding medical school access and increases in physician : inhabitant ratios have been variable.[8,9,11,22,28] Some countries, such as Australia, have implemented national policies, specifying the expansion of schools, changes in medicine curricula, rural student recruitment, admissions policies and enhancement of programme establishment in rural locations, with promising results.[22,23] Other countries, such as China, India and the USA, implemented expansion processes with lower levels of coordination and regulation, potentially affecting reduction of maldistribution of physicians.[8,9,11,28]

The results of this study demonstrate that the recent expansion of medical schools in Brazil was associated with reduction of physician shortages and regional inequalities. The federal expansion prioritised regions with a lower physician : inhabitant ratio.[26,27,29] Private expansion was stimulated by fiscal incentive policies and programmes of access to education for socially excluded sectors of the population, making the expansion of medical schools in the less developed municipalities attractive. However, the data reveal that public expansion has been broader and that the introduction of financial incentives for the private sector is insufficient to reverse regional inequalities. The impact of PMMB regulation on the expansion of private schools cannot yet be assessed as it requires further analysis.

The increase in the number of places per inhabitants in regions showing a deficit of doctors indicates the potential to minimise inequities in access to medical education.[13,29] Concurrent with this expansion, federal medical schools have implemented changes in their student admission policies, establishing social and racial quotas (50.0% of admissions in public federal schools) that raise the chances of admission for students from rural and underserved areas.[26]

The municipalities in which medical schools were implemented increased the capacity for attracting and retaining doctors as well as expanding health care services, stimulating the labour market and creating opportunities for graduates. This process occurred in municipalities with lower GDP per capita, demonstrating that medical school expansion is capable of strengthening the local health care sector, even in more fragile economies. The impact of implementing medical schools was greater in municipalities with lower income and in regions with an inferior physician : inhabitant ratio. The analysis of the correlation between the distance from the state's capital and the increase in attraction of physicians demonstrates the potential of the establishment of medical schools in remote locations to attract physicians. These results suggest that severity of shortages, investment in establishing medical schools and their economic impact on the health sector can play important roles in attracting physicians. The improvement in health care structure and increase in the local medical workforce can strengthen regional health care networks and expand the coverage of services, reducing the need to transport the population to more developed locations. Thus, the integration of education policies with health care actions such

Table 3 Physician : inhabitant ratio and number of physicians in 2007 and 2016 in municipalities without medical schools and municipalities with a new medical school

	Number of physicians				Physician : inhabitant ratio			
	Municipality without medical school		Municipality with a new medical school		Municipality without medical school		Municipality with a new medical school	
	Median (IQ range)		Median (IQ range)		Median (IQ range)		Median (IQ range)	
Categories	**2007**	**2016**	**2007**	**2016**	**2007**	**2016**	**2007**	**2016**
Region*								
Central-West	74.0 (57.5–103.5)	111.0 (69.5–138.0)	102.5 (89.3–240.5)	181.0 (123.0–382.5)	1.0 (0.6–1.2)	0.9 (0.7–1.4)	1.1 (0.9–1.2)	1.5 (1.2–1.8)
Northeast	38.5 (25.0–67.5)	57.5 (38.3–99.8)	99.5 (55.0–177.6)	159.0 (113.3–335.0)	0.5 (0.4–0.8)	0.7 (0.5–1.2)	0.9 (0.7–1.3)	1.4 (1.2–1.9)
Southeast	115.5 (72.0–221.3)	154.0 (100.8–284.3)	168.0 (107.0–397.5)	245.0 (170.0–604.5)	1.3 (0.8–1.6)	1.6 (1.0–2.1)	1.6 (1.3–1.8)	2.1 (1.7–2.6)
South	95.5 (53.8–105.5)	138 (67.8–207.3)	200.5 (93.0–337.3)	332.5 (184.8–575.5)	1.2 (0.8–1.5)	1.5 (1.0–2.3)	1.2 (1.0–1.4)	1.9 (1.7–2.5)
Physician : inhabitant ratio in the state in 2007								
Below the national average	50.0 (30.0–89.0)	71.0 (41.0–130.0)	110.5 (85.8–287.5)	201.0 (140.0–454.0)	0.7 (0.4–1.0)	0.8 (0.5–1.4)	1.1 (0.9–1.4)	1.7 (1.3–2.1)
Above the national average	119.0 (82.0–230.0)	161.0 (113.0–296.0)	338.0 (123.3–431.5)	632.0 (224.8–705.5)	1.3 (0.9–1.7)	1.6 (1.1–2.2)	1.8 (1.4–2.5)	2.7 (2.2–3.5)
GDP per capita in 2007								
Below the national average	53.5 (32.0–102.0)	77.5 (42.0–144.3)	110.5 (82.0–272.0)	218.0 (138.5–430.5)	0.7 (0.4–1.1)	0.9 (0.5–1.4)	1.2 (0.8–1.5)	1.8 (1.3–2.2)
Above the national average	119.0 (77.8–215.0)	158.5 (107.5–302.8)	174.0 (97.3–361.3)	231.5 (146.8–602.5)	1.4 (1.0–1.7)	1.7 (1.1–2.3)	1.2 (1.1–1.8)	1.8 (1.5–2.7)
Population size in 2007								
50 000–100 000 inhabitants	53.0 (32.0–87.3)	73.5 (42.0–131.3)	93.0 (62.5–108.0)	150.0 (113.5–214.5)	0.8 (0.5–1.3)	1.1 (0.6–1.7)	1.3 (0.9–1.5)	1.7 (1.3–2.4)
100.001–500.000 inhabitants	173.5 (102.8–253.8)	237.5 (127.8–390.8)	292.0 (135.5–388.5)	485.0 (225.0–677.0)	1.1 (0.6–1.6)	1.3 (0.8–2.1)	1.1 (1.0–1.6)	1.8 (1.4–2.3)
Total	73.0 (38.0–133.8)	108.0 (52.0–189.3)	125.5 (92.8–313.0)	220.0 (143.0–551.8)	0.9 (0.5–1.4)	1.2 (0.6–1.8)	1.2 (1.0–1.5)	1.8 (1.4–2.3)

* Statistical analyses concerning the North region were not performed because of the low number of municipalities in the group with new medical schools. GDP, gross domestic product per capita; IQ, interquartile range.

Table 4 Comparison of the increase in physician : inhabitant ratio between 2007 and 2016 in municipalities without medical schools and municipalities with a new medical school

Categories	Municipality without a medical school Ratio (IQ range)	Municipality with a medical school implemented since 2007 Ratio (IQ range)	p value
Region*			
Central-West	0.1 (−0.1–0.4)	0.5 (0.2–0.7)	0.012
Northeast	0.2 (0.0–0.4)	0.5 (0.4–0.6)	<0.001
Southeast	0.3 (0.0–0.5)	0.7 (0.3–0.7)	0.001
South	0.4 (0.2–0.6)	0.7 (0.7–1.2)	0.032
Physician : inhabitant ratio in the state in 2007			
Below the national average	0.2 (0.0–0.4)	0.5 (0.4–0.7)	<0.001
Above the national average	0.3 (0.0–0.6)	0.8 (0.5–1.3)	0.002
GDP per capita in 2007			
Below the national average	0.2 (0.0–0.4)	0.6 (0.4–0.7)	<0.001
Above the national average	0.4 (0.1–0.6)	0.6 (0.3–0.7)	0.025
Population size in 2007			
50 000–100 000 inhabitants	0.2 (0.1–0.5)	0.4 (0.4–0.7)	<0.001
100 001–500 000 inhabitants	0.2 (0.0–0.5)	0.6 (0.4–0.7)	<0.001
Total	0.2 (0.0–0.5)	0.6 (0.4–0.7)	<0.001

* Statistical analyses concerning the North region were not performed because of the low number of municipalities present in the group with new medical schools. GDP, gross domestic product per capita; IQ, interquartile range.

as expansion of facilities can be a strategy to improve health care and reduce health inequities in countries with similar workforce challenges.[30–32]

The increase in undergraduate places that occurred in Brazil was based on the creation of national public policies involving the increase of financing, changes in admission policies, integration between education and health care sectors and regulation mechanisms.[26,27] The PMMB has established new mechanisms for evaluating the quality of medical schools and directives for medical education based on health needs. The expansion of medical schools and medicine residency programmes became a part of strategies for workforce planning, to ensure implementation of UHC and seek a long-term balance between the supply and demand of professionals.[27]

Despite advances in reduction of shortages and inequities, this expansion of medical schools to less developed areas has important challenges for quality assurance.[16] Brazil is facing an important economic crisis that reduces public and private investments in health and education.[33] This reduction can impair implementation of infrastructure improvements and teaching and education projects, which may have a negative effect on quality.

The PMMB associated the expansion of medical schools with strategies for increasing the numbers of generalists in underserved areas, linking the establishment of schools to the creation of medical residency programmes, especially in family medicine.[27] This initiative aims to expand medical residency programmes to medium and small cities, in conjunction with improving capacity to retain health care workers in these municipalities.[28,29] Between 2006 and 2016, 2238 placements in family medicine residency programmes were created and most were made available after the PMMB (79.9%).[34] The pace of expansion has

Table 5 Health care facilities : inhabitant ratio between 2007 and 2016 by municipality characteristics

Variables	Municipality without a medical school Ratio (IQ range)	Municipality with a new medical school Ratio (IQ range)	p value
Region*			
Central-West	0.4 (0.15–1.0)	0.5 (0.3–0.9)	0.780
Northeast	0.2 (0.1–0.4)	0.5 (0.2–0.6)	<0.001
Southeast	0.5 (0.2–1.0)	0.9 (0.4–1.6)	0.003
South	0.6 (0.3–0.9)	1.0 (0.7–2.1)	0.097
Physician : inhabitant ratio in the state in 2007			
Below the national average	0.3 (0.1–0.5)	0.5 (0.3–0.8)	<0.001
Above the national average	0.5 (0.2–1.0)	1.6 (1.0–2.1)	<0.001
GDP per capita in 2007			
Below the national average	0.3 (0.1–0.5)	0.6 (0.3–1.0)	<0.001
Above the national average	0.5 (0.3–1.0)	0.7 (0.4–1.6)	0.142
Population size in 2007			
50 000–100 000 inhabitants	0.3 (0.2–0.7)	0.5 (0.3–1.1)	0.006
100 001–500 000 inhabitants	0.3 (0.1–0.5)	0.6 (0.3–1.1)	0.001
Total	0.3 (0.2–0.7)	0.6 (0.3–1.1)	<0.001

* Statistical analyses concerning the North region were not performed because of the low number of municipalities present in the group with new medical schools. GDP, gross domestic product per capita; IQ, interquartile range.

been inadequate and, as in other countries, there is an insufficient number of medical students intending to become family physicians. Consequently, most of the places in family medicine are not filled.[17,34,35] This situation requires further analysis and elaboration of new strategies, because the expansion of residencies in family medicine is an essential element of medical education in Brazil.[27,34]

In 2016, about 66 million Brazilians lived in cities with <50 000 inhabitants, demonstrating that reducing physician shortages in rural and deprived areas required additional measures. A few institutions in underserved areas prioritised the admission of students from small municipalities in the region, aiming to increase retention of physicians.[36] This strategy was shown to be efficient in other countries and could be added to the system of social quotas of public universities located in areas lacking doctors.[19,23] The implementation of rural clinical schools could be another strategy to guarantee rural practice learning experiences and improve the quality of health care in smaller municipalities.[19]

CONCLUSIONS

Although this study provides some evidence of the potential effectiveness of policy implementation, it is not without limitations. The design of this study does not establish causality. However, the data suggest satisfactory results. The implemented policies must be continued for the objectives outlined to be met in the long term. Therefore, it is important to continue the monitoring process and to conduct additional studies using other methodologies to identify positive (and negative) effects of policy implementation. Further research to evaluate the impact of this expansion on the distribution of doctors, the quality of medical education, changes in admission policies and improvements in access to health care should be conducted. Follow-up studies of graduating students' career intentions will provide additional evidence of the impact of policies on workforce expansion. Analyses of physician practice patterns (specialty choice and practice location) are needed to evaluate the effect of these policies on retention in underserved areas.

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