

Structure and work process regarding child care in Primary Health Care in Brazil: an ecological study with data from the Program for Primary Health Care Access and Quality Improvement 2012-2018*

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Abstract

Objective: To assess the structure of primary health care centers (PHCCs) and the work process of primary care teams in child care in Brazil. **Methods:** This was an ecological study with data from the three cycles of the Program for Primary Health Care Access and Quality Improvement 2012-2018, by states and regions. Seven structural and thirteen procedural indicators were analyzed. Student's t-test was used to compare indicator averages between regions. **Results:** 85,845 teams participated in the three cycles of the program, grouped into 68,320 PHCCs. In the last evaluation cycle (2017-2018), mean percentage adequacy rates were higher among the structure indicators: health center operation (99%), equipment/materials (82%), vaccine availability (74%) and medication dispensing (70%). Population without coverage (68%) and making appointments with specialists (52%) corresponded to the lowest percentages of adequacy of process indicators. **Conclusion:** Process indicators had higher levels of adequacy than structure indicators.

Keywords: Primary Health Care; Health Evaluation; Indicators of Health Services; Child Health; Ecological Studies.

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Introduction

At the 1978 World Health Summit in Alma-Ata, Republic of Kazakhstan, it was discussed and proposed that Primary Health Care (PHC) should be the main strategy and preferred gateway to health care.^{1,2} Brazil has followed the worldwide movement to strengthen PHC in order to develop comprehensive health care and autonomy for health system users, impacting on factors that determine and condition community health.² However, backsliding may occur, considering the alteration of fundamental points in the National Primary Health Care Policy in 2017, together with a scenario of political and economic crisis in Brazil.³

Brazil has followed the worldwide movement to strengthen PHC in order to develop comprehensive health care and autonomy for health system users, impacting on factors that determine and condition community health.

Aiming at institutionalizing the monitoring and assessment process in the Brazilian National Health System (SUS), especially in PHC, and agreeing on service qualification goals, several assessment methodologies have been proposed since the 1990s in Brazil. This evolution culminated with the implementation, in 2011, of the National Program for Primary Health Care Access and Quality Improvement (PMAQ-AB).^{4,5}

Within this scenario of PHC service evaluation, monitoring and qualification, actions to prevent and promote child health must be a priority, especially in early childhood (from zero to 72 months), due to their greater susceptibility to diseases and illnesses, as well as the possibility of rapid progression to unfavorable outcomes.^{6,7}

In Brazil, PHC indicators have served to evaluate child care quality,⁷⁻¹⁰ especially in time-series analyses, describing the main causes of child hospitalization due to health-sensitive conditions.^{7,9} However, such initiatives and their implementation are mostly concentrated in the South and Southeast regions of the Brazil;^{7,8} few have used national sampling to associate

PHC structural and procedural aspects with child care outcomes, and none have used data from the three PMAQ-AB evaluation cycles.^{7,8,10}

The Donabedian triad for health care quality evaluation - structure, work process and outcome - was adopted by Araujo et al.¹⁰ in national data analysis for 2013 and 2014 and the first PMAQ-AB cycle. Those authors found that structural aspects (PHCC working hours, vaccine availability and medication dispensing) and work process (matrix support) were associated with child hospitalization.^{10,11}

Structural deficiencies, such as underfinancing of actions and scarcity of qualified human resources, have compromised the execution of PHC actions, including those that are essential.¹² Therefore, according to Donabedian's theoretical model, health system evaluation should begin with knowledge of its structural aspects, which are essential for providing effective care.¹¹

The data analysis of the three PMAQ-AB evaluation cycles, as proposed in this study, will allow evaluation, over time, of the child care conditions provided by PHC in Brazil, supporting future analyses of association between structure, work process and outcome. Qualification of these findings increases the odds of better care process performance and, therefore, achievement of good results,¹¹ providing support for the accomplishment of the PMAQ-AB guidelines, which includes reinforcing the National Primary Health Care Policy.⁴

The aim of this study was to examine the structure of primary health care centers (PHCCs) and the work process of primary care teams in child care in Brazil.

Methods

This is an ecological study which used secondary data from three PMAQ-AB cycles (2012, 2014 and 2017/2018), per Federative Unit and geographic macro-regions of Brazil. It is part of the multicenter research entitled '*Avaliação externa e censo das Unidades Básicas de Saúde - PMAQ-AB*' ['External evaluation and census of Primary Health Care Centers - PMAQ-AB'],¹³ conducted by consortia under the coordination of various universities and research centers in Brazil.

Three editions (cycles) of PMAQ-AB have already been conducted. The first two cycles of the program had four phases, (1) adherence and agreement setting, (2) development, (3) external evaluation and

(4) agreement resetting, whereas the third cycle was composed of a cross-cutting strategic development axis and three phases: (i) adherence and agreement setting; (ii) certification; and (iii) agreement resetting. In the third cycle, external evaluation of the program was conducted in the certification phase.⁴

The first PMAQ-AB cycle took place in 2012, at the same time as the PHCC census which examined the infrastructure, equipment, facilities, human resources and materials of these centers. The second and third cycles of the program, held in 2014 and 2017/2018 respectively, consisted of external evaluation of the PHCCs and their teams. 85,845 teams participated in this study, which voluntarily adhered to PMAQ-AB, deployed at 68,320 PHCCs.

The secondary data for analysis were obtained from Ministry of Health databases containing the microdata of each evaluation cycle, available in digital format: <http://aps.saude.gov.br/ape/pmaq>.

PHCC structure variables and team work process variables were used, derived from modules I and II of each PMAQ-AB cycle, respectively (Figure 1). In primary data collection, module I variables were collected just once for each PHCC as a whole, while module II variables were collected from each team working at each PHCC.

Indicators related to PHCC structure and team work process were developed from the aggregation of variables that could be associated with child care, collected in the three evaluation cycles. Figure 1 describes the PHCC structure indicators: health center operation; health center operation at special times; medication dispensing at the health center; health center facilities; equipment, material and supplies availability; vaccine availability; and rapid testing at the health center. The team work process indicators are also described in Figure 1: emergency care at the health center; team planning; matrix or institutional support received; defined catchment area and existence of maps; population without coverage; appointment scheduling; specialist appointment scheduling; clinical protocol use; exam request; service supply and demand control center; child follow-up; educational activities; and home visiting (Figure 1).

Data analysis was performed using SPSS® version 23 statistical software. First, the average percentage of each indicator was calculated, obtained from the sum of the observed variables divided by the total

of the variables. Considering that the work process refers to team activities and that the analysis unit is the PHCC, which has one or more teams, the average percentage of the team work process indicators per PHCC was calculated. Next, the structure and work process indicators of each PMAQ-AB cycle were grouped, separately, for the PHCC level, using the National Registry of Health Establishments (CNES) code. Modules I and II of each cycle of the program were grouped by using the same code. The next step consisted of data stacking the three cycles in a single database at state level. Data analysis consisted of calculating averages and standard deviations (SD) per federative unit and geographical macro-region. Indicator averages between the regions were compared within each PMAQ-AB cycle, using the Student's t-test with Bonferroni correction at a 0.05 significance level.

The study was approved by the Research Ethics Committee of the Federal University of Pelotas (Opinion No. 38, May 10, 2012) and complied entirely with the ethical precepts recommended by National Health Council Resolution No. 466, dated December 12, 2012.

Results

Of the 68,320 participating PHCCs, 25,124 (36.8%) were from the Northeast and 22,656 (33.2%) from the Southeast (Table 1). The Midwest region had the lowest number of participants, 4,963 (7.3%).

The average percentages of the seven PHCC structure indicators are shown in Table 2. The highest adequacy percentages in the last PMAQ-AB cycle (2017/2018) were: health center operation (99%), equipment, material and supplies availability (82%), vaccine availability (74%) and medication dispensing at the health center (70%).

In the external evaluation of the first cycle (2012), the Northern region PHCCs presented the highest average adequacy percentage (99%) for the 'health center operation' indicator. Northeast region health centers had the lowest result, both in the first (89%) and second evaluation cycles (98%). In the third cycle, the PHCCs of all regions had at least 99% adequacy for this indicator.

In the three cycles of the program, the Southeast region obtained the highest average percentages of PHCC operation at special times (lunchtime, night shift or weekends), with 57% on average in the first cycle,

Indicators	Description
Primary health care center (PHCC) structure indicators	
Health center operation	Average percentage of PHCCs operating at least five days a week
Health center operation at special times	Average percentage of PHCCs operating during special times: lunchtime, night shift or weekends
Medication dispensing at the health center	Average percentage of PHCCs dispensing medication
Health center facilities	Average percentage of facilities at PHCCs: clinic, nursing room, wound dressing room, procedure room, inhalation room and exclusive vaccination room
Equipment, material and supplies availability	Average percentage of equipment, materials and supplies needed for child care available at PHCCs: anthropometer, adult pressure device, pediatric or neonatal pressure device, nebulizer, 150kg anthropometric scale, child scale, anthropometric ruler, adult stethoscope, pediatric or neonatal stethoscope, exclusive refrigerator for vaccines, glucose meter, clinical flashlight, ophthalmoscope, otoscope, monofilament kit for sensitivity test (esthesiometer), sonar or Pinard's stethoscope, clinical thermometer, tongue depressor, disposable needles of various sizes, thermal boxes for vaccines, measuring tape, serum/macrodrops and microdrops kit, surgical/micropore tape and others, gauze, reagent strips for measuring capillary blood glucose, disposable syringes of various sizes, disposable syringes with attached needle, slide (for malaria) and printed material - Pregnant Women and Child Health Handbooks
Vaccine availability	Average percentage of immunobiologicals recommended by the Brazilian National Immunization Program available at PHCCs for child care
Rapid testing at the health center	Average percentage of rapid tests performed at PHCCs: pregnancy, syphilis, HIV, hepatitis and thick blood smear tests for malaria
Team work process indicators	
Emergency care at the health center	Average percentage of PHCC with teams performing emergency care
Team planning	Average percentage of PHCCs with team planning activities
Matrix or institutional support received	Average percentage of PHCCs with teams receiving matrix or institutional support
Defined catchment area and existence of maps	Average percentage of PHCCs with teams in defined catchment area and existence of maps
Population without coverage	Average percentage of PHCCs with teams with population without coverage in the surrounding area
Appointment scheduling	Average percentage of PHCCs with teams scheduling appointments
Specialist appointments scheduling	Average percentage of PHCCs with teams that, if a service user needs to be referred for specialized consultation, schedule and inform the date of the consultation with the specialist
Clinical protocol use	Average percentage of PHCCs with teams using clinical protocols
Exam request	Average percentage of recommended tests that are requested at PHCCs
Service supply and demand control center	Average percentage of PHCCs that refer service users to the service supply and demand control center, to be forwarded to other care provision sites
Child follow-up	Average percentage of recommended child follow-ups performed by PHCCs: vaccination, childcare, nutritional status, low weight, prematurity, violence, accidents etc.
Educational activities	Average percentage of PHCCs with teams performing educational activities
Home visiting	Average percentage of PHCC teams performing home visits

Figure 1 – Structure and work process indicators regarding child care in the three cycles of the National Program for Primary Health Care Access and Quality Improvement (PMAQ-AB), 2012, 2014 and 2017/2018

Table 1 – Distribution of primary health care centers participating in the National Program for Primary Health Care Access and Quality Improvement (PMAQ-AB), by geographic macroregions, Brazil, 2012, 2014 and 2017/2018

Macroregion	Primary health care centers							
	2012		2014		2017/2018		Total	
	N	%	N	%	N	%	N	%
North	1,287	9.2	1,690	7.0	2,384	7.9	5,361	7.8
Northeast	2,824	20.3	9,704	40.3	12,596	41.5	25,124	36.8
Southeast	6,696	48.1	7,165	29.8	8,795	29.0	22,656	33.2
South	2,268	16.3	3,607	15.0	4,341	14.3	10,216	15
Midwest	844	6.1	1,889	7.9	2,230	7.3	4,963	7.3
Brazil	13,919	100.0	24,055	100.0	30,346	100.0	68,320	100.0

23% in the second and 25% in the third. The lowest scores for this indicator were seen in the Northeast (31%) and Southern (33%) regions in the first cycle, the Northeast (10%) and Midwest (11%) in the second cycle and the Midwest (9%) in the third cycle.

Medication dispensing at PHCCs was most frequently provided in the North (85%) in the first cycle, whereas in the second cycle the Northeast (87%) and South (85%) obtained the highest average percentages. In the third cycle, the Northeast (85%) PHCCs continued to have the best results. The Southeast had the lowest results for this indicator, with 68% on average in the first cycle, 63% in the second, and 49% in the third.

The regions with the highest average percentages of equipment, material and supplies availability at PHCCs were: Southeast (72%) and South (71%), in the first cycle; South (77%), in the second; and Northeast (84%), South and Midwest (83%) in the third. The lowest results in all cycles were found in the North, with 56% on average in the first cycle, 68% in the second and 74% in the third.

Regarding vaccine availability at PHCCs, in the first two cycles of the program, the Midwest region had the highest average percentage (63% in the first cycle; and 71% in the second, along with the South), with no significant differences in relation to the other regions. In the third cycle, the Northeast (80%) obtained the highest average percentage of available vaccines.

In the first evaluation cycle, the North had a higher average percentage of rapid testing at PHCCs (10%). In the second cycle, the North continued to be the region with the highest provision of these tests (21%), followed

by the South (20%). In the third cycle the South (80%) had the highest result (Table 2).

The results of the thirteen PHCC team work process indicators are shown in Table 3. The indicators with the lowest adequacy mean percentages in the last PMAQ-AB cycle (2017/2018) were 'population without coverage' (68%) and 'specialist appointment scheduling' (52%). Most of the process indicators achieved results above 70%, with no disparities between regions, in all evaluation cycles. The indicators with adequacy levels higher than 75% in all regions, in all three PMAQ-AB cycles, are worthy of mention: team planning; support received; defined catchment area and existence of maps; exam request; service supply and demand control center; child follow-up; and home visiting.

'Emergency care at the health center' indicator was customary among the PHCCs, with the indicator ranging from 73% (Northeast) to 77% (Midwest) in the first cycle, 75% (North) to 81% (Northeast) in the second cycle, and from 92% (South) to 94% (North and Midwest) in the third cycle.

Nationally, 39% of teams reported 'population without coverage' in the area around their PHCCs during the first cycle, 63% in the second, and 68% in the last evaluation.

In the first cycle, 52% (Southeast) to 59% (North) of PHCC teams made appointments for consultations; this average percentage ranged from 72% (Midwest) to 76% (South) in the second cycle, while in the third cycle the values ranged from 69% (Northeast and Southeast) to 71% (Midwest), without any significant regional differences. Nationally, specialist appointment

Table 2 – Mean and standard deviation of health care center structure indicators for primary health care in the three cycles of the National Program for Primary Health Care Access and Quality Improvement (PMAQ-AB), by geographic macroregions, Brazil, 2012, 2014 and 2017/2018

Indicators	2012					2014					2017/2018								
	N	NE	SE	S	MW	Brazil	N	NE	SE	S	MW	Brazil	N	NE	SE	S	MW	Brazil	
Health center operation	99±7	89 ^b ±31	97 ^c ±18	93 ^d ±26	95 ^e ±21	95±22	99 ^a ±6	98 ^b ±9	99 ^c ±6	99 ^d ±6	99 ^e ±6	99±7	100 ^a ±4	99 ^b ±5	100 ^c ±5	99 ^d ±6	99 ^e ±6	99±5	
Health center operation at special times	46±37	31 ^b ±35	57 ^c ±36	33 ^b ±36	39 ^b ±36	45±37	15 ^b ±19	10 ^b ±14	23 ^c ±16	12 ^d ±19	11 ^b ±17	15±17	16 ^a ±19	13 ^b ±17	25 ^c ±17	11 ^d ±17	9 ^e ±17	9 ^e ±17	16±18
Medication dispensing at the health center	85±36	77 ^b ±42	68 ^b ±47	76 ^{ab} ±43	72 ^c ±45	73±45	81 ^a ±39	87 ^b ±33	63 ^c ±48	85 ^b ±35	71 ^d ±46	78±41	78 ^a ±42	85 ^b ±36	49 ^c ±50	77 ^d ±42	49 ^e ±50	49 ^e ±50	70±46
Health center facilities	48±34	51 ^b ±31	65 ^c ±32	61 ^d ±29	65 ^e ±31	60±32	62 ^a ±16	65 ^b ±14	66 ^c ±13	71 ^d ±11	67 ^e ±13	66±14	45 ^a ±18	49 ^b ±18	51 ^c ±18	48 ^d ±18	50 ^e ±17	50 ^e ±17	49±18
Equipment, material and supplies availability	56±22	60 ^b ±24	72 ^c ±17	71 ^c ±19	68 ^d ±21	68±20	68 ^a ±14	71 ^b ±11	74 ^c ±12	77 ^d ±9	73 ^e ±10	73±12	74 ^a ±12	84 ^b ±11	82 ^c ±11	83 ^d ±9	83 ^d ±10	83 ^d ±10	82±11
Vaccine availability	45±43	53 ^b ±38	59 ^d ±39	58 ^d ±37	63 ^d ±38	57±39	66 ^a ±35	69 ^b ±28	62 ^c ±39	71 ^d ±36	71 ^d ±35	67±34	72 ^a ±35	80 ^b ±23	66 ^c ±38	72 ^d ±38	78 ^e ±36	78 ^e ±36	74±33
Rapid testing	10 ^d ±21	3 ^b ±12	9 ^b ±15	5 ^c ±14	7 ^d ±20	7±16	21 ^a ±27	12 ^b ±21	16 ^c ±22	20 ^d ±23	16 ^e ±24	16±22	53 ^a ±29	63 ^b ±35	51 ^c ±44	80 ^d ±30	61 ^e ±36	61 ^e ±36	61±38

Key: N (North), NE (Northeast), SE (Southeast), S (South) and MW (Midwest).

Notes: When the superscript letters are repeated in the same line within each subtable of the PMAQ-AB cycles, they indicate that there were no statistically significant differences between the macroregions. The macroregional means were compared within each PMAQ-AB cycle using Student's t-test with Bonferroni correction (p>0.05).

scheduling scored 40%, 39% and 52% in the first, second and third cycles, respectively. In the last evaluation, the results showed no statistically significant differences between the regions.

Use of clinical protocols by PHCC teams scored a 60% (South) to 66% (Northeast) average in the first cycle; in the second cycle, it ranged from 59% (Midwest) to 65% (Northeast); and in the third cycle the highest score was 87%, in the North, with no statistical differences compared to the Northeast, Southeast and Midwest, all with 86%, while the South reported 85% of PHCCs following clinical protocols during care provision.

Educational activities conducted by PHCC teams were an indicator that showed homogeneity between the regions, except for the Midwest and Northeast, which showed the lowest average percentages in the first (MW: 65%) and second cycles (NE: 71%), respectively. In the third cycle, 86 or 87% percentage averages were found, with no statistically significant differences between the regions (Table 3).

Discussion

The results show few regional differences in the work process of PHCC teams in providing care to children in Brazil. Overall, it was found that PHCCs operate every working day, although there is a need to expand service provision to include special times.

There are differences in structural aspects between the regions, especially requiring adaptations to physical infrastructure and increasing availability of rapid testing and immunobiologicals. However, despite the structural deficiency scenario, staff work process adequacy scored higher percentages. Donabedian states that structure, work process and outcome are related in a probabilistic manner, not by causality.¹¹

The strengths of the study are primarily the significant and growing number of PHCCs and teams participating in each PMAQ-AB cycle, and the fact that the structure data were collected on-site by trained interviewers. This is a large national study, unprecedented in the evaluation of child care conditions in PHC, conducted in three periods within six years. However, the norms of PMAQ-AB, a voluntary program, constitute a significant limitation of this work. The teams were aware that they would be evaluated and therefore could have provided overstated data, since the better their performance,

the greater the financial incentive they would receive. Caution is therefore needed in the generalization of the work process indicators. Other limitations of the study were restricting it to use of structural and procedural indicators without considering outcome indicators, as well as not including data from module III of the program that evaluated users' perception of the quality of care given at the PHCCs.

The structure indicators show significant differences between PHCCs, according to the sociodemographic and political aspects of the different regions in Brazil.¹⁴ This becomes all the clearer when the indicators related to physical infrastructure are analyzed, in particular availability of equipment, materials and supplies, the highest average adequacy percentages of which corresponded to the regions with the best economic indicators. The Midwest, Southeast and South had the highest scores for structure indicators, except for PHCC standard operating hours and rapid testing in the first cycle, medication dispensing in the first and third cycles, and vaccine availability in the third.

Investments in PHC, especially through PMAQ-AB, have improved the majority of the indicators analyzed. However, regional inequities related to the socioeconomic status of the geopolitical regions, Family Health Strategy coverage, and PHCC structure can be seen.^{14,15} Studies based on national data from the first PMAQ-AB cycle (2012), which analyzed PHCC structural adequacy for cervical cancer prevention and for care for people with diabetes *mellitus*, as well as a further nationwide descriptive study on PHCC structure for care for people with diabetes in the first two cycles of the program (2012 and 2014),¹⁶⁻¹⁸ identified greater precarity in the PHCCs of the regions with lower socioeconomic indicators, i.e., the North and Northeast regions of Brazil.

In the first cycle, the Northeast did not perform better for any structure indicator and even had the worst scores for three of the indicators. However, in the third cycle, the Northeast was not among the worst performers, and obtained the best results for the 'medication dispensing in the health center', 'equipment, materials and supplies' and 'vaccine availability' indicators. In a national study conducted in 2012, when classifying PHCCs in five categories - unsatisfactory; rudimentary; limited; regular; reference -, pointed out that most PHCCs that were classified as 'regular' were located in the Northeast region,

Table 3 – Mean and standard deviation of primary health care team work process indicators in the three cycles of the National Program for Primary Health Care Access and Quality Improvement (PMAQ-AB), by geographic macroregions. Brazil, 2012, 2014 and 2017/2018

Indicators	2012					2014					2017/2018							
	N	NE	SE	S	MW	Brazil	N	NE	SE	S	MW	Brazil	N	NE	SE	S	MW	Brazil
Emergency care at the health center	75 ^{a,b} ±32	73 ^a ±33	76 ^b ±31	75 ^b ±32	77 ^b ±31	75±32	75 ^a ±27	81 ^b ±23	79 ^c ±24	79 ^c ±24	77 ^b ±24	79±24	94 ^a ±18	93 ^b ±21	93 ^{a,b} ±19	92 ^c ±22	94 ^b ±19	93±20
Team planning	88 ^a ±20	89 ^a ±19	89 ^a ±20	89 ^a ±19	89 ^a ±19	89a±20	91 ^a ±20	90 ^a ±20	91 ^a ±20	91 ^a ±19	92 ^a ±19	91±20	95 ^a ±14	94 ^a ±17	95 ^a ±15	93 ^b ±18	95 ^a ±15	94±16
Support received	85 ^{a,b} ±26	85 ^a ±27	83 ^b ±28	83 ^b ±28	84 ^{a,b} ±26	84±27	85 ^a ±27	89 ^b ±23	89 ^b ±24	90 ^b ±23	90 ^b ±22	89±24	86 ^a ±25	84 ^b ±27	85 ^b ±27	83 ^b ±28	83 ^{b,c} ±28	84±27
Defined catchment area and existence of maps	90 ^a ±22	91 ^a ±20	90 ^a ±22	90 ^a ±21	90 ^{a,b} ±20	90±21	92 ^a ±20	93 ^a ±20	92 ^a ±20	94 ^b ±18	92 ^a ±21	93±20	95 ^a ±16	95 ^{a,b} ±18	95 ^a ±17	94 ^b ±20	95 ^{a,b} ±18	95±18
Population without coverage	43 ^a ±29	38 ^a ±30	40 ^a ±30	38 ^b ±30	41 ^{a,b} ±30	39±30	60 ^{b,c} ±46	67 ^b ±44	61 ^a ±46	63 ^a ±45	57 ^a ±47	63±45	68 ^{a,b} ±44	67 ^a ±44	69 ^a ±44	67 ^{a,b} ±44	68 ^{a,b} ±44	68±44
Appointment scheduling	59 ^a ±48	58 ^a ±48	52 ^a ±49	53 ^a ±49	56 ^b ±48	54±49	74 ^{a,b,c} ±30	75 ^a ±31	74 ^a ±31	76 ^b ±30	72 ^a ±30	75±30	70 ^a ±27	69 ^a ±29	69 ^a ±28	70 ^a ±29	71 ^a ±29	70±28
Specialist appointment scheduling	41 ^a ±35	42 ^a ±35	41 ^a ±35	36 ^b ±35	39 ^{a,b} ±34	40±35	36 ^a ±32	41 ^b ±34	36 ^a ±34	41 ^b ±35	34 ^a ±33	39±34	51 ^a ±36	51 ^a ±36	52 ^a ±36	51 ^a ±37	53 ^a ±37	52±36
Clinical protocol use	65 ^a ±37	66 ^a ±37	62 ^{b,c} ±38	60 ^b ±38	65 ^a ±38	63±38	62 ^{a,d,e} ±38	65 ^b ±37	62 ^{a,c} ±38	64 ^{b,d} ±37	59 ^a ±37	63±38	87 ^a ±21	86 ^b ±23	86 ^{a,b} ±23	85 ^b ±25	86 ^b ±23	86±23
Exam request	89 ^a ±9	89 ^a ±11	89 ^a ±11	90 ^a ±9	89 ^a ±10	89±10	90 ^a ±13	89 ^a ±12	90 ^{a,b} ±13	90 ^b ±13	90 ^b ±12	90±13	96 ^a ±13	95 ^a ±16	95 ^a ±15	94 ^b ±18	95 ^a ±15	95±16
Service supply and demand control center	91 ^a ±28	89 ^a ±30	90 ^a ±30	90 ^a ±30	90 ^a ±29	90±30	83 ^a ±36	85 ^a ±35	87 ^b ±33	86 ^{a,b} ±34	87 ^b ±33	85±34	94 ^a ±23	93 ^a ±25	93 ^a ±24	93 ^a ±25	93 ^a ±24	93±24
Child follow-up	78 ^a ±18	77 ^a ±19	77 ^a ±19	77 ^a ±18	78 ^a ±18	77±19	76 ^a ±26	76 ^a ±26	76 ^a ±26	76 ^a ±26	76 ^a ±26	76±26	88 ^a ±15	87 ^b ±18	87 ^a ±16	85 ^a ±19	87 ^{a,b,c} ±17	87±17
Educational activities	70 ^a ±28	69 ^a ±28	70 ^a ±27	70 ^a ±28	65 ^b ±29	70±28	75 ^a ±28	71 ^a ±30	75 ^a ±29	74 ^a ±29	73 ^a ±30	73±29	86 ^a ±23	87 ^a ±24	87 ^a ±23	86 ^a ±25	87 ^a ±23	87±23
Home visiting	100 ^a ±5	100 ^a ±7	100 ^a ±7	100 ^a ±6	99 ^a ±7	100±6	93 ^a ±24	93 ^a ±24	94 ^a ±23	94 ^a ±23	94 ^a ±23	94±23	98 ^a ±14	96 ^b ±18	97 ^a ±16	96 ^b ±19	97 ^{a,b} ±16	97±17

Legenda: N (Norte), NE (Nordeste), SE (Sudeste), S (Sul) e CO (Centro-Oeste).

Notas: Quando as letras sobrescritas são repetidas em uma mesma linha dentro de cada subtabela dos ciclos do PMAQ-AB, denotam que não houve diferenças estatisticamente significantes entre as macroregiões. As médias das macroregiões foram comparadas dentro de cada ciclo do PMAQ-AB, utilizando-se o teste t de Student com correção de Bonferroni ($p > 0.05$).

indicating efficiency in the application of financial resources. They also stressed that, despite poor investment in structure, it could be possible to achieve standards of excellence in the services they provide in the region.¹⁵

The 'health center operation' indicator showed good results in all regions of Brazil, right from the first PMAQ-AB cycle, scoring 100% adequacy in the North and Southeast (third cycle), with no statistical differences for the other regions. This finding shows PHCC compliance with Ministry of Health instructions to operate at least five days a week.³

PHCC operating at special times (lunchtime, night shift and/or weekends) was more common in the Southeast, in all evaluation cycles. However, in the third cycle, only a quarter of PHCCs in that region operated at those times. Unavailability of special times at PHCCs is a hindrance and compromises access to services.¹⁹⁻²¹ To change this situation, in 2019, the Ministry of Health launched the '*Saúde na Hora*' ['Health on the Spot'] program to extend service provision times at PHCCs by providing financial incentives to the Family Health Strategy and Oral Health teams.²²

PHCC building infrastructure showed better adequacy in the Southeast and Midwest, in the first and third evaluation cycles, and in the South in the second cycle. However, in the third cycle, even in the regions with the best scores, only half the PHCC building structure items were found to be in ideal conditions. Deficient physical infrastructure is admittedly one of the limitations to comprehensive child health care in PHC.²³ Such structural inadequacies are linked to the large number of health centers operating in makeshift locations, such as adapted residences, for example.²³

The 'equipment, materials and supplies' indicator scored better, so that in the third cycle, PHCCs had more than eight out of ten material resources needed for child care. This data represents an improvement in PHC provision and resolute capacity, meeting the wishes of health workers for better care conditions in this health care scenario.²³ Lack of equipment and supplies at PHCCs is an important limitation for team performance.¹⁵

Vaccine availability was greater in the Southeast, Midwest and South in the first two cycles. Whereas in the last cycle, the Northeast performed better, with eight out of ten vaccines available at its PHCCs. However, nationally, a quarter of vaccines were unavailable in the third cycle. A similar result was found in a study

that evaluated management and quality of PHCC services in the midwestern region of São Paulo state.²⁴ Unavailability of immunobiologicals recommended for child care may have contributed to the failure of many Brazilian municipalities to meet vaccination goals, and coverage of several vaccines shows a decline in relation to previous years.^{25,26} Other factors that influence this scenario could be hesitation by the population to adhere to vaccination programs²⁷ and lack of time for those responsible to take their children to PHCCs at regular service hours, since less than one fifth of PHCCs worked at special times in the third cycle.²⁵

Rapid testing at PHCCs was the indicator with the second greatest discrepancy between the regions. In the Southeast and Northeast, only slightly more than half the rapid tests were available, while in the South, eight out of ten test types were available. Nationally, the data show that testing availability needs to be expanded, since only six out of ten rapid tests recommended by the Ministry of Health were provided at PHCCs, according to this study.

Rapid testing allows pregnancy detection in the first trimester, start of prenatal follow-up, and especially early detection of syphilis, HIV, hepatitis and malaria, enabling timely diagnosis and appropriate treatment for each condition. A study that analyzed data from the second PMAQ-AB cycle found that PHCCs where rapid testing for syphilis was available expanded case reporting among pregnant women, enabled adequate treatment and reduced vertical transmission of *Treponema pallidum*.²⁸ Therefore, rapid test availability at PHCCs produces immediate benefits for the population, especially pregnant women and children.

The results of this study show that the work process indicators are more adequate and show greater uniformity between the regions, most of which achieved results above 70% in all evaluation cycles. The exceptions were: 'appointment scheduling' in the first cycle; 'clinical protocol use' in care provision in the first and second cycles; and specialist appointment scheduling and 'population without coverage' in all three cycles. Using national data from the 2014 PMAQ-AB in their study, found that six out of ten teams achieved a high level of quality (70% adequacy or more) in child care, as a result of investments, establishment and strengthening of programs with direct or indirect impact on child health.²⁹

In all three evaluation cycles, it was found that over 70% of PHCCs provided emergency services, in all regions, with minor differences between them. In the third cycle, nine out of ten teams performed emergency services, showing compliance with Ministry of Health recommendations. PHCCs, as part of the Health Care network, must ensure initial care for less complex emergency situations³⁰ and thus it is essential that their teams are prepared to adequately attend to these scenarios.³⁰

It can be concluded that in all three PMAQ-AB evaluation cycles, the PHCC team work process showed better results and greater uniformity between the regions, when compared to the service structure indicators. Well applied investments in the structure of primary health care centers should promote

immediate improvements in these indicators, facilitating the provision of universal, equitable, comprehensive and quality care in all regions, in order to meet the goals of promoting and protecting child health in Brazil.

Authors' contributions

Santos DMA, Alves CMC, Rocha TAH and Thomaz EBAF took part in the study concept and design, data interpretation and drafting the manuscript. Queiroz RCS and Silva NC took part in data analysis and drafting the manuscript. All authors reviewed and approved the final version of the article. They declare that they are responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

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