

Quality of antenatal care in primary health care in Brazil: a latent class analysis

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Abstract

Background: Adequate antenatal care (ANC) is fundamental in preventing maternal and neonatal mortality. Developing indicators for assessing the ANC quality in Primary Health Care (PHC) is essential.

Objective: To characterize subgroups of quality of care with respect to ANC at the PHC level in Brazil.

Methods: We conducted a cross-sectional study with data from the first Brazil's National Program for Improving Primary Care Access and Quality (PMAQ-AB) Cycle (2011–2012). A total of 16 566 PHC teams participated in the first cycle of the PMAQ-AB, corresponding to 49.6% of the teams active across Brazil, distributed across 69.3% of Brazilian municipalities. To assess the quality of ANC, six indicators were defined: 'Group of medicines,' 'Protocols and patient flows,' 'Record-keeping practices,' 'ANC routine tests,' 'Protocols for early detection of pregnant women and ANC provision,' and 'Identification and ANC of low/high-risk pregnancies.' Latent Class Analysis (LCA) was carried out to characterize the quality of care provided by PHC teams according to these six indicators.

Results: 'Identification and ANC of low/high-risk pregnancies' indicator had the highest percentage of teams providing adequate care (39.5%), while 'ANC routine tests' had the lowest percentage (16.8%). The LCA identified three classes, and 20.5% of PHC teams had the probability of belonging to the class denominated 'High adequacy.'

Conclusion: Using a national PHC-level dataset, we evaluated PHC teams' ANC adequacy through six indicators. Brazilian PHC teams consistently show weaknesses across these indicators, particularly in essential care. This approach can guide global initiatives to evaluate the quality of ANC.

Key words: primary health care, quality of antenatal care, latent class analysis

Objectives

The provision of maternal and child care is an international concern and a focus of the United Nations Sustainable Development Goals [1]. Antenatal care (ANC) systematizes a set of practices and guidelines directed towards pregnant women [2], and, according to Brazilian legislation, it should be predominantly provided at the Primary Health Care (PHC) level [3].

ANC aims to ensure a healthy pregnancy and appropriate development of the fetus, preventing adverse health outcomes

for the mother and her future infant. Thus, ANC considers promoting maternal and fetal health, diagnosing and treating complications, and reducing the risk of gestational complications during labor and postpartum [4–6]. Regular ANC visits have been shown to benefit babies by improving intrauterine growth and reducing the risk of infection, thereby increasing infant survival rates [7]. These visits also provide the opportunity to assess maternal nutritional status and provide counseling, screen for potential pregnancy complications, treat infections, and carry out early management of newborn

Key Messages

- This study demonstrates the development of a robust theoretical and analytical model for a pragmatic assessment of the quality of antenatal care (ANC) in primary health care (PHC) settings.
- The indicator 'Identification and ANC of low/high-risk pregnancies' exhibited the highest percentage of teams providing adequate care (39.5%), while 'ANC routine tests' recorded the lowest percentage (16.8%).
- The Latent Class Analysis (LCA) identified three classes, with 20.5% of PHC teams characterized as having 'High adequacy' of care, 23.9% with an 'Intermediate adequacy' of care, and 55.6% with 'Low adequacy' of care.
- Our findings underscore the importance of investing in systematic data collection to promote the improvement of PHC quality. This guidance is crucial for global initiatives aimed at evaluating the quality of ANC.
- Furthermore, during 2011–2012, Brazilian PHC teams displayed significant weaknesses across the six studied indicators, particularly in the provision of fundamental care (routine tests, medications, supplies, the process of identifying high-risk pregnancies, protocols, and patient flows). This retrospectively supports the need for the implementation of a quality-enhancement program such as the National Program for Improving Primary Health Care Access and Quality (PMAQ-AB).

illness [8, 9]. These interventions are essential for reducing maternal, neonatal, and infant morbimortality, as well as improving birth weight [10–13].

However, for ANC to be effective, it is recommended to initiate it early in pregnancy and to ensure it comprises a set of actions established by care protocols informed by scientific evidence [4, 5]. These may vary slightly depending on the institution that develops them, although they always maintain some common traits. For example, the World Health Organization (WHO) recommends that pregnant women receive at least eight antenatal care visits, with the first ideally taking place within the first 12 weeks of gestation, followed by additional visits at 20, 26, 30, 34, 36, 38, and 40 weeks of gestation [4]. On the other hand, the Brazilian Ministry of Health recommends a minimum of six consultations, also identifying the need to preferably receive the first one in the first trimester, followed by two in the second trimester, and also recommends a greater frequency (three visits) in the third trimester of pregnancy [6].

In addition to visit frequency, essential elements of ANC interventions have been emphasized to ensure the quality of care. Quality encompasses both the provision of care from a health systems perspective and the experiences of women when receiving health care services [14]. ANC actions in Brazil are guided by the quality and effectiveness criteria elaborated by the Rede Cegonha initiative [15]. Nevertheless, existing literature indicates concerns about the subpar quality of ANC in primary care settings [16, 17] and persistent regional and sociodemographic inequalities in terms of access and outcomes [17–19].

Overall, the quality of ANC is determined by availability of resources at both managerial and healthcare levels,

as well as the implementation of routine actions adhering to technical-scientific standards, and timely access [6, 20–23]. However, assessing its adequacy in detail poses a significant challenge [21, 23, 24] and demands the development of appropriate indicators that assess ANC quality in PHC. To address the issue of monitoring and evaluation of PHC services, including ANC, in 2011, the Federal Government launched the National Program for Improving Primary Health Care Access and Quality (PMAQ-AB) as a strategy to assess and enhance the quality of PHC facilities and services provided [25].

Therefore, this study characterizes subgroups of quality of care with respect to the provision of ANC at the PHC level in Brazil, using data from the PMAQ-AB's first cycle.

Methods

Study design, population, and data

This cross-sectional study utilized data from modules I (structure of PHC facilities) and II (PHC team's work processes) of the PMAQ-AB, collected during the program's first cycle, between 2011 and 2012.

Indeed, to date, three cycles of PMAQ have been conducted: Cycle I in 2011–2012, Cycle II in 2013–2014, and Cycle III in 2017–2018. We consider that there are a number of advantages behind employing the data collected during the first cycle of the PMAQ-AB, namely: (i) the period during which the PMAQ-AB was first implemented was marked by a progressive political environment, conducive to advancements in Brazilian health policies; (ii) the PMAQ-AB' Cycle 1 was, historically, the first attempt to collect nationwide quality data, as it employed a meticulously discussed data collection instrument, collaboratively constructed by administrators, the academic community, and civil society representatives; (iii) additionally, after harmonization of the questions across the data collection tools of the two subsequent cycles, to ensure comparability, it would be possible to assess the development of the quality of ANC throughout the implementation of a program that aimed to improve quality of PHC.

The PMAQ-AB evaluation in 2011–2012 covered 16 566 PHC teams, distributed across 3857 municipalities (69.3% of the total 5565 municipalities existing in Brazil at the time of the data collection [20]), accounting for 49.6% of PHC teams active in that period.

Latent class indicators

To identify in the PMAQ-AB questionnaire the variables that pertained to ANC, we used criteria and standards derived from Brazilian legislation, guidelines, protocols, existing scientific evidence, and consultation with PHC experts. Subsequently, the selected questions were grouped into six different ANC indicators, which were in turn classified as adequate or inadequate to represent the quality of care at the PHC level [3, 5].

Statistical analysis

Initially, descriptive analyses were carried out to identify the frequencies of PHC teams providing adequate ANC, in terms of each variable of the six indicators composing antenatal care.

Subsequently, we applied Latent Class Analysis (LCA) to characterize the adequacy of ANC provided by PHC teams. LCA is a multivariate statistical method that uses conditional and unconditional probabilities to describe categorical constructs based on a set of categorical indicators [26]. The resulting models were assessed using Akaike Information Criterion (AIC), Bayesian Information criterion (BIC), entropy, and the Vuong-Lo-Mendell-Rubin likelihood ratio test [26].

The interpretation of the latent classes was used as an additional model selection criteria, and the local independence assumption of LCA was evaluated through the analysis of standardized bivariate residuals [26, 27]. A maximum percentage of 10% of residuals was deemed acceptable. The latent classes according to the response patterns on the LCA indicators and their posterior probabilities are also presented.

The descriptive analysis and the LCA were performed with Stata 15.0 and Mplus 8.6 [28], respectively.

As this study used secondary data from publicly available databases provided by the Brazilian Ministry of Health, submission to the Research Ethics Committee was not required.

Results

Table 1 provides the definitions for all six indicators related to the antenatal care quality component. The constituent variables for each of these six indicators, along with their corresponding number and frequencies, are detailed in **Table 2**. The description of the ‘group of medicines’ indicator is detailed in **Supplementary Table 1S**.

Figure 1 displays the frequencies of PHC teams providing adequate care in relation to each of the six indicators of the ANC quality component. The indicator ‘Identification and ANC of low/high-risk pregnancies’ had the highest frequency of teams providing adequate care (39.5%), while the indicator ‘ANC routine tests’ had the lowest frequency (16.8%).

Table 3 presents the model fit statistics for different latent class models with varying numbers of classes. Despite the lowest AIC (111 460.0) and BIC (111 668.3) values for the LCA model with four classes, the model with three classes was chosen because of its greater interpretability. Moreover, the classification quality of this latter model is also superior (entropy = 0.529).

Figure 2 presents the three latent classes selected as our final model: 20.5% of PHC teams were characterized as having a ‘High adequacy’ of care, 23.9% as having an ‘Intermediate adequacy’ of care, and 55.6% as having a ‘Low adequacy’ of care.

The ‘High adequacy’ class had the highest probabilities of adequacy across all six indicators. PHC teams in this class had a 68.1% probability of reporting adequacy for group of medicines, 72.6% for protocols and patient flows, 67.7% for record-keeping practices, 53.3% for ANC routine tests, 67.2% for protocols for early detection of pregnant women and ANC provision, and 67.7% for identification and ANC of low/high-risk pregnancies (**Figure 2** and **Supplementary Table 2S**). In the class labeled as ‘Intermediate,’ the indicator with the highest probability of adequacy was the ‘Identification and ANC of low/high-risk pregnancies’ (63.8%). Meanwhile, in the class labeled as ‘Low adequacy,’

Table 1 Development of the six ANC indicators

ANC indicator	Definition
Group of medicines	This indicator was composed of eight groups of essential medicines for the care of pregnant women: analgesics, antidiabetics, antibacterials, antihypertensives or cardiovascular agents, antiparasitics, anti-asthmatics, antacids, and antiemetics, as well as multivitamins. For each group, the PHC facility should have at least one medicine to be considered adequate. Additionally, the PHC team should have answered ‘yes’ to the question about the administration of benzathine penicillin G to pregnant women in the facility.
Protocols and patient flows	For this indicator, the PHC team needed to have documents containing referral protocols and patient flows for pregnant women for several situations such as delivery (maternity ward), serological examination for syphilis (VDRL) and HIV, glucose exam, uroculture, and ultrasound. If the team answered ‘yes’ to all questions and had defined the maternity ward for delivery, the indicator was considered adequate.
Record-keeping practices	It was asked whether the professional responsible for monitoring the pregnant woman had records of dental consultation and collection of cytopathological examination. When the answers were positive, and there was also a record of the pregnant women’s booklet proving this, the indicator was considered adequate.
Antenatal care routine tests	This indicator consisted of ten questions about the antenatal tests performed by the PHC team, including syphilis serology (VDRL), fasting glucose, HIV serology, hemoglobin and hematocrit, urine culture, serology test for hepatitis B and toxoplasmosis, and three rapid tests for syphilis, HIV, and pregnancy. If the PHC team answered positively to all questions and could obtain the results of the pregnant women’s examinations in time for necessary interventions, the indicator was considered adequate.
Protocols for early detection of pregnant women and antenatal care provision	This indicator was based on two questions. The first question asked whether the PHC team considered the early enrollment of pregnant women in the protocol for accepting spontaneous demand. The second question asked whether the team had defined protocols and therapeutic guidelines for prenatal care. To be considered adequate, the health professional should have answered ‘yes’ to both questions.
Identification and antenatal care of low/high-risk pregnancies	The PHC team was required to answer ‘yes’ to three questions regarding pregnant women with some level of risk or vulnerability: (i) organizing service offerings and referrals based on the risk classification, (ii) keeping a record of the number of high-risk pregnant women in the area, and (iii) attending to the complications or emergencies of these women. To prove these activities, the PHC team should always have a document available. Additionally, the team was asked if they offered a program aimed at antenatal care and if the community health worker identified pregnant women who missed appointments during home visits. To consider this indicator adequate, the health professional should have answered positively to each question.

Table 2 Frequency of PHC teams providing adequate care, in terms of each variable of the six indicators composing ANC. PMAQ-AB, Brazil, 2011–2012

	% of PHC teams providing adequate care	Number of PHC teams providing adequate care
1. Group of medicines		
Analgesic	75.5	12 506
Antidiabetics	47.7	7909
Antibacterials	75.4	12 496
Antihypertensive or cardiovascular action	78.8	13 052
Antiparasitic	71.2	11 803
Antiasthmatics	73.3	12 146
Antiacids and antiemetics	64.7	10 726
Vitamins, multivitamins, minerals	75.6	12 529
The application of benzathine penicillin G is performed at the facility	50.2	8314
2. Protocols and patient flows		
Defined referral protocols and patient flows: delivery (maternity ward)	48.3	8006
Defined referral protocols and patient flows: serological examination for syphilis (VDRL) in pregnant women	50.4	8349
Defined referral protocols and patient flows: serological examination for HIV in pregnant women	50.7	8403
Defined referral protocols and patient flows: glucose exam	49.4	8183
Defined referral protocols and patient flows: uroculture or urine summary (type I urine)	48.7	8068
Defined referral protocols and patient flows: ultrasound exam for pregnant women	50.9	8437
Pregnant women accompanied by the team has a defined maternity for delivery	82.8	13 722
3. Record-keeping practices		
In the monitoring of pregnant women, there is a record of: the professional responsible for monitoring the pregnancy	91.9	15 231
In the monitoring of pregnant women, there is a record of: dental consultation	55.9	9259
In the monitoring of pregnant women, there is a record of: collection of cytopathological examination	73.9	12 236
There is a copy/record of the pregnant women's booklet, or another form with equivalent information, in the PHC facility	77.4	12 813
The PHC team uses the pregnant women's booklet to monitor pregnant women; there is a document to prove it	92.0	15 248
4. Antenatal care routine tests		
Syphilis serology (VDRL) tests are performed for antenatal care	98.0	16 239
Fasting glucose tests are performed for antenatal care	97.7	16 190
HIV serology are performed for antenatal care	97.7	16 181
Hemoglobin and hematocrit tests are performed for antenatal care	97.0	16 076
Urine culture or urinalysis tests are performed for antenatal care	95.4	15 804
Serology tests for hepatitis B are performed for antenatal care	94.4	15 632
Serological examinations for toxoplasmosis are performed for antenatal care	92.8	15 368
The PHC team gets the results of pregnant women examinations in time for the necessary interventions	73.3	12 142
Rapid syphilis test	3.1	512
Rapid HIV test	19.3	3201
Rapid pregnancy test	6.4	1062
5. Protocols for early detection of pregnant women and antenatal care provision		
The protocol for accepting spontaneous demand considers early enrollment of pregnant women	29.3	4849
The PHC team has defined protocols and therapeutic guidelines for antenatal care	74.9	12 410
6. Identification and antenatal care of low/high-risk pregnancies		
The PHC team organizes the service offers and referrals (consultations and tests) of pregnant women based on the assessment and classification of risk and vulnerability; there is a document to prove it.	67.5	11 176
The PHC team has a record of the number of high-risk pregnant women in the territory; there is a document to prove it.	52.3	8657
The PHC team attends to the complications or emergencies of the high-risk pregnant woman; there is a document to prove it.	47.8	7932
Antenatal care is among the services provided to special interest groups	84.3	13 971
During home visits, the CHW carries out community outreach to identify pregnant women who have missed appointments	93.6	15 498

the indicator with the highest probability of adequacy was 'Record-keeping practices' (17.6%) (Figure 2 and Supplementary Table 2S).

When comparing the three classes, it is worth highlighting the two indicators with the greatest percentage point difference for the conditional probabilities. Between the 'High

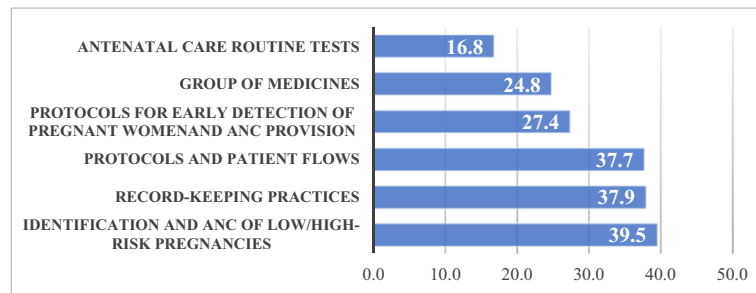


Figure 1 Percentage of adequacy for the ANC quality indicators.

Table 3 Comparison of model fit statistics for different latent class models for ANC quality. Brazil, 2011–2012

	Number of classes			
	1	2	3	4
Number of estimated parameters	6	13	20	27
AIC	119 237.5	112 138.5	111 614.4	111 460.0
BIC	119 283.8	112 238.8	111 768.7	111 668.3
Entropy	-	0.623	0.529	0.472
Vuong-Lo-Mendell-Rubin likelihood ratio test	-	1 vs 2 classes <0.001	2 vs 3 classes <0.001	3 vs 4 classes <0.001

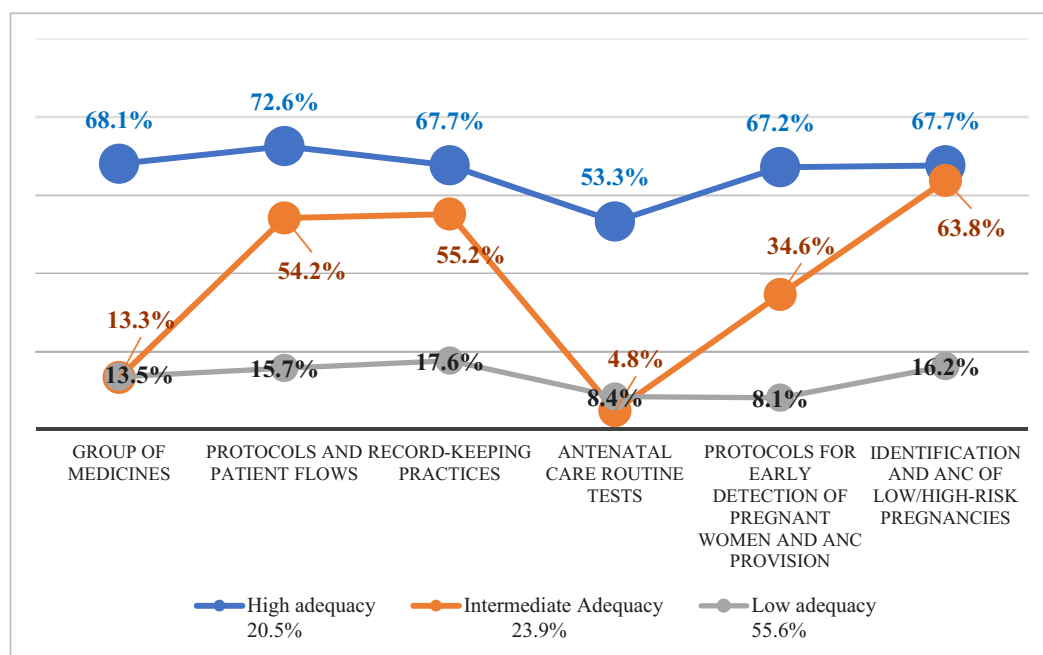


Figure 2 Latent class membership of PHC units in relation to PMAQ-AB indicators for ANC quality. PMAQ-AB, Brazil, 2011–2012.

adequacy' and 'Intermediate adequacy' classes, the indicator 'Group of medicines' had a difference of 54.8 p.p. On the other hand, the indicator 'Protocols for early detection of pregnant women and ANC provision' had the greatest percentage point difference (59.1) when comparing the 'High adequacy' with the 'Low adequacy' class.

Supplementary Table 3S displays the response patterns for the six indicators of ANC quality. The most frequent response pattern indicated inadequacy across all six indicators (24.3%), with a 95.4% probability of belonging to the 'Low adequacy' class. Additionally, within the 'Low adequacy' class, the maximum number of 'adequate' indicators observed

was two. Conversely, the response pattern featuring all six indicators classified as adequate accounted for 2.2% of the PHC teams and had a 99.3% probability of belonging to the 'High adequacy' class. This pattern exhibited at least four adequate indicators.

Discussion

Statement of principal findings

Our study used LCA and real-world data from the PMAQ-AB external evaluation dataset to identify subgroups of quality of care related to ANC at the PHC level in Brazil.

To ensure comprehensive and effective ANC for pregnant women in PHC, facilities must have the necessary infrastructure, and healthcare professionals must perform procedures, tests, and provide guidance to promote their health [5]. ‘Identification and ANC of low/high-risk pregnancies’ was the indicator of the ANC component that showed the highest percentage of adequacy in terms of availability and quality.

Interpretation within the context of the wider literature

Compared to the recommended amount, in low-resource settings, a reduced number of ANC visits increases the risk of perinatal mortality [29]. Thus, many LMICs have adopted community health workers (CHWs) programs to strengthen PHC systems and extend care to vulnerable groups [30]. CHWs play a vital role in improving the quality of maternal and child health care, access to PHC services, and reducing maternal, newborn, and infant morbimortality [31–36]. In Brazil, CHWs are required members of the basic PHC team, and their main function is to carry out home visits and community outreach for vulnerable groups, or those with greater health needs. Through these visits, they monitor child development, promote health, and prevent diseases. CHWs, who are community members with training in the health area, are considered a link between the community and the health facility, helping pregnant women meet the desired number of antenatal consultations and fostering vaccination of pregnant women and children through outreach initiatives. Their presence is associated with better PHC practices, including those related to children’s and women’s health [37].

The Brazilian Ministry of Health has implemented several strategies to enhance the quality of healthcare services, including rapid tests and examinations for diagnosing pregnancy complications, HIV infection, and screening for syphilis and viral hepatitis in PHC [38]. On-site testing for maternal syphilis can be particularly useful in improving ANC quality and reducing perinatal mortality in areas where laboratory facilities are not available [39]. Repeating HIV tests in pregnant women during the third trimester or during breastfeeding, as well as reviewing the urgent results of critically ill children, could help prevent a significant number of deaths in children under 5 years of age [40]. However, the lack of medicines and rapid diagnostic tests remains a well-known problem in the public PHC system, especially prior to the implementation of PMAQ-AB. Vanderlei and Navarrete (2013) [41] found that the constant lack of medication and regulatory mechanisms could contribute to post-neonatal infant deaths, while the shortage of resources, training, staff, and overcrowding have been noted as contributors in reducing the efficiency of healthcare. In a study conducted by Droti *et al.* (2019) [42] in eight sub-Saharan African countries, the availability of priority medicines recommended by WHO for pregnant women and children was found to be unacceptably low in most of them.

To ensure high-quality ANC, it is crucial for health facilities to have a well-structured system that provides comprehensive care, including the availability of rapid tests and medications [21, 43, 44]. Additionally, outreach, home visits, and bonding with the healthcare team are important aspects of quality ANC. However, according to Luz *et al.* (2018) [20],

the majority of PHC facilities in Brazil do not meet the standards established in national protocols in terms of structure and processes required for adequate ANC. ANC’s managerial and care dimensions were found to be of low quality, with very few teams having the necessary resources to provide adequate care. These findings are consistent with other studies in the literature that have identified inadequate medications [45], difficulties in performing tests [46], and low application of HIV and syphilis tests. Furthermore, a high percentage of facilities had expired materials [47], and there was a lack of protocols, patient flows agreed upon with municipal management [48], and various structures in the facilities investigated in a local study [49]. Therefore, there is a need for improvements in the infrastructure and processes of ANC in PHC facilities to ensure high-quality care for pregnant women [23, 44].

In Brazil, specifically, low quality of ANC has been commonly discussed [17, 50]. In Mexico, low referral of pregnant women to educational activities was evidenced [51]. In Europe, a systematic review [52] showed that, although maternal care systems are well implemented in the continent, inequalities persist in Central and Eastern European countries, which suffer from barriers to access for maternal care, outdated material resources, lack of medication, and inadequate and outdated protocols, among others. A study carried out in a more populous and developed region of Asia highlighted that the quality of ANC was extremely inadequate, mainly due to inadequacy and low coverage in managerial and healthcare levels, distance from the units, deficiency of facilities and working hours, and availability of human resources [53].

The greatest percentage point difference for the conditional probabilities when comparing ‘High adequacy’ and ‘Low adequacy’ for protocols for early detection of pregnant women and ANC provision is worth noting. PHC, as the gateway to the health system, has presented important shortcomings, such as limited opening hours or health network fragmentation [54]. Initiatives such as extended hours and advanced access are relevant but still incipient. Protocols and guidelines can help guide evidence-based practices to prevent maternal deaths. ANC in PHC units should include routine exams with timely results. Based on the clinical examination and the results of these tests, the pregnancy may be identified as high-risk, and referral to specialized services should be ensured. However, the PHC team must continue to follow up with the pregnant woman to maintain the bond and provide comprehensive care to her and her family [23, 44], as recommended by the principles that guide the Brazilian health system [5, 55].

Strengths and limitations

The strengths of this study include the following: (i) the inclusion of many questions in the PMAQ-AB questionnaire that required documentation as proof, providing a significant layer of security to ensure the robustness of our data; (ii) the robustness of the employed ANC quality model, considering an indicator of structure and work process; and (iii) the use of LCA to measure the ANC component, which has several advantages, such as the possibility of identifying subgroups within a population based on response patterns of the observed variables (indicators), no distributional assumptions about the indicators, and easy characterization of categories

through conditional and unconditional probabilities. Additionally, LCA can be easily implemented in several statistical software.

Regarding the limitations of this study, it is important to acknowledge that participation in the PMAQ-AB was voluntary, which may have led to non-participation of some PHC facilities and teams with poorer performance, especially in the first cycle. Despite this limitation, significant variations in the quality and distribution of PHC teams evaluated across the country were observed in the first cycle. Furthermore, the data used to develop the indicators and component in this study were collected through interviews with health professionals and direct observation by interviewers, without contemplating the user's perception of quality/performance.

Implications for policy, practice, and research

We found that, in 2011–2012, Brazilian PHC teams exhibited significant weaknesses across the six studied indicators, particularly in the provision of fundamental care, including routine tests, medications, supplies, the process of identifying high-risk pregnancies, protocols, and patient flows. This, in our view, supports retrospectively the need for implementation of a quality-enhancement program such as the PMAQ-AB.

It is also worthy to highlight that the model developed to answer our research question captures vital facets of antenatal care quality, thereby being applicable within contemporary contexts. Our intention is to inspire forthcoming research endeavors, both domestically and internationally, facilitating the adoption of the employed measurement model and methodology.

We recommend the development of further studies that scrutinize the quality of ANC in greater depth, assessing, for instance, how it has evolved over time, considering evaluations of Cycles II and III of the PMAQ-AB. Such endeavors have the potential to contribute towards ensuring that expectant mothers receive the highest standard of ANC, thereby promoting improved health outcomes for both them and their children.

Conclusions

Utilizing a national dataset sourced from the PHC level, this study characterized the quality of ANC services by formulating and operationalizing six comprehensive indicators, namely: Group of Medicines, Protocols and Patient Flows, Record-Keeping Practices, ANC Routine Tests, Protocols for Early Detection of Pregnant Women and ANC Provision, and Identification and ANC of Low/High-Risk Pregnancies. Their development was meticulously guided by both international and national references and validated by advanced LCA techniques.

The primary distinction of this study resides precisely in its ability to demonstrate the construction of a robust theoretical and analytical model to pragmatically assess the quality of antenatal care in primary health care settings, as well as to gauge quality utilizing a fitting methodology (LCA).

The study's findings underscore the importance of investing in systematic data collection for the promotion of PHC quality improvement efforts—as was done with the implementation of the PMAQ-AB.

Supplementary materials

Supplementary material is available at *INTQHC Communications* online.

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Data availability

Data are available in a public, open access repository: <https://aps.saude.gov.br>.

Conflict of interest

None declared.

Author contributions

NO drafted the initial manuscript, reviewed, and revised the manuscript. EPP-J acquired data and funding and supervised the study process. NO, EPP-J, and MdPF-Q were responsible for study conception. LDAFA, RA, APGFV-M, JRA, MPVDP, MdPF-Q, LAL, and YHSS were responsible for data analysis and interpretation. EPP-J, VM, EFA, AMPL, RA, LDAFA, APGFV-M, LAL, MLB, and MYTI critically reviewed and revised the manuscript for important intellectual content. All authors participated in preparing and approving the final manuscript as submitted and agree to be accountable for all aspects of the work.

Ethics and other permissions

As this study used secondary data from publicly available databases provided by the Brazilian Ministry of Health, submission to the Research Ethics Committee was not required.

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