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The *Mais Médicos* (More Doctors) Program in Northeast: evaluation of hospitalizations for Primary Healthcare-sensitive conditions

Rogério Fabiano Gonçalves [1]
Islândia Maria Carvalho de Sousa [1]
Oswaldo Yoshimi Tanaka [2]
Carlos Renato dos Santos [3]
Keila Brito-Silva [3]
Lara Ximenes Santos [4]
Adriana Falangola Benjamin Bezerra [5]

Abstract *This paper analyzes the increase in professionals in Brazil's Northeastern Region resulting from the* Mais Médicos *(More Doctors) Program. The scale of the increase was analyzed through the indicator Hospitalizations for Primary-Care Sensitive Conditions* (HPSCs). *The method used was a quantitative approach, based on data on distribution of doctors and service they provided in these states, and on hospitalizations for diarrhea and gastroenteritis in the period September 2012 to August 2015. The choice of this condition took into account the aspects of: its high frequency in the period; the simplicity of intervention; and its historic occurrence in the Northeast. The results show that the* Mais Médicos *Program had an influence on the reduction of hospitalizations for this type of condition – they fell by 35% in the period investigated, with important differences between the states. In spite of the significant scale of the entry of medical professionals into the health system, it is known that in isolation simply increasing the number of professionals of a particular type has a limited effect in improving primary healthcare.*

Key words *Program evaluation, Family health strategy, Primary care*

[1] Universidade de Pernambuco. Av. Cardoso de Sá s/n, Vila Eduardo. 56328-903 Petrolina PE Brasil. rogeriofabiano@gmail.com
[2] Departamento de Prática de Saúde Pública, Faculdade de Saúde Pública, USP. São Paulo SP Brasil.
[3] Núcleo de Saúde Coletiva, Centro Acadêmico de Vitória, Universidade Federal de Pernambuco (UFPE). Vitória de Santo Antão PE Brasil.
[4] Centro Acadêmico do Agreste, UFPE. Caruaru PE Brasil.
[5] Departamento de Medicina Social, Centro de Ciências da Saúde, UFPE. Recife PE Brasil.

Introduction

In recent years there has been increasing discussion on the availability of doctors in Brazil, their regional distribution, and the quality of medical training, and also the impact of these questions on access to primary healthcare in the Single Health System (SUS), and on its capacity to provide solutions[1,2]. In spite of the controversies in this discussion as to the diagnosis of the reality and the possible solutions, Brazil's Health Ministry instituted the *Mais Médicos (More Doctors)* Program in the second half of 2013[3].

One of the main purposes of this program is training in health, and provision of doctors in regions that are priority for the SUS. In relation to provision of care, a component of the program named the *Mais Médicos (PMM)* Project, the Health Ministry issued public tenders for temporary entry of doctors into primary healthcare. Although priority was given to entry of professionals trained in Brazilian higher education institutions, or with diplomas that had been revalidated in Brazil, the number of people interested in the initial tenders was not enough to meet the demand of municipalities. As a result the remaining vacancies were made available to exchange doctors: non-Brazilian doctors qualified to practice medicine in other countries[2].

After just over 2 years from putting the project in place, the Health Ministry reported that 18,240 doctors participated in the project in 4,058 municipalities (72.9% of the municipalities of Brazil), as well as 34 indigenous districts, benefiting approximately 63 million people. The proportion of exchange doctors was approximately 71%, the majority of them from Cuba[4].

The Northeast was the region that received the largest number of doctors through the PMM in the five first rounds of tenders and start of professional activities. The rounds began in September 2013 and ended in July 2014. According to Health Ministry data[5], of the 14,465 doctors who began their activities in the Project up to the 5th round, 4,825 (33.4%) went to the Northeast, followed by the Southeast with 30, the South with 16.6%, the North with 13.1% and the Center-West with 6.4%.

The region showed high demand for doctors in primary healthcare, with participation of 1,303 municipalities (72.6%) up to the 5th round of tenders, as well as being an important location of occurrence of illnesses influenced by socio-economic issues[6]. Over recent decades it has also been the region with strong adherence to the Family Health Strategy (ESF), which has expanded greatly in all the states[7].

In spite of the scale of the PMM and of the significance of the problem in which it seeks to intervene – access for the population to health service in primary healthcare – knowledge about the results of this initiative is still only incipient, and questions and uncertainties remain, as to its potential, political tensions and the wide exposure it has received in the media.

Also, evaluation of primary healthcare required overcoming of theoretical and operational challenges that arise from the complexity of historical and contextual processes. Baseline studies have helped to elucidate evidences of effectiveness[8], but these studies have concentrated on large-scale municipalities, with populations of more than 100,000, where there is some type of care available. The focus of the PMM was municipalities that have difficulties in ensuring this care, mainly small ones, and ones that have been little studied as to the effectiveness of primary healthcare.

In spite of the limits imposed on any type of evaluation, especially a recent project that involves a specific actor, it is necessary to look for strategies that elucidate their effects on primary healthcare. The point of view of the project is that the effectiveness of primary healthcare is greater when its coverage is widened through the teams of the Family Health Strategy (ESF) System. One of the instruments commonly used to evaluate the effectiveness of primary healthcare in various contexts is the observation of Hospitalizations for Primary Healthcare-Sensitive Conditions (HPHSCs)[9,10]. The supposition is that when primary healthcare is accessed at an opportune time it can reduce or avoid hospitalization for some PHSCs, and thus its effectiveness can be measured based on the figures for these[11].

However, to what extent did the arrival of new players make it possible to improve the effectiveness of the ESF? In the context of the diversity of profiles of the municipalities, and the diversity of insertion of the many of the doctors who joined the municipalities, what can be observed in the behavior of PHSCs? Having these questions in mind, the objective of this study is to evaluate the PMM in the Northeastern region, using hospitalizations for PHSCs as an indicator of the effectiveness of the Family Health Strategy, using as a contextual comparison parameter the ratio of doctors per 10,000 in the states of Brazil.

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Methods

This was a quantitative study to analyze the results achieved by the PMM. It uses as reference HPHSC events in municipalities of the Northeast (NE), and was carried out in two stages – Stage 1: Exploratory study; and Stage 2: Evaluation study with selection and analysis of one PHSC.

Stage 1: Exploratory study

This was a phase of structuring of the object of the study based on an exploratory raising of data. Records of hospitalizations authorized for PHSCs in the Hospital Information System (SIH) of the SUS were used. The data were obtained by transfer of files from the site of the IT Department of the SUS (Datasus) and explored, for the years 2008 to 2014, using the software *TabWin*.

Hospitalizations for PHSCs were consulted according to the International Classification of Diseases (ICD-10), based on the criteria for selection used in the calculation of the indicator *Proportion of hospitalizations for primary healthcare-sensitive conditions.* This is adopted by the Health Ministry as a parameter for evaluation of the target for reduction of hospitalizations for this group of causes, serving as an estimate for the problem solving capacity of primary healthcare[12]. The PHSCs that enter the calculation of the indicator were determined by adaptation of the Brazilian List of Hospitalizations for Primary Healthcare Sensitive Conditions, published by Ministerial Order 221 of April 17, 2008 (issued by the Health Ministry and SAS).

Based on the criteria of selection of the PHSCs used in the construction of this indicator, hospitalizations were found, by location of residents, for 380 ICD-10 codes. This number was high due to the scope of classifications of groups of sensitive conditions.

Data relating to the distribution of doctors in the Family Health Strategy and the population coverage of the health teams of primary healthcare were incorporated into this preliminary set of results on hospitalizations for PHSCs in the Northeast. The data were ran through descriptive statistics. The decision to use these data was due to the importance of providing support and analysis of wider scope.

Stage 2: Evaluation study with selection and analysis of one PHSC

Considering the database of PHSCs obtained, one was selected that met three criteria: high frequency in the period, simplicity of intervention, and historic occurrence in the northeast. Of the group of sensitive conditions, hospitalizations for diarrhea and gastroenteritis of presumed infectious origin (ICD-10: A09) were analyzed.

The period of the study was from September 2012 to August 2015, which enabled inclusion of the first year before the start of the activities of the PMM and the first two years of its execution. In this period, doctors who were included in up to the fifth round of joining the project carried had been in activity for a minimum of 14 months, and for a maximum of 24 months. The study universe was the 1,794 municipalities of the Northeast. The criterion for inclusion in the sample was participation of the municipality in the PMM, with its adhesion confirmed in the five first rounds of the project. As a result of this, 1,303 municipalities of the Northeast (72.6% of the total) were included.

Of the 1,303 municipalities of the sample, those which did not have a record of hospitalization for this condition in the 36 months of the reference period of the study were excluded. The number of exclusions was only 61 municipalities (4.7% of the municipalities participating in the PMM in the Northeast).

The large scale of the number of municipalities in the sample in relation to the quantitative total of municipalities in each state varied from 45% in the state of Paraíba to 85% in Ceará, and the percentage was 60% or over in six states. The proportion of population represented by the sample of municipalities in relation to the total population in each state varied from 61% in Paraíba to 95% in Ceará. It can be noted that six states had a percentage higher than 80% of the resident population.

For analysis of the data the sample of municipalities was grouped in its totality, characterizing representation of the Northeastern Region, also being stratified by states. The Shapiro-Wilk Test was used to ascertain whether the sum of the monthly frequencies of hospitalization for PHSCs, ordered in three temporal series of 12 months – for 3 years of a period investigated – was compatible with a Gaussian distribution. In accordance with the assumptions of normality, the averages of hospitalization of the temporal series were compared using the Scott-Knott (SK) hierarchical grouping algorithm, with significance level 5%. The SK, which is a package of functions of the 'R' software ('ScottKnott' package, CRAN repository), tests the similarity of averages, grouping them by similarity and hierarchy of values[13].

The Friedman non-parametric test and its respective post-hoc test, based on the thesis of Nemenyi[14], were used for comparison of the averages in each state and year. This option was chosen because there is a dependency relationship of the hospitalization events between the years for a single territory and the temporal series being constituted for three years. The following were added to the analysis: percentages that determine the relative performance of the states by variation of the averages of hospitalization; standardized rates of these averages as related to the population size of the samples; and also, of the doctors participating in the PMM. The method of calculation of each element is as follows:

- *Standardized mean*: ratio between the average of hospitalizations for PHSCs in a given year and state and the populational sample of that state in the year considered. The result was adjusted to 10,000 inhabitants.

- *Reduction %*: Percentage of 'relative reduction' of the average of hospitalizations in each state, calculated by subtraction of the average of the third year from that of the first, and division of this result by the average for the first year.

- *Adjusted reduction %*: This is a proportion that compares the performance between the states as to reduction of the average of hospitalization. It was calculated based on the difference of average between the year 1 and year 3 in each state, which was divided by the population of the sample of municipalities of the related territory, so as to obtain the relative variation per inhabitant. Each variation found was divided by the sum of all the variations.

- *Number of doctors of the PMM per 10,000 population*: a parameter for the concentration of PMM doctors in each state. Obtained by calculating the ratio of PMM doctors to the population of the sample of municipalities in each state and adjusted for 10,000 population.

This study is a development from the multicenter survey "Innovative initiatives in the organization of healthcare networks and health regions, and their impact on the structuring of supply by the SUS: an evaluative study", coordinated by the Political Economy of Health Research Group of UFPE.

Results

PHSCs in the Northeast: different contexts

Hospitalizations for the whole of the group of PHSCs in the Northeast have a non-uniform distribution between the states in the period 2008 to 2014 (Figure 1). The state of Maranhão was the only one with a quantitative increase in hospitalizations when 2008 and 2014 are compared. The reduction seen in the other states was not gradual, with the exception of Alagoas. In Alagoas there was the largest variation between the two years, with a reduction of 44.2%. Sergipe, in all the years, recorded the lowest frequency of hospitalizations.

These differences, especially in scale of occurrence, could indicate the existence of particularities as to the social, economic, and environmental determinants of health in the states, above all, in relation to the characteristics of healthcare.

The group of illnesses comprising infectious gastroenteritis and complications, which includes diarrhea and gastroenteritis of presumed infectious origin, was 37% of hospitalizations for PHSCs, in the period, followed by the asthma group (11.3%) and cardiac insufficiency (9.6%).

While observing the effect of the PMM on the increase on doctors in the Family Health Strategy, up to the 5th round of acceptance by professionals, it was found that there was a variation between 20 and 45% in the quantity of doctors that existed in the states at the time of the project being made official. However, the number of professionals in the Family Health Strategy expanded on a smaller scale than the incorporation of the PMM (Figure 2).

In Figure 2, taking Ceará as an example, we found that the number of doctors was 2.6 per 10,000 population before the PMM, with the increase of 1.1 at the end of the 5th round of the project, increasing to 3.0 – less than the expected increase of 3.7 professionals. Thus, the incorporation of doctors of the PMM in the Family Health Strategy resulted in a lower increase in the ratio of doctors than expected, a characteristic which was reproduced in all the states. Another point to be mentioned was the small variation of coverage of the Basic Healthcare Teams in the states after the implementation of the PMM.

Effectiveness of the PMM: evaluation of the reduction of hospitalizations for diarrhea and gastroenteritis

Hospitalizations for diarrhea and gastroenteritis of presumed infectious origin totaled 181,152 cases in 1,242 municipalities that took part in the PMM over the period investigated (69.2% of the municipalities of the Northeast). Averages of hospitalization increased from 6,092.8 in the first year, to 5,040.5 in the second and 3,962.7 in the third. The reduction in average

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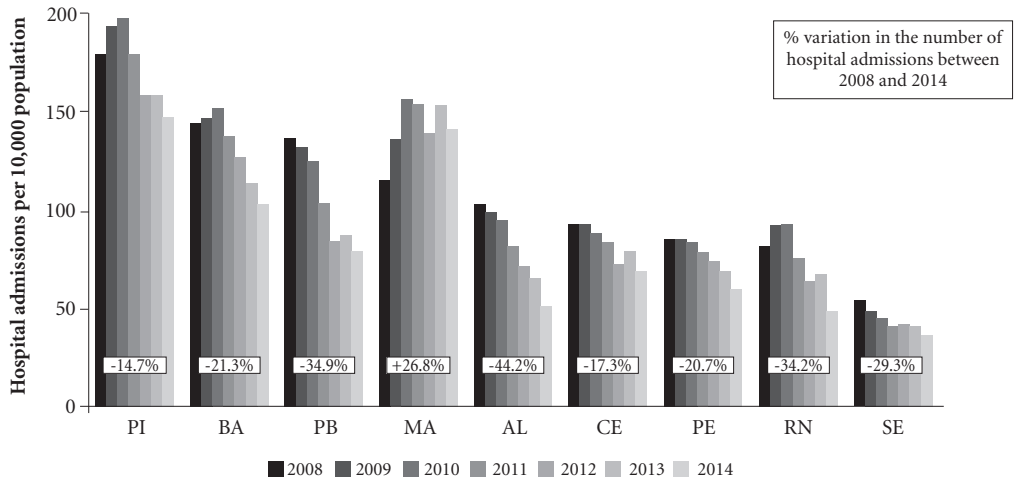

Figure 1. Distribution of admissions for sensitive PHC conditions in states in the Northeast Region, 2008 – 2014, adjusted per 10,000 inhabitants in each administrative unit of Brazil and percentage variation between 2008 and 2014.

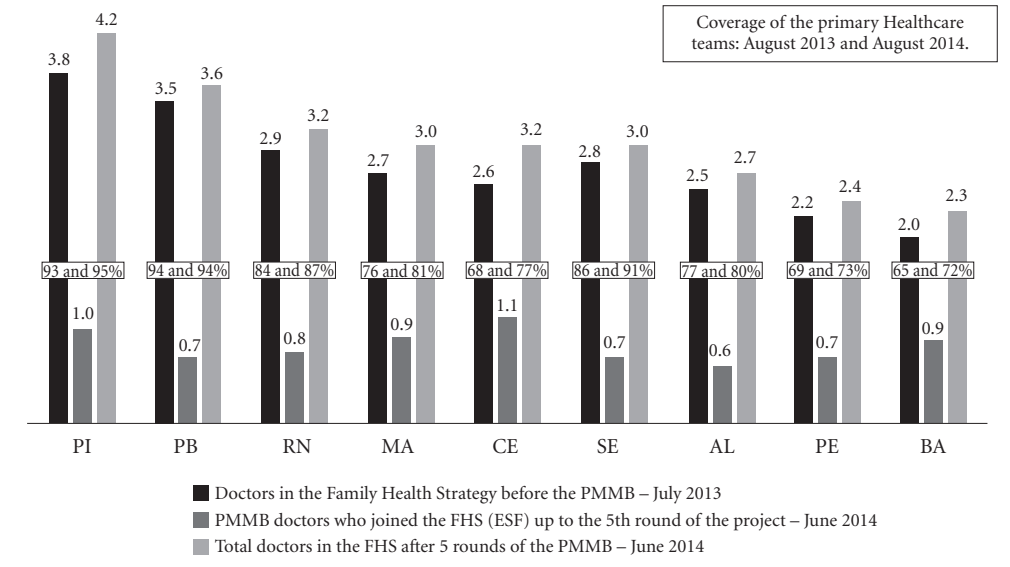

Figure 2. Distribution of doctors in the Family Health Strategy in states in the Northeast Region, by number of professionals per 10,000 inhabitants and percentages of coverage by Primary Health Teams.

Notes: the Family Health Strategy (FHS) includes the participation of 'family and community doctors' and 'FHS doctors' in the following establishments: health center / primary health unit, health post, family health unit, mixed unit and mobile river units.
PMMB – the More Doctors for Brazil Project, a component of the Mais Médicos Programme.
Coverage by Primary Health Teams – indicator used by DATASUS to estimate the population coverage of health team (with and without doctors) in the FHS per 3,000 inhabitants.

from the first to the third year was 35.0%. Figure 3 shows the behavior of these hospitalizations, by year of their occurrence.

As shown in Figure 3, the condition studied showed consecutive reduction of hospitalizations in each year, with approximation of means and medians, and lower dispersion of the data in years 2 and 3 compared to the first year. The Scott-Knott analysis confirms the difference of averages between the years ($p < 0.05$).

Considering the distribution of the averages of hospitalizations by states, the highest values were registered in Bahia and Maranhão; and the lowest in Sergipe and Alagoas (Table 1). These results, in principle, show relationship with the size of the population of the sample of municipalities in each state. According to the results of the Friedman post-hoc test ($p < 0.05$), four states showed a difference of averages in the period: BA, PE, PI and RN.

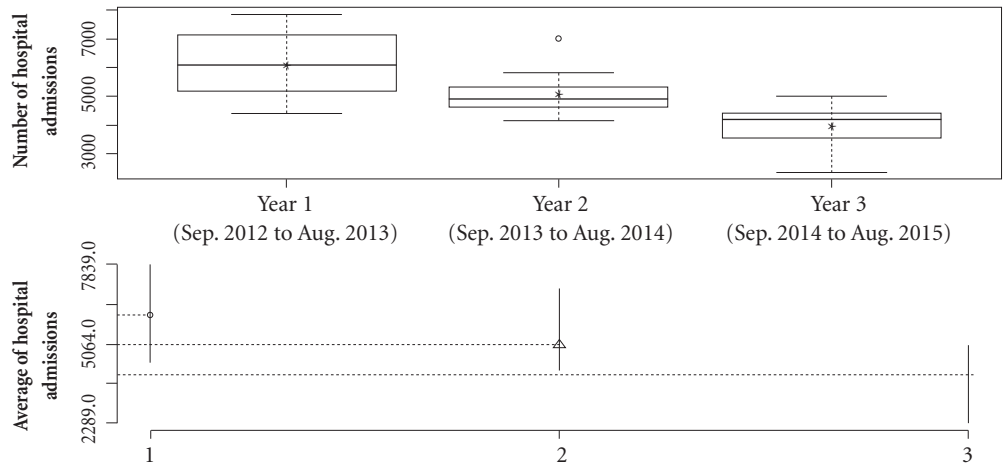

Figure 3. Box plots of admissions for Diarrhea and Gastroenteritis and comparison of measures using the Scott-Knott algorithm, in a sample of municipalities in the Northeast, from the first year prior to the launch of the PMMB (Sep. 12 to Aug. 13) to its first two years (Sep. 13 to Aug. 14 and Sep. 14 to Aug. 15)

Notes: - The asterisks in the box plots represent the average number of admissions in each year.
- The Scott-Knott, with a 5% significance level, lists the averages in decreasing order of value. For each average in the figure, equivalent symbols point to similar averages and different symbols point to different averages.

Table 1. Comparison of the averages of hospital admissions for Diarrhea and Gastroenteritis in the States of Brazil's Northeastern Region, by sample of municipalities, for the first year prior to the implementation of the *Mais Médicos* Project (Sep. 2012 to Aug. 2013) and the first two years of its being in place (Sep. 2013 to Aug. 2015).

State	Average number of hospital admissions			Difference of means between years (Friedman post-hoc test) p value (1st and 3rd year)
	1st year	2nd year	3rd year	
BA	2033.6	1625.5	1338.8	0.000
MA	978.8	1114.5	820.1	0.158
PE	945.1	553.4	403.5	0.000
CE	656.8	538.3	466.5	0.160
PI	578.3	542.3	393.5	0.000
PB	349.8	265.7	224.8	0.330
RN	305.0	187.1	147.7	0.001
AL	203.7	161.1	127.0	0.081
SE	41.8	52.7	40.8	0.870

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In Table 2, when comparing the averages of year 1 with those of year 3, it is seen that the highest percentage reduction of average took place in Pernambuco (57.3%), followed by Rio Grande do Norte (51.6%). However, when this reduction is adjusted for the populational size of the states, the best performance is by Piauí (18.3%), followed by Pernambuco (17.3%) and Rio Grande do Norte (16.9%). We note that Piauí on reaching the ratio of 1.2 doctors of the PMM per 10,000 population, reaches a high incorporation of doctors of the PMM in the region, making it possible to infer an effect of this greater supply of doctors.

It can be seen in Table 2 that the lowest adjusted reactions took place in Sergipe and Ceará. Ceará, despite having received a large contingent of doctors of the program and having risen to 1.2 doctors per 10,000, presented the second lowest adjusted reaction (5.8%). It is also observed that in both the first and the third year Ceará presented lower standardized averages than the majority of the states (from 0.8 in the first year to 0.6 in the third year). The small reduction observed may be due to the starting point of this average – because it was among the lowest values, it was less favorable to larger variations.

In Sergipe there was practically no alteration of average between the years. At the same time, the averages standardized for the population, in the two years (0.2), show that in this state the magnitude of hospitalizations was considerably reduced in relation to the others, even not varying in the period. The analysis suggests that the circumstances identified in Sergipe and in Ceará, are not easily captured by this indicator (index of number of doctors of the PMM per 10,000 inhabitants). At the same time, they presented the lowest distribution of hospitalizations for PHSCs in the period from 2008 to 2014 (Figure 1).

Another highlight is the high standardized averages of Piauí and of Maranhão compared to the other states in the third year (1.5 and 1.4 respectively). These values, even though they refer to diarrhea and gastroenteritis, are compatible with the scale of hospitalizations for PHSCs presented in Figure 1.

The index of doctors in the PMM in the sample of municipalities in each state of the Northeast was close to 1 doctor per 10,000 inhabitants at the end of the period. The change observed, from 0.8 to 1.2, indicates a certain homogeneity in the distribution of doctors of the PMM between the states of the Northeastern Region which demonstrates the quest to make the supply of doctors more balanced in the region, but not yet guided by the differences of epidemiological profiles as suggested in the interpretation of Figure 1.

If we analyze the average percentage reduction in the period adjusted for population, which enables a more appropriate analysis than the absolute number of hospitalizations, we identified that four states presented a performance less

Table 2. Reduction in the averages of hospital admission for Diarrhea and Gastroenteritis in the States of the Northeastern Region of Brazil, by sample of municipalities, for the first year prior to the implementation of the *Mais Médicos* Project (Sep. 2012 to Aug. 2013) and the first two years of its being in place (Sep. 2013 to Aug. 2015), compared with number of doctors participating in the PMMB, and their number per 10,000 population.

State	Hospital admission for Diarrhea and Gastroenteritis						Reduction of hospitalization averages		PMM doctors	
	1st year (Sep. 2012 to Aug. 2013)			3rd year (Sep. 2014 to Aug. 2015)						
	Average	sd	Standardized mean	Average	sd	Standardized mean	Reduction %	Reduction % adjusted	nº	Rate per 10,000 pop
PI	578.3	155.0	2.2	393.5	99.6	1.5	32.0	18.3	312	1.2
PE	945.1	253.5	1.2	403.5	98.8	0.5	57.3	17.3	650	0.8
RN	305.0	169.0	1.3	147.7	58.7	0.6	51.6	16.9	240	1.0
PB	349.8	162.5	1.4	224.8	60.9	0.9	35.7	13.3	241	1.0
BA	2033.6	253.5	1.5	1338.8	275.9	0.9	34.2	13.0	1298	0.9
AL	203.7	90.4	0.9	127.0	39.9	1.0	37.6	8.4	186	0.8
MA	978.8	285.2	1.6	820.1	154.2	1.4	16.2	6.8	629	1.0
CE	656.8	270.1	0.8	466.5	172.7	0.6	29.0	5.8	996	1.2
SE	41.8	19.3	0.2	40.8	12.2	0.2	2.6	0.2	153	0.8

Note: The description of the meaning and method of calculation of each element is set out in the *Methods* section.

than 10%, which could suggest that as well as the increase of this supply of doctors other adjustments in the work process of Primary Healthcare may possibly be necessary that would allow better performance at the door of entry to the system.

Discussion

The study, by evaluating the PMM of the Northeastern Region, through the occurrence of hospitalizations for Diarrhea and Gastroenteritis of presumed infectious origin (DG), makes important contributions to the dialogue on the results of the *Mais Médicos* Program in primary healthcare.

The selection of DG, from among the group of PHSCs, showed itself to be pertinent. It is considered that the acute character of occurrence and development of the condition, the need for opportune medical assistance to patients, and the relative simplicity of the treatment in the majority of cases, qualify it as a more sensitive condition for evaluating alterations in primary healthcare, in the short term.

According to Brandt et al.[15], therapeutic handling of acute diarrhea from infectious origin has not undergone important alterations in recent years, and continues to be grounded on maintenance of the state of hydration and nutrition of the patient. Thus, the medical approach could involve therapies of oral or intravenous rehydration, appropriate diet recommendation and careful use of medications. In more severe cases, hospital admission is usually indicated, mainly, when it occurs in younger people and in the elderly[16].

The reduction of the average of hospitalizations for DG in the sample investigated, with a significant decline in the last two years, compared to the speed of reduction of all the sensitive conditions in the period 2008 to 2014, suggests the influence of the PMM, which appears to have leveraged the trend already found in prior years. The study by Boing et al.[11] corroborates the downward trend evidenced in this study by analyzing the period from 1998 to 2009, but with a lower intensive reduction attributing the phenomenon of reduction to expansion of the coverage of the Family Health Strategy in Primary Healthcare and the more appropriate supply of health services. However, in the last decade DG was among the three principal causes of hospitalizations for PHSCs[17].

Taking into account that the PMM has been and is being implemented gradually and only for a few semesters, we expect more effective changes in the health situation of the population, caused by the opportunity of access to healthcare, to take place only over time. Thus, the trend to reduction of DG is likely to remain in the coming years until it reaches a limit, as from which more substantial changes, outside the field of health, will need to happen for the downward trend to be maintained.

The analysis through the ratio of doctors per 10,000 inhabitants, by relating the number of doctors to the population of the states, helps one to understand that although there has been a considerable influx of doctors through the PMM and reduction of DG, this increase appears not to have been sufficient for improvement of primary healthcare. One of the points to be highlighted is that the desirable quest for a more homogenous distribution of doctors in the country should come accompanied by investments in the quality of equipment and infrastructure, something which is specified in the legal framework of the *Mais Médicos* Program.

A survey that investigated the critical factors for the permanence of a doctor in the Family Health Strategy indicated that the problems of infrastructure in the health units were determinant for professionals' leaving. Unhealthy working conditions, and absence of the equipment, materials and inputs necessary for carrying out the activities were among the main complaints[18]. However, it is not known to what extent the PMM succeeded in reversing this scenario – this is a subject that merits future studies. In the case of DG, even though the intervention is eminently clinical and in most cases does not require input of more dense technologies, it is indispensable that there should be services with adequate infrastructure and routine materials and inputs.

Since a part of the doctors of the PMM were integrated into existing teams of the Family Health Strategy, with an increase of the ratio of doctors per 10,000 inhabitants lower than expected, one asks: was the integration of doctors a replacement in the incomplete teams, or substitution? Studies indicate that in spite of the expansion of coverage in the last five years, primary healthcare has innumerable challenges[7], and among the highlights are fragility in the infrastructure, incompleteness of the teams and turnover of professionals[19,20].

In this circumstance, the PMM makes progress in reduction of turnover of doctors, and in strengthening of the link between professionals and the community, by continuing to act in the territory. At the same time, the possibility of smaller expansion of the Family Health Strategy,

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based on the formation of new health teams in areas previously not served, could mean that the necessary supply is still a challenge.

It is fundamental to point out that the vacancies in the PMM are for the municipalities that seek adhesion to the project, but this adhesion is based on the assumption that the municipality has infrastructure and sources to ensure insertion of the doctor and his activity[4]. Thus, when the municipality declares the demand for a doctor but cannot meet these requirements, provision of a doctor by PMM is not possible. Thus, it is possible that the real need for coverage of doctors in the municipalities is underestimated.

The differences in the occurrence of hospitalizations between the states were observed, both for the group of PHSCs, and also for DG. The cases of the states of Piauí and Sergipe are illustrative and tend to reveal the potential and the limits of the PMM. In Piauí the considerable reduction of hospitalizations for DG, but with a high level being maintained, may be a reflection of the complexity of the social determinants of health in the state and indicate that provision and concentration of doctors should also be thought out according to characteristics of the epidemiological profile of the states and municipalities.

As determined by the Health Ministry, the priority areas and regions with need and difficulty of retention of a doctor in the Family Health Strategy are decided based on a model of indicators, more centered on socio-economic questions, relating to the activity of the professional and health coverage – number of beds, and population dependent on the SUS[21].

In Sergipe, the state with the lowest proportion of hospitalizations in the Northeast in all the years, its averages of hospitalization being maintained after the PMM are an indication that improvement of primary healthcare requires other adjustments. Thus, new studies are recommended to adequately evaluate the reality of primary healthcare in the state.

The report by Unicef in partnership with the WHO on diarrhea clarifies that control of the condition is more than a question of medical care. Although it is emphasized that health systems should be able to prevent and treat diarrhea, with sufficiency of human resources and lower turnover of professionals, the document also recommends other strategies, such as: water supply and sewerage actions, actions in health education, and guarantee of supply of water to the population[22].

Final considerations

In the last decade DG has been among the three principal causes of hospitalization for primary healthcare sensitive conditions, and remains as a significant cause of death in people under the age of five. Thus, ensuring adequate care is fundamental for improving the effectiveness of primary healthcare: investments in infrastructure, qualified professionals and integration with the health services network are fundamental steps to be taken. However, although diarrhea is a PHSC, it is a complex problem and a consequence of other conditioning factors, and the health system by itself has limited scope for eradicating it.

Notwithstanding the limits of the function of the doctor in primary healthcare, the study elucidates that the PMM has had and influence in reduction of hospitalizations for DG. These results deserve follow-up to go deeper, to provide an answer to the question of how much the presence of these doctors contributed to this reduction, associating the findings to other variables, such as the economic, demographic and other indicators. Further, qualitative studies are necessary that would be able to evidence the effects of the PMM on support, linkage, continuity of care and reduction of the inequalities in access.

Collaborations

RF Gonçalves contributed in the conception, outlining, data collection, drafting and approval of the version to be published. IMC Sousa contributed in the conception, outlining, drafting and approval of the version to be published. OY Tanaka participated in the drafting, critical analysis and approval of the version to be published. CR Santos helped in the analysis of the data. KSB Silva carried out a critical analysis. LX Santos helped in revision of the paper. AFB Bezerra helped in the conception, outlining, drafting and approval of the version to be published.

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