

Prenatal care in Brazil: a cross-sectional study of the Program for Improving Primary Care Access and Quality, 2014

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Abstract

Objective: to describe the adequacy of primary health care center structure, requests for tests and prenatal care reported by female health service users within the scope of the Program for Improving Primary Care Access and Quality (PMAQ) in Brazil. **Methods:** this was a cross-sectional study using PMAQ Cycle II (2014) data. **Results:** data from 9,909 health centers, 9,905 teams, and 9,945 female health service users were included; 70.1% (95%CI 69.2;71.0) of health centers had adequate structure; 88.0% (95%CI 87.4;88.7) of the teams requested all tests; 59.8% (95%CI 58.8;60.8) of female health service users reported receiving total guidance, and 23.4% of them (95%CI 22.5;24.2) underwent all physical examination procedures; teams that participated in both Cycle I and Cycle II presented better results. **Conclusion:** in spite of shortcomings in Primary Care structure and work process in Brazil, PMAQ appears to positively affect prenatal care.

Keywords: Primary Health Care; Prenatal Care; Health Services Research; Quality of Health Care; Cross-Sectional Studies.

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Introduction

Prenatal care, when carried out in accordance with World Health Organization (WHO) recommended standards,¹ should ensure fetal development and offer effective support, with the aim of reducing the risk of complications during childbirth and the postnatal period and impacting positively on maternal and newborn health.^{1,2}

A Brazilian study provided evidence that between 1986 and 2013, the percentage of pregnant women having one or more prenatal care visits increased from 78.7% to 97.4%, and that the percentage of those who had their first prenatal care visit in the first trimester of pregnancy increased from 59.1% to 84.3%.³ According to a systematic review of the use of prenatal care service use, prenatal care visits below the recommended frequency or starting after the sixth month of pregnancy was associated with women who were of lower socio-economic status, unemployed and had low levels of schooling.⁴ In Brazil, the proportion of women in 2013 having six or more antenatal care visits was greater among those who were older, were of White race/skin color, had higher income and who lived in the Southern region of Brazil and in smaller municipalities.⁵

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For Brazilian citizens in general, and for pregnant women in particular, Primary Health Care (PHC) is the point of entry into the Brazilian National Health Service (SUS), attending to their needs, providing a continuum of care, seeking to prevent possible complications during pregnancy.^{2,6} With the aim of ensuring comprehensive and effective prenatal care for pregnant women in PHC, the Ministry of Health recommends that primary health care centers (PHCCs) have the necessary structure and that health professionals there carry out procedures, examinations and provide guidance to promote their health.²

Evaluating the quality of health care is important, especially in a context of social and regional inequalities

such as those found in Brazil.⁷ Donabedian^{8,9} developed a model for evaluating service quality based on three items: structure; work process; outcome. According to Donabedian, better structures increase the possibility of a better work process, and this, in turn, determines outcomes, signifying improved service user and population health status.^{8,9}

The National Program for Improving Primary Care Access and Quality (PMAQ), implanted in 2011 by the Ministry of Health, aims to induce increased PHC access and quality, by means of a financial incentive offered according to the performance of participating Primary Care teams.¹⁰ Thus far there have been three PMAQ cycles: Cycle I, in 2012; Cycle II, in 2014; and Cycle III in 2017. During the evaluation stage of each PMAQ cycle, data was collected on access to primary care services and the quality of care delivered, including prenatal care indicators. Evaluation of the quality of health care offered in the primary care network is scarce in Brazil. With regard to prenatal care, the majority of such studies have been conducted with smaller samples at the local level.¹¹

This study was conducted on a national scale and is similar to Donabedian's quality evaluation proposal,^{8,9} by investigating the three dimensions of health services: structure; work process as reported by health teams; and quality of care delivered as evaluated by service users.

The objective of this study was to describe the adequacy of primary health care center structure, requests for tests made by health teams and prenatal care reported by female health service users within the scope of PMAQ, and to compare these outcomes between teams that only took part in PMAQ Cycle II and those that took part in PMAQ Cycles I and II.

Methods

This study had a cross-sectional design using data from the PMAQ Cycle II external evaluation. The evaluation was headed by six higher education institutions (Federal University of Pelotas, Federal University of Rio Grande do Sul, Federal University of Rio Grande do Norte, Federal University of Bahia, Federal University of Minas Gerais and the Oswaldo Cruz Institute Foundation [Fiocruz]) in relation to Primary Care teams throughout the entire national territory between December 2013 and March 2014. PMAQ included the teams indicated by municipal health service managers

and their respective PHCCs, as well as a sample of service users present at the health services on the day of the evaluation.

This article refers to a selected part of the sample comprising data on women aged 18 years old or more registered with the health teams and PHCCs, present at the health centers on the day of the evaluation and who answered the following questions:

“Do you have children aged under 2 years old?”

If the reply was ‘Yes’, they were then asked:

“Did you attend prenatal care visits the last time you were pregnant?”

If the reply to this second question was also ‘Yes’, they were then asked:

“Did you have your prenatal care visits at this health center?”

The data were collected in three ways and from three points of view: (i) interviewer observation of service structure conditions; (ii) interviews with health professionals regarding team work process organization; and (iii) prenatal care as perceived by female service users.

When the service had anthropometric weighing scales (150kg), a sphygmomanometer, an adult stethoscope, a disposable speculum, a tape measure, a spotlight, a gynecological examination table, a Pinard or sonar stethoscope, its structure was defined as being ‘adequate’.

Test requesting was considered to be ‘adequate’ when women reported that the following tests had been requested: toxoplasmosis, qualitative urine test, hepatitis B, HIV, hemoglobin/hematocrit, syphilis and fasting blood sugar. Guidance was considered to be adequate when the interviewed women reported having received guidance during pregnancy on the importance of the cervical cancer prevention examination (Papanicolaou test), care of newborn, diet and weight gain and exclusive breast feeding. Procedures were also considered to be adequate when services users reported that during prenatal care visits fundal height and arterial pressure were measured, a gynecological examination was performed, as well as breast and oral cavity examinations.

The following independent variables were examined (i) geopolitical region (North; Northeast; Midwest; Southeast; South), (ii) municipality size¹² (number

of inhabitants: up to 10,000; 10,001-30,000; 30,001-100,000; 100,001-300,000; over 300,000), (iii) municipal human development index¹³ (or HDI, classified in quartiles: 0.467-0.642; 0.643-0.730; 0.731-0.787; 0.788-0.919), (iv) municipal coverage of the Family Health Strategy¹⁴ (or FHS, expressed as a percentage of the population covered: up to 50%; 50.1%-75%; 75.1%-99.9%; 100%) and (v) and having participated in PMAQ Cycle I (yes; no).

The data were collected and recorded using electronic forms installed on tablets and automatically sent to the Ministry of Health central server. Resolving data inconsistencies and criticism was the responsibility of each of the institutions that headed the PMAQ Cycle II external evaluation process. Further details of the PMAQ methodology can be found in a document published by the Ministry of Health.¹⁰ Analysis was performed using the Stata statistical package version 12.1.¹⁵ Each outcome was described separately, according to the independent variables. Proportions and their respective 95% confidence intervals (95%CI) were compared in order to examine differences. All the analyses took into consideration the total population (Cycle II), stratification of those teams that took part in both Cycle I and Cycle II, and stratification of those that only took part in Cycle II.

The PMAQ study project was approved by the Federal University of Pelotas Faculty of Medicine Research Ethics Committee (CEP/FAMED/UFPel): Record No. 487.055/2013. All participants signed a Free and Informed Consent form.

Results

A total of 24,055 PHCCs, 29,778 health teams and 91,203 health service users were evaluated in PMAQ Cycle II. For this study we used data from 9,909 PHCCs (5,471 participating in both Cycle I and Cycle II; and 4,427 participating only in Cycle II) and 9,905 health teams (5,474 participating in both Cycle I and Cycle II; and 4,431 participating only in Cycle II) linked with 9,945 female service users (5,474 users cared for by teams participating in both Cycle I and Cycle II; and 4,431 cared for by teams participating only in Cycle II) who had prenatal care during their most recent pregnancy at the PHCC where they were interviewed.

With regard to PHCC structure, all items of equipment were found in more than 80% of health centers.

Table 1 – Prevalence rates and 95% confidence intervals of indicators of primary health care center structure, test requesting and prenatal care outcome, stratified by teams taking part in Cycles I and II, Cycle II and total sample, within the scope of the Program for Improving Primary Care Access and Quality (PMAQ), Brazil, 2014

Variables	Cycles I and II	Cycle II Only	Entire Sample
	% (95%CI) ^a	% (95%CI) ^a	% (95%CI) ^a
PHCC structure ^b (Module I)	n=(5,471) ^c	(n=4,427) ^c	(n=9,909)
Anthropometric weighing scales (150kg)	84.0 (83.0;85.0)	84.1 (83.1;85.2)	84.1 (83.3;84.8)
Sphygmomanometer	99.6 (99.4;99.8)	99.0 (98.7;99.3)	99.3 (99.1;99.5)
Disposable speculum	92.0 (91.3;92.7)	90.6 (89.8;91.5)	91.4 (90.8;91.9)
Adult stethoscope	99.2 (99.0;99.4)	98.3 (97.9;98.7)	98.8 (98.6;99.0)
Tape measure	97.7 (97.3;98.1)	96.3 (95.7;96.9)	97.0 (96.7;97.4)
Spotlight	97.2 (96.8;97.7)	95.2 (94.6;95.9)	96.3 (96.0;96.7)
Gynecological examination table	96.5 (96.0;97.0)	94.0 (93.3;94.7)	95.4 (94.9;95.8)
Pinard or sonar stethoscope	98.2 (97.9;98.6)	96.9 (96.4;97.4)	97.6 (97.3;97.9)
All equipment	71.9 (70.7;73.1)	67.9 (66.5;69.3)	70.1 (69.2;71.0)
Test requesting (Module II)	(n=5,474) ^c	(n=4,431) ^c	(n=9,905)
Fasting blood sugar	99.3 (99.0;99.5)	98.8 (98.5;99.1)	99.1 (98.9;99.2)
Hemoglobin/hematocrit	98.2 (97.8;98.5)	97.0 (96.5;97.5)	97.7 (97.4;98.0)
Hepatitis B	96.9 (96.4;97.3)	94.3 (93.7;95.0)	95.7 (95.3;96.1)
HIV ^d	98.0 (97.7;98.4)	96.6 (96.0;97.1)	97.4 (97.1;97.7)
Syphilis	98.7 (98.4;99.0)	98.1 (97.7;98.5)	98.4 (98.2;98.7)
Urine	96.3 (95.8;96.8)	94.5 (93.8;95.2)	95.5 (95.1;95.9)
Toxoplasmosis	95.0 (94.4;95.6)	91.6 (90.8;92.4)	93.5 (93.0;93.9)
All tests	90.0 (89.2;90.8)	85.5 (84.5;86.6)	88.0 (87.4;88.7)
Patient care (Module III)	(n=5,474) ^c	(n=4,431) ^c	(n=9,945)
Diet and weight gain	88.6 (87.7;89.4)	87.2 (86.2;88.2)	87.9 (87.3;88.6)
Exclusive breastfeeding	91.2 (90.5;92.0)	90.3 (89.4;91.1)	90.8 (90.2;91.3)
Caring for newborn	85.6 (84.7;86.5)	84.8 (83.7;85.8)	85.2 (84.5;85.9)
Importance of Papanicolaou test	67.1 (65.9;68.3)	63.3 (61.8;64.7)	65.3 (64.4;66.3)
All guidance	61.3 (60.0;62.6)	58.1 (56.6;59.5)	59.8 (58.8;60.8)
Fundal height measurement	97.3 (96.9;97.7)	96.0 (95.4;96.6)	96.7 (96.4;97.1)
Arterial pressure measurement	99.1 (98.9;99.4)	98.5 (98.1;98.8)	98.8 (98.6;99.1)
Oral cavity examination	50.9 (49.6;52.3)	47.1 (45.6;48.6)	49.2 (48.3;50.2)
Gynecological examination	43.5 (42.2;44.8)	38.9 (37.4;40.3)	41.4 (40.5;42.4)
Breast examination	57.8 (56.5;59.1)	54.5 (53.1;56.0)	56.3 (55.3;57.2)
All procedures	24.6 (23.5;25.8)	21.8 (20.6;23.1)	23.4 (22.5;24.2)

a) 95%CI: 95% confidence interval.

b) PHCC: primary health care center.

c) n with missing data according to the participation in Cycles I and II variable.

d) HIV: human immunodeficiency virus.

Better structure was found at PHCCs that participated in both Cycle I and Cycle II of PMAQ: 71.9% (95%CI 70.7;73.1) of all health centers had all the equipment that was evaluated, whereas 67.9% (95%CI 66.5;69.3) of PHCCs that only participated in Cycle II had all items of equipment (Table 1).

Taking the sample as a whole, 88.0% of health professional teams requested all tests to be performed. Taking the health teams that participated in both Cycle I and Cycle II, 90.0% (95%CI 89.2;90.8) requested all tests, while this prevalence rate was 85.5% (95%CI 84.5;86.6) for those that only took part in Cycle II (Table 1).

More than 80% of service users reported having received guidance on newborn feeding and weight gain, exclusive breast feeding and care. On the other hand, guidance on the importance of the cervical cancer prevention test (Papanicolaou test) was reported by less than 70% of service users, resulting in 59.8% (95%CI 58.8;60.8) of interviewees (total sample) having received adequate guidance. Among service users whose health teams took part in both Cycle I and Cycle II, 61.3% (95%CI 60.0;62.6) reported having received complete guidance; while for those whose teams only took part in Cycle II, 58.1% (95%CI 56.6;59.5) received adequate guidance (Table 1).

More than 95% of the women stated that fundal height and arterial pressure were measured during prenatal care visits. However, less than 60% of interviewees reported having had gynecological, oral cavity and breast examinations, resulting in only 23.4% (95%CI 22.5;24.2) of interviewees (total sample) having received adequate physical examination procedures. Among service users whose health teams took part in both Cycle I and Cycle II, this proportion was 24.6% (95%CI 23.5;25.8); while among those whose health teams only took part in Cycle II, the proportion was 21.8% (95%CI 20.6; 23.1) (Table 1).

Taking the sample as a whole, the Northern region had lower prevalence of PHCCs with adequate structure (59.6%). No significant differences were found with regard to population size, HDI and FHS coverage. With regard to prevalence rates found among PHCCs with teams that took part in both Cycle I and Cycle II, compared to the teams that only took part in Cycle II, the structure of PHCCs participating in Cycles I and II was better in the Northeast region, in municipalities with population size between 10,001 and 30,000

inhabitants, with HDI falling in quartiles Q1 or Q2 and with FHS coverage of up to 50% (Table 2).

Greater prevalence of adequate test requesting was found in the Southern region (96.7%), in municipalities with more than 300,000 inhabitants (95.3%), higher HDI (96.6%) and lower FHS coverage (92.2%) (total sample). Health teams that took part in both Cycle I and Cycle II of PMAQ had greater prevalence of adequate test requesting in relation to those that only took part in Cycle II. These differences were identified in the North, Northeast and Midwest regions and in municipalities with between 10,001 and 100,000 inhabitants. They were found especially in HDI quartiles Q1 and Q2 (in Q3 this difference was not statistically significant) and in all strata of FHS coverage (Table 3).

With regard to care reported by service users, in the total sample the highest prevalence rates for having received complete guidance were found in the Southern region (64.6%), in municipalities with up to 10,000 and with more than 300,000 inhabitants, with higher HDI, and with FHS coverage of up to 50% and 100% of the population. When comparing service users whose teams took part in both Cycle I and Cycle II with service users whose teams only took part in Cycle II, prevalence of having received complete guidance was higher in those that took part in both Cycle I and Cycle II, in the Northeast and Southern regions, and in places with a lower HDI (Table 4).

Taking the total sample, receiving all procedures was more prevalent in the Southeast and Southern regions, and in municipalities with more than 300,000 inhabitants and higher HDI. When comparing prevalence of receiving all procedures from teams that took part in both Cycle I and Cycle II with that of prevalence reported for teams that only took part in Cycle I, no significant differences were found between regions, population size, HDI or FHS coverage (Table 4).

Discussion

The findings of this study provide evidence that adequacy of primary health care center structure, guidance and procedures delivered to pregnant women in prenatal care by primary health services in Brazil was below 80%. On the other hand, tests requested were adequate for the majority of health teams.

Regarding primary health care centre structure, all items of equipment were found in around seven out

Table 2 – Prevalence rates and 95% confidence intervals for primary health care centers with adequate structure for prenatal care, according to municipal contexts, stratified by teams taking part in Cycles I and II, Cycle II and total sample, within the scope of the Program for Improving Primary Care Access and Quality (PMAQ), Brazil, 2014

Variables	Adequate PHCC structure ^a		
	All equipment		
	Cycles I and II (n=5,471) ^a % (95%CI) ^b	Cycle II Only (n=4,427) ^a % (95%CI) ^b	Entire Sample (n=9,909) % (95%CI) ^b
Region of Brazil			
North	60.6 (55.6;65.6)	59.0 (54.7;63.2)	59.6 (56.4;62.8)
Northeast	73.7 (71.7;75.7)	67.5 (65.4;69.6)	70.5 (69.1;72.0)
Midwest	71.0 (66.8;75.1)	70.4 (66.1;74.6)	70.6 (67.6;73.5)
Southeast	73.4 (71.5;75.2)	71.0 (68.4;73.5)	72.5 (71.0;74.0)
South	68.8 (65.2;72.5)	69.4 (64.3;74.6)	69.0 (66.0;71.9)
Population size (inhabitants)			
Up to 10,000	71.6 (68.4;74.9)	70.9 (67.2;74.7)	71.3 (68.9;73.8)
10,001-30,000	73.4 (71.2;75.6)	67.6 (65.0;70.1)	70.7 (69.1;72.4)
30,001-100,000	72.2 (69.7;74.7)	67.0 (64.3;69.8)	69.7 (67.8;71.5)
100,001-300,000	74.6 (71.4;77.9)	68.7 (65.0;72.4)	71.9 (69.4;74.3)
Over 300,000	68.3 (65.7;70.9)	66.7 (63.4;70.0)	67.7 (65.6;69.7)
HDI^c (quartiles)			
Q1 (0.467-0.642)	73.8 (71.7;75.8)	68.2 (66.0;70.3)	70.9 (69.4;72.4)
Q2 (0.643-0.730)	72.8 (70.7;74.9)	66.4 (64.0;68.9)	69.9 (68.3;71.5)
Q3 (0.731-0.787)	70.1 (67.5;72.8)	68.6 (65.5;71.8)	69.4 (67.4;71.5)
Q4 (0.788-0.919)	68.6 (65.4;71.7)	70.7 (65.7;75.7)	69.2 (66.5;71.8)
FHS coverage^d			
Up to 50%	72.7 (70.3;75.0)	66.8 (64.3;69.4)	69.9 (68.2;71.6)
50.1 - 75%	68.9 (66.4;71.4)	67.7 (64.7;70.7)	68.4 (66.5;70.3)
75.1 - 99.9%	71.6 (69.0;74.2)	66.4 (63.4;69.4)	69.2 (67.3;71.2)
100%	74.0 (71.8;76.2)	70.2 (67.7;72.8)	72.3 (70.6;74.0)

a) n with missing data according to the participation in Cycles I and II variable.

b) 95%CI: 95% confidence interval.

c) HDI: human development index.

d) FHS: Family Health Strategy.

of every ten PHCCs. A study published in 2001¹⁶ found similar a result, with 70% of health centers having ideal structure, although that study was conducted in just one medium-sized city in the Southern region of Brazil.

When evaluating the quality of test requests, we found that during prenatal care nine out of every ten teams requested all the tests under evaluation. This finding may indicate the success of women's health care policies implemented during the last fifteen years. An example of these successful policies is the Stork Network (Rede Cegonha): a relevant Ministry of Health strategy providing structured and organized care for mother and child health nationwide,

ensuring women's right to reproductive planning and humanized care during pregnancy, childbirth and the postpartum period.²

On the other hand, only 60% of service users reported having received complete guidance during antenatal care. This result is similar to that found by Tomasi et al.⁵ in their study of PMAQ Cycle I data for the year 2012, indicating that there was no improvement regarding this item. Guidance does not incur costs for the health system^{17,18} but even so it was not given to all pregnant women. During prenatal care health professionals have many opportunities to give guidance to pregnant women, given the number of

visits they have.^{2,5,19} The ideal – and possible – scenario would be to provide this guidance to 100% of pregnant women.

Less than a quarter of service users reported having all procedures performed during prenatal care at PHCCs. This finding is also in agreement with that of Tomasi et al.⁵ In our study, less than 60% of service users had oral cavity, gynecological and breast examinations. When comparing this with Cycle I data presented by Tomasi et al., we found a small increase in the prevalence of oral cavity examinations (from 45% to 49%) and a reduction in gynecological examinations (from 45% to 41%).⁵

PHCCs and health teams in the Southeast and Southern regions had better structure, better test requesting and better care as reported by service users, possibly because of having more resources made available for investment in Health.²⁰ This situation is compatible with the better results achieved by Primary Care services in municipalities with better HDI found by our study.

Taking the ‘population size’ and ‘FHS coverage’ variables, the findings were controversial: structure was found to be better in municipalities that were smaller and had 100% FHS coverage. A possible explanation for

Table 3 – Prevalence rates and 95% confidence intervals for health teams making adequate test requests for prenatal care, according to municipal contexts, stratified by teams taking part in Cycles I and II, Cycle II and total sample, within the scope of the Program for Improving Primary Care Access and Quality (PMAQ), Brazil, 2014

Variables	Health teams making adequate test requests		
	All tests		
	Cycles I and II (n=5,474) ^a % (95%CI) ^b	Cycle II Only (n=4,431) ^a % (95%CI) ^b	Entire Sample (n=9,905) % (95%CI) ^b
Region of Brazil			
North	77.2 (72.9;81.5)	66.3 (62.2;70.4)	70.8 (67.8;73.8)
Northeast	87.8 (86.3;89.2)	84.6 (83.0;86.2)	86.2 (85.1;87.3)
Midwest	85.8 (82.6;89.0)	81.5 (77.9;85.1)	83.7 (81.3;86.1)
Southeast	93.2 (92.1;94.2)	93.8 (92.4;95.2)	93.4 (92.5;94.2)
South	96.5 (95.1;97.9)	97.1 (95.3;99.0)	96.7 (95.6;97.9)
Population size (inhabitants)			
Up to 10,000	88.7 (86.4;91.0)	85.5 (82.6;88.4)	87.3 (85.5;89.1)
10,001 - 30,000	86.6 (84.9;88.2)	80.2 (78.1;82.4)	83.7 (82.3;85.0)
30,001 - 100,000	87.3 (85.4;89.1)	82.8 (80.6;85.0)	85.1 (83.7;86.5)
100,001-a 300,000	94.2 (92.5;96.0)	90.2 (87.9;92.5)	92.3 (90.9;93.8)
Over 300,000	95.7 (94.5;96.8)	94.6 (93.1;96.2)	95.3 (94.3;96.2)
HDI^c (quartiles)			
Q1 (0.467-0.642)	84.4 (82.6;86.1)	79.1 (77.2;80.9)	81.6 (80.4;82.9)
Q2 (0.643-0.730)	89.3 (87.8;90.7)	85.7 (83.9;87.5)	87.7 (86.5;88.8)
Q3 (0.731-0.787)	95.1 (93.8;96.3)	94.8 (93.3;96.3)	95.0 (94.0;95.9)
Q4 (0.788-0.919)	96.4 (95.2;97.7)	97.2 (95.4;99.0)	96.6 (95.6;97.7)
FHS coverage^d			
Up to 50%	94.4 (93.2;95.6)	89.7 (88.1;91.4)	92.2 (91.2;93.2)
50.1 - 75%	88.5 (86.7;90.2)	82.8 (80.4;85.2)	86.1 (84.7;87.5)
75.1 - 99.9%	88.2 (86.4;90.1)	83.6 (81.2;86.0)	86.2 (84.7;87.7)
100%	88.6 (87.0;90.2)	84.8 (82.8;86.7)	86.9 (85.6;88.1)

a) n with missing data according to the participation in Cycles I and II variable.

b) 95%CI: 95% confidence interval.

c) HDI: human development index.

d) FHS: Family Health Strategy.

Table 4 – Prevalence rates and 95% confidence intervals for adequate prenatal care reported by health service users, according to municipal contexts, stratified by teams taking part in Cycles I and II, Cycle II and total sample, within the scope of the Program for Improving Primary Care Access and Quality (PMAQ), Brazil, 2014

Variables	Adequate care reported by female users of primary health care centers					
	All guidance			All procedures		
	Cycles I and II (n=5,474) ^a % (95%CI) ^b	Cycle II Only (n=4,431) ^a % (95%CI) ^b	Entire Sample (n=9,945) % (95%CI) ^b	Cycles I and II (n=5,474) ^a % (95%CI) ^b	Cycle II Only (n=4,431) ^a % (95%CI) ^b	Entire Sample (n=9,945) % (95%CI) ^b
Region of Brazil						
North	53.9 (48.8;59.0)	54.8 (50.5;59.1)	54.4 (51.2;57.7)	16.7 (12.8;20.6)	16.9 (13.6;20.1)	16.7 (14.2;19.2)
Northeast	64.8 (62.6;67.0)	59.0 (56.8;61.2)	61.8 (60.2;63.3)	23.9 (22.0;25.9)	22.7 (20.8;24.6)	23.3 (21.9;24.6)
Midwest	47.1 (42.5;51.7)	45.4 (40.8;50.1)	46.3 (43.1;49.5)	14.0 (10.8;17.2)	15.0 (11.7;18.4)	14.6 (12.3;16.8)
Southeast	61.4 (59.3;63.4)	61.5 (58.7;64.2)	61.3 (59.7;63.0)	28.1 (26.2;30.0)	23.8 (21.4;26.3)	26.6 (25.1;28.1)
South	65.5 (61.8;69.2)	63.1 (57.7;68.4)	64.6 (61.6;67.7)	27.5 (23.8;31.1)	27.2 (22.0;32.3)	27.5 (24.5;30.4)
Population size (inhabitants)						
Up to 10,000	63.6 (60.1;67.0)	61.3 (57.3;65.3)	62.5 (59.9;65.1)	23.0 (20.0;26.1)	21.1 (17.8;24.5)	22.2 (19.9;24.4)
10,001 – 30,000	61.0 (58.6;63.4)	56.4 (53.7;59.2)	59.0 (57.1;60.8)	24.1 (22.0;26.3)	20.8 (18.6;23.0)	22.6 (21.1;24.2)
30,001 – 100,000	59.1 (56.4;61.8)	58.1 (55.2;60.9)	58.6 (56.7;60.6)	21.3 (19.0;23.6)	19.5 (17.2;21.8)	20.5 (18.9;22.1)
100,001 – 300,000	62.1 (58.5;65.7)	54.7 (50.8;58.7)	58.6 (55.9;61.2)	23.5 (20.2;26.8)	21.4 (18.1;24.7)	22.5 (20.1;24.8)
Over 300,000	62.1 (59.3;64.8)	61.1 (57.7;64.5)	61.7 (59.6;63.8)	30.4 (27.7;33.0)	28.1 (24.8;31.3)	29.5 (27.4;31.5)
HDI^c (quartiles)						
Q1 (0.467-0.642)	63.8 (61.5;66.0)	57.9 (55.6;60.1)	60.7 (59.1;62.3)	24.2 (22.2;26.2)	21.1 (19.2;23.0)	22.6 (21.2;24.0)
Q2 (0.643-0.730)	58.6 (56.3;60.9)	56.3 (53.7;58.9)	57.5 (55.8;59.3)	20.3 (18.4;22.2)	19.7 (17.6;21.8)	20.0 (18.6;21.4)
Q3 (0.731-0.787)	60.3 (57.5;63.1)	57.8 (54.4;61.1)	59.2 (57.1;61.4)	25.1 (22.6;27.7)	22.8 (19.9;25.7)	24.2 (22.3;26.1)
Q4 (0.788-0.919)	63.1 (59.8;66.4)	68.2 (63.1;73.3)	64.5 (61.8;67.3)	34.4 (31.0;37.7)	33.3 (28.0;38.6)	34.1 (31.2;36.9)
FHS coverage^d						
Up to 50%	61.5 (59.0;64.0)	58.7 (56.0;61.4)	60.2 (58.3;62.0)	24.9 (22.6;27.2)	24.0 (21.6;26.4)	24.5 (22.8;26.1)
50.1 - 75%	60.1 (57.4;62.7)	55.9 (52.7;59.0)	58.3 (56.2;60.3)	24.7 (22.4;27.1)	21.0 (18.4;23.7)	23.1 (21.4;24.9)
75.1 - 99.9%	59.4 (56.6;62.2)	57.0 (53.9;60.2)	58.4 (56.3;60.5)	22.8 (20.4;25.2)	20.4 (17.8;23.1)	21.9 (20.1;23.6)
100%	63.6 (61.2;66.0)	59.9 (57.2;62.7)	62.0 (60.2;63.8)	25.7 (23.5;27.9)	21.3 (19.0;23.6)	23.7 (22.1;25.3)

a) n with missing data according to the participation in Cycles I and II variable.

b) 95%CI: 95% confidence interval.

c) HDI: human development index.

d) FHS: Family Health Strategy.

this result is that, usually, smaller municipalities focus on Primary Care, whereas in addition to primary care, medium- and large-sized municipalities also have medium and high complexity health system structures and are frequently recognized as regional referral services. Adequate test requesting was greater in municipalities that were larger and had lower FHS coverage. It may be that the fact of working in large centers means that health professionals have greater access to continuing education activities that cover these aspects. Adequate care as reported by service users did not have a defined pattern for the 'guidance' and 'procedures' variables.

In general, PHCCs with teams that took part in both Cycle I and Cycle II had better results for structure, test requesting and health care provided to the women who were interviewed. One of the hypotheses put forward regarding the achievement of these results lies in the financial incentive received by teams and health centers taking part in PMAQ between 2012 and 2014. Indeed it was during this short space of time that this initiative was the only intervention focused on improving Primary Care. The result of this study should be interpreted with caution. It is not a controlled intervention study with adjustments for other variables capable of influencing it. The findings support the continuity of the program. However, it is important that the hypothesis of the financial incentive, as a factor determining improved Primary Care, be confirmed in future analyses that take into consideration a longer period of time and a larger number of evaluations. This will be possible once PMAQ Cycle III data are made available.

When considering the limitations of this study, selection bias cannot be ruled out, given that health team adherence to PMAQ is voluntary. Adherence to Cycle II was considerable and involved teams from all over the country: more than 70% of PHCCs took part. In Cycle I, adherence was around 30% and was concentrated on the best teams and best PHCCs. For this reason, caution is recommended as to generalizing its results to all of Brazil's PHCCs. The situation of prenatal care in Brazil may be even more precarious than has been revealed here, since PHCCs and teams in worse conditions did not take part in the evaluation. Cycle III, conducted in 2017, has almost universal

adherence and, therefore, future analyses will be able to contribute to controlling this bias.

Proxy variables were also used as a means of evaluating the work of the health teams. Evaluation of the work process of health professionals is known to be much more complex; however, the approach used in this study was limited by the availability of variables on the data collection instruments and, furthermore, individual user differences were not explored, which could have revealed inequities in terms of care.

Standing out among the positive points of the study is its uniqueness: the study was carried out in the Primary Care network of the Brazilian National Health System and used a comprehensive sample of PHCCs from all over the country. In addition, the PMAQ external evaluation instrument was built based on three dimensions – PHCC structure, health team work process and care received by service users –, thus enabling a more far-reaching approach to evaluating prenatal care. The majority of studies conducted in Brazil with the aim of evaluating the quality of prenatal care have used only one or two of these dimensions.^{16,18,21,22}

A further positive result of this evaluation worthy of note is the increase of around 5% in PHCCs with adequate structure, considering the short space of time of just two years between PMAQ Cycles I and II. Based on an approximate estimate of 40,000 PHCCs in operation in Brazil, this 5% increase when extrapolated to absolute numbers will represent 2,000 PHCCs with better structures if they join PMAQ.

Nevertheless, prenatal care in Brazil's primary health care network requires improvements. Guidance on the importance of having cervical cancer prevention examinations and guidance on having oral cavity, gynecological and breast examinations needs to be better explored by health professionals when monitoring pregnant women. To this end, they and their teams at primary health care centers need to take part in continuing education processes. Based on data from PMAQ Cycles I, II and III, we recommend that further studies be carried out to evaluate the consistency of these findings, as well as to evaluate the effectiveness of the Program for Improving Primary Care Access and Quality in achieving its objectives.

Authors' contributions

Neves RG, Flores-Quispe MP and Tomasi E contributed to the study conception and design, data analysis and interpretation and drafting the first version of the manuscript. Facchini LA and Fassa AG contributed to data analysis and interpretation and critical review of the manuscript. All the authors have approved the final version of the manuscript and are responsible for all aspects of the work, including guaranteeing its accuracy and integrity.

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