








Supply of Inputs and Procedures Non-Invasive and Micro-Invasive in Primary Care: Historical Series by Brazilian Regions

Manoelito Ferreira Silva-Junior¹, Larissa Yumi Ito², Letícia Simeoni Avais², Letícia Plocharski³,
Natália Almeida Bastos-Bitencourt⁴, Ana Cláudia Rodrigues Chibinski⁵, Alessandra de Souza
Martins⁵

¹Department of Healthy I, Southwest Bahia State University, Jequié, BA, Brazil.

²Postgraduate Program in Dentistry, State University of Ponta Grossa, Ponta Grossa, PR, Brazil.

³State University of Ponta Grossa, Ponta Grossa, PR, Brazil.

⁴Department of Rehabilitative & Reconstructive Dentistry, School of Dentistry, University of Louisville, Louisville, KY, United States.

⁵Department of Dentistry, State University of Ponta Grossa, Ponta Grossa, PR, Brazil.

Corresponding author: Manoelito Ferreira Silva-Junior

E-mail: manoelito.junior@uesb.edu.br

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ABSTRACT

Objective: To analyze the supply of input and procedures, non-invasive and micro-invasive, for dental caries lesions in Primary Care in Brazil, comparing the Brazilian geographic regions in three different periods.

Material and Methods: Historical series study based on secondary data extracted from the 1st Cycle (2012), 2nd (2014), and 3rd cycle (2018) of the External Evaluation of the National Program for Access and Quality of Primary Care. The proportions of Oral Health Teams offering non-invasive (fluor) and micro-invasive (sealants) supplies and procedures between Brazilian geographic regions were compared using the Chi-square test, using the Z Test adjusted by the Bonferroni method, and between the years (2012, 2014, and 2018) using the Cochran Q test ($p < 0.05$). The percentage variation between the proportions per cycle was calculated.

Results: The availability of inputs of fluor gel in Brazil increased between 2014 (91.6%) and 2018 (94.1%) ($p < 0.001$), but statistically only in the Northeast and North ($p < 0.001$). The offer of the topical fluorine procedure increased between 2012 (78.8%) and 2018 (87.4%) ($p < 0.001$) in Brazil, with the most significant increase in the North (+7.5%) and Northeast (+22.0%). There was greater availability of inputs of sealants in Brazil between 2012 (56.8%) and 2018 (69.5%) ($p < 0.001$) in Brazil, and more significant expansion in the Northeast (+43.4%). There was a greater offer of the sealing procedure in Brazil between 2014 (98.6%) and 2018 (98.5%), compared to 2012 (94.7%) ($p < 0.001$), with more significant expansion in the North (+5.8%).

Conclusion: There was an increase in the supply of input and procedures, non-invasive and micro-invasive, in Primary Care in Brazil. Despite maintaining regional inequalities, they were reduced, with greater expansion in the North and Northeast regions between the years evaluated.

Keywords: Primary Health Care; Dental Health Services; Outcome and Process Assessment.

Introduction

The world population has dental caries as the condition that most impacts oral health [1]. Its management can be carried out with non-invasive treatments (those that do not remove dental tissue and involve the control of mineral balance), micro-invasive (those that remove dental tissue at a micrometric level due to, for example, acid etching of the surface) and invasive (those that remove tooth tissue at a macrometric level, using hand or rotary instruments) in together with the disease control [2,3]. However, it is recommended that minimally invasive treatment of the lesions be carried out whenever possible.

In the case of non-cavitated active lesions, it must be ensured that the chosen treatment stops the progression of the lesion and prevents cavitation. As these lesions are not yet cavitated, it is possible to induce remineralization to reverse the demineralization process. The sooner the lesion is diagnosed, the greater the possibility of applying non-invasive (fluorides) or micro-invasive (sealants) methods [4].

The lack of information, resources, and procedures that could prevent the onset and progression of caries affects the economically and socially most needy areas, which consequently have a higher prevalence of the disease [1]. Therefore, social inequalities negatively impact the distribution of the disease and access to oral health care [5,6].

One way to reduce the impact of social inequalities on oral health is by formulating public policies for better living conditions and health care. In Brazil, the National Oral Health Policy (*Política Nacional de Saúde Bucal* in Portuguese) (PNSB), implemented in 2004, as a way to guarantee comprehensive health care in Brazil through the Unified Health System (*Sistema Único de Saúde – SUS*, in Portuguese). The SUS stands out as the world's most prominent public program for oral health [7].

The SUS organizes the health system into three levels, with Primary Care (PC) being the first level, which has Oral Health Teams (OHT) [7]. The PNSB, in addition to considering PC as a gateway and a multidisciplinary work, envisages being more resolute, establishes comprehensiveness through the referral of more complex treatments, and creates care networks that are articulate between secondary and tertiary levels of care [8].

Since dental caries are highly prevalent in the Brazilian population [9] and PC is the ideal place for prevention and health promotion activities [10], assessing how the public service at this level of care has offered minimal intervention in dentistry is essential. Therefore, this study aimed to analyze the supply of input and procedures, non-invasive and micro-invasive, for dental caries lesions in Primary Care in Brazil, comparing the Brazilian geographic regions in three different periods.

Material and Methods

Study Design

The historical series study was based on secondary data from the External Evaluation (EA) with health professionals from the Basic Health Units (UBS) of the 1st, 2nd or 3rd Cycle of the Program for Improving Access and Quality of Primary Care (*Programa de Melhoria do Acesso e da Qualidade da Atenção Básica - PMAQ-AB*).

Ethical Aspects

The data are in the public domain and made available by the Ministry of Health. All PMAQ-AB cycles were approved by the Research Ethics Committees of the Higher Education Institutions collaborating in the data collection. Participating professionals were presented with a Free and Informed Consent Form.

Data Extraction Source

The PMAQ-AB was created by the Ministry of Health (MS) in 2011. It aims to encourage teams and managers to improve the quality of SUS services offered to the population. The program also proposes a set of strategies for better qualification, evaluation, and monitoring of all health worker teams [11].

Adherence to the PMAQ-AB was voluntary and not mandatory. It was carried out by the municipal management individually by PC Health Teams that wished to participate. The PMAQ-AB was an evaluation policy to measure, finance, and qualify PC. This program had three cycles, each lasting two years: the first cycle was held in 2011-2012, the second cycle was held in 2013-2014, and the third cycle was held in 2016-2018 [11].

All PMAQ-AB cycles were coordinated tripartitely by the Department of Primary Care (DPC) of the Ministry of Health, the National Council of Health Secretaries, and the National Council of Municipal Health Secretaries. Higher education institutions collaborated for the external evaluation stage.

Sample Universe

The sample universe in this study was the OHT that adhered to and received external evaluation of the 1st, 2nd, or 3rd Cycle of the PMAQ-AB. Each cycle was treated independently, and the evaluated OHT did not need to have participated in more than one cycle.

Variables were selected from Module I (structure) and II (work process) of the 1st Cycle (2012) and from Module V (inputs) and VI (work process) of the 2nd (2014) and 3rd Cycle (2018) of the data collection from the External Evaluation of the PMAQ-AB. It consisted of an interview with a professional from the OHT and verification of documents and instruments at the Basic Health Unit. All OHTs were eligible, regardless of the respondent's professional category (dentist or oral health technician/assistant).

Data Collection

The external assessment was carried out by independent professionals who had been previously selected and calibrated to apply validated forms, record data on tablets, and analyze supporting documents when necessary.

In the first cycle, 17,482 Primary Care and Oral Health Teams joined (53% of the OHT registered in the year), 19,946 (89.6% of the OHT registered in the year), and 25,090 (93% of the OHT registered in the year). The External Assessment took place in 16,552 OHT in the 1st cycle (94.7% of the OHT adhered to the cycle), 18,333 in the 2nd cycle (91.9% of the OHT adhered to the cycle), and 22,993 in the 3rd cycle (91.6% of the OHT registered in the cycle). Data loss can occur due to the incorrect filling of some variables during the database extraction.

Variables

The outcomes (dependent variables) of the study were divided into two blocks (Table 1): 1) Supplies and 2) Offer of non-invasive/micro-invasive procedures provided by OHT. The independent variables were: 1) Brazilian geographic regions: South, Southeast, Midwest, Northeast, and North; and 2) The year of evaluation cycles: 2012, 2014, or 2018.

Data Analysis

Data were adjusted and analyzed using the Statistical Package for the Social Sciences (SPSS) 20.0 and presented in absolute (n) and relative (%) frequencies. The associations of the variables studied (outcomes) and the independent variables (regions or cycles) were performed using the chi-square test ($p < 0.05$).

To compare the prevalence between Brazilian geographic areas, the Z Test with Bonferroni adjustment ($p < 0.05$) was used, and to compare the cycles, the Cochran Paired Q Test ($p < 0.05$). After previous adjustments for comparability, all variables were dichotomized into “Yes” or “No” (Table 1). The percentage variation was calculated between the comparable variables as follows $[(\text{proportion in the next cycle} \div \text{proportion in the previous cycle}) - 1] \times 100$. Equiplots were created to display the inequalities between the Brazilian geographic regions.

Table 1. Definition of study variables and categories according to questions and response categories.

Variables	Question	Bank Category	Analysis Category
Supplies for non-invasive procedures made available for OHT:			
Fluoride Gel			
2 nd Cycle	V.9.14: Fluoride gel V.9.14/1: In sufficient amount?	Yes/No	Yes: Has it and sufficient amount ≥ 1 ; No: It does not have enough or amount = 0.
3 rd Cycle	V.9.17: Fluoride gel in sufficient amount?	Yes/No	Yes: yes; / No: no.
Sealants			
1 st Cycle	I.20.4: Sealants I.20.4/1: Sealants sufficient amount?	Yes/No	Yes: It has it and a sufficient amount ≥ 1 ; No: It does not have enough or an amount = 0.
2 nd Cycle	V.9.24: Sealants V.9.24/1: Sealants sufficient amount?	Yes/No	Yes: Has it and sufficient amount ≥ 1 ; No: It does not have enough or amount = 0.
3 rd Cycle	V.9.37: Sealants sufficient amount?	Yes/No	Yes: yes; / No: no.
Offer of non-invasive procedures made available for OHT:			
Topic Fluoride Application			
1 st Cycle	II.36.2: The team performs basic oral health procedures, such as: II.36.2: Topic fluoride application	Yes/No	Yes: yes; / No: no.
2 nd Cycle	Does the Oral Health Team perform the following procedures at the Health Unit? VI.16_5_7: Topic fluoride application	Yes/No	Yes: yes; / No: no.
3 rd Cycle	VI.7.5: In clinical care, the Oral Health Team performs: VI.7.5: Topic fluoride application	Yes/No	Yes: yes; / No: no.
Sealant Application			
1 st Cycle	II.36.2: The team performs basic oral health procedures, such as: II.36.2: Sealant application	Yes/No	Yes: yes; / No: no.
3 rd Cycle	VI.7.5: In clinical care, the Oral Health Team performs: VI.7.5: Application of ionomeric sealant	Yes/No	Yes: yes; / No: no.

Results

Fluorine gel showed high availability of raw material for OHT in Brazil, with an increase from 2014 (91.6%) to 2018 (94.1%) ($p < 0.001$). Regional disparities were less evident. The South region had the highest availability in 2014 (95.8%), and the North region had the lowest availability (86.9%). In 2018, the Northeast region had the

highest availability (95.6%), and the Southeast region (91.8%) had the lowest, without differing from the Midwest region (93.1%) and North region (93.8%). Between 2014 and 2018, there was a reduction in input availability in the South region (-1.9%) (p=0.003) and a more significant increase in availability in the Northeast (+5.2%) and North regions (+7.9%) (p<0.001) (Table 2 and Figure 1).

Table 2. Comparison between the proportion of offer and application of fluoride gel and sealant among Oral Health Teams in Primary Care, according to Brazilian geographic regions and PMAQ-AB cycles.

Variables	Brazilian Geographic Region						p-value*
	Brazil N (%)	South N (%)	Southeast N (%)	Midwest N (%)	Northeast N (%)	North N (%)	
Fluoride Gel Offer							
2014 (n=16,551)	15,153 (91.6)	2,205 (95.8)a	3,740 (91.6)b	1,307 (91.8)b	6,899 (90.9)b	1,001 (86.9)c	<0.001
2018 (n=20,301)	19,106 (94.1)	2,498 (94.0)a	4,659 (91.8)b	1,573 (93.1)a,b	8,966 (95.6)c	1,410 (93.8)a,b	<0.001
Variation (%)	2.7	-1.9	0.2	1.4	5.2	7.9	
p-value**	<0.001	0.003	0.674	0.174	<0.001	<0.001	
Fluoride Gel Application							
2012 (n=12,562)	11,893 (94.7)A	1,949 (97.1)Aa	3,817 (94.5)Ab	881 (95.0)Aa,b	4,496 (94.1)Ab	750 (92.8)Ab	<0.001
2014 (n=18,333)	18,070 (98.6)B	2,550 (99.1)Ba	4,991 (98.7)Ba	1,562 (98.4)Ba,b	7,702 (98.5)Ba	1,265 (97.0)Bb	<0.001
2018 (n= 22,993)	22,651 (98.5)B	2,958 (98.6)Ba-e	5,982 (97.9)Cd,e	1,893 (97.9)Bc,e	10,114 (99.1)Cb	1,704 (98.2) Ba,c,d,e	<0.001
Variation (%) (2012-2014)	4.1	2.1	4.4	3.6	4.7	4.5	
Variation (%) (2014-2018)	-0.1	-0.5	-0.8	-0.5	0.6	1.2	
Variation (%) (2012-2018)	4.0	1.6	3.6	3.1	5.3	5.8	
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Sealant Offer							
2012 (n=24,974)	14,186 (56.8)A	2,865 (64.0)Aa	5,070 (67.2)Ab	1,218 (62.1)Aa	4,164 (44.0)Ac	869 (56.6)Ad	<0.001
2014 (n=16,551)	11,214 (67.8)B	1,847(80.3)Ba	3,172 (77.7)Ba	1,123 (78.9)Ba	4,342(57.2)Bb	730 (63.3)Bc	<0.001
2018 (n=20,301)	14,111 (69.5)C	2,163 (81.4)Ba	3,746 (73.8)Cb	1,351 (80.0)Ba	5,919 (63.1)Cc	932 (62.0)Bc	<0.001
Variation (%) (2012-2014)	19.4	25.5	15.6	27.1	30.0	11.8	
Variation (%) (2014-2018)	2.5	1.4	-5.0	1.4	10.3	-2.1	
Variation (%) (2012-2018)	22.4	27.2	9.8	28.8	43.4	9.5	
p-value**	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	
Sealant Application							
2012 (n=12,562)	9,903 (78.8)A	1,723 (85.8)Aa	3,404 (84.3)Aa	794 (85.4)Aa	3,370 (70.5)Ab	612 (75.7)Ac	<0.001
2018 (n= 22,993)	20,102 (87.4)B	2,712 (90.4)Ba	5,480 (89.6)Ba	1,717 (88.8)Ba	8,780 (86.0)Bb	1,413 (81.4)Bc	<0.001
Variation (%)	10.9	5.4	6.3	4.0	22.0	7.5	
p-value	< 0.001	< 0.001	< 0.001	0.01	< 0.001	0.001	

Present only the results in the “Yes” category tables. However, the “No” category was considered for analysis; *Lowercase letters represent the statistical differences between Brazilian geographic regions per line (p<0.05); **Uppercase letters represent the statistical differences between cycles (years) per column (p<0.05).

The topical fluoride application had the same proportion in 2014 (98.6%) and 2018 (98.5%), both being higher compared to 2012 (94.7%) ($p < 0.001$). It was increased by +4% between 2012 and 2018. A high proportion of procedures were performed in all Brazil regions, above 90%. The North region showed the highest percentage increase (+5.8%), with the proportion going from 92.8% in 2012 to 98.2% in 2018 ($p < 0.001$) (Table 2 and Figure 1).

Regarding the supply of sealants, there was an expansion of the availability of OHT between 2012 (56.8%), 2014 (67.8%), and 2018 (69.5%) ($p < 0.001$). Brazil had the highest percentage variation (+22.4%) from 2012 to 2018. Regional inequalities remained in all three cycles ($p < 0.001$). Even though the Northeast is the region with the highest percentage expansion between 2012 and 2018 (+43.4%), it had the lowest availability throughout the period (44.0%, 57.2%, and 63.1%, respectively) among all Brazilian regions, not differing only from the North region (62.0%) in 2018 (Table 2).

Regarding the procedures for performing sealants, there was an increase in Brazil from 2012 (78.8%) to 2018 (87.4%) ($p < 0.001$), with a percentage increase of +10.9%. The Northeast had the highest variation in percentage increase (22.0%) ($p < 0.001$). This region had the lowest number of procedures performed in 2012 (70.5%) compared to other areas of Brazil. In 2018, it continued with the lowest sealant procedures (86.0%), surpassing only the North region (81.4%). Thus, regional inequalities can be verified in both cycles ($p < 0.001$). In both cycles (2012 and 2018), the South, Southeast, and Midwest regions performed more sealants than the North and Northeast (Table 2 and Figure 1).

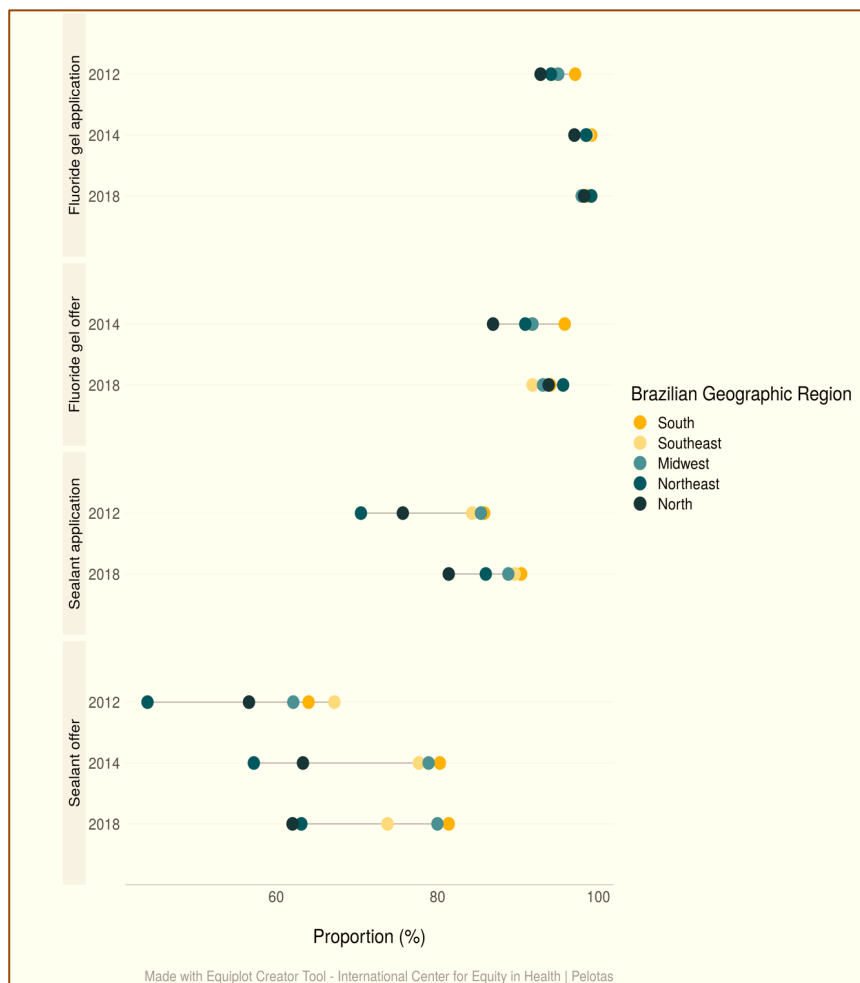


Figure 1. Equiplot between the proportion of offer and application of fluoride gel and sealant among Oral Health Teams in Primary Care, according to Brazilian geographic regions and PMAQ-AB cycles.

Discussion

Most oral health teams had supplies available and performed non-invasive and micro-invasive procedures for dental caries prevention or treatment in primary care in Brazil. These results show that, despite the past of Dentistry curative practices with a surgical approach to carious lesions [7,12], Brazilian oral health, within its public health system, is encouraging prevention practices as proposed by the PNSB. With the advancement of knowledge and the introduction of new materials in the market, Dentistry follows the philosophy of minimal intervention, with a therapeutic approach to the causes of the disease [13]. As in the present study, the culture of minimally invasive procedures appears to be more present in dental practices. It represents an expressive advance for oral health, given the historically mutilating procedures of Dentistry [14].

In the present study, it was evidenced that the increase in the availability of inputs may have influenced the increase in the performance of non-invasive and micro-invasive procedures for the prevention or treatment of dental caries lesions in AB since there was a significant increase in both availability and in carrying out the dental procedures. In practice, changes in clinical conduct are incorporated slowly, as they often depend on the professional's will, continuing education, the dissemination of updated recommendations, and mainly the availability of inputs [15]. Therefore, it is possible to observe that public policies to encourage permanent training, such as Permanent Education in Health (*Educação Permanente em Saúde*, in Portuguese - EPS), and the focus on prevention and health promotion, with a model of patient care, have worked in Brazil [16,17]. The PMAQ-AB seems to have played a fundamental role as an evaluation policy, which is vital for obtaining an overview of the reality of AB. Visualizing failures, such as the lack of inputs, can promote awareness among managers and a better ability to solve weak points. Also, because it is a performance incentive program, it may have accelerated the qualification process by purchasing inputs and incentives to carry out the procedures.

In the last cycle (2018), more than 90% of oral health teams from all Brazilian regions presented fluoridated gel and carried out the application. It becomes a positive point, demonstrating that the teams are carrying out prevention and providing good care to patients. It should be highlighted that, in all regions, the performance of the procedure is greater than the availability of inputs, with more than 95% of oral health teams performing the procedure. This result can occur because, regarding the availability of the evaluated material, the answer is intrinsic to the understanding of "sufficiency." In this sense, although the OHT has the input and performs the procedure, the professional respondent may perceive that the quantity is not able to meet the demand. Service management must take a careful look at this so that the clinical conduct is technically based and not limited to the (un)available input.

Despite the availability of fluoridated gel input having increased in the Northeast and North regions, there was no significant increase in the Southeast and Midwest regions, with a reduction in the South. Teams from all Brazilian regions increased the application of fluoride gel between the three evaluation cycles. The areas with the worst oral health conditions (North and Northeast) [18] were precisely the ones that presented the most improvement in the availability and realization of fluoride gel. This growth occurred in the places that most needed it, demonstrating that the principle of equity is being complied with.

Concerning sealant, there was a significant increase in all regions in the proportion of teams that have the material and carry out the procedure throughout the cycles, with emphasis on the Northeast region. It is the region with the highest percentage of oral health teams incorporated into the family health strategy [19], and strengthening health promotion and prevention practices are expected as a healthcare model.

Just under 70% of the teams stated that they had a sealant supply available, although almost 90% of the teams in 2018 reported the procedure was performed. This possibility of data inconsistency can be due to using

and incorporating other techniques and materials not identified by the teams as materials for sealants. Such as glass ionomer cement, glass carbomer, or flowable resin can be used for this purpose [20-22].

Sealants present a simple and easy-to-perform technique with a short clinical time, low cost, and are scientifically proven [23]. Despite this, 1/3 of the teams still did not present the input for carrying out the procedure, with primary care being the privileged place to carry out disease promotion and prevention procedures, being the place closest to the population, and where the caries disease diagnosis is accomplished [7]. When correctly indicated and performed within the protocol, sealants can contribute to keeping teeth healthy and functioning throughout the patient's life, preventing the development and progression of carious lesions at the dentin level [24]. Paralyzing the process in the early stages of carious lesions is of paramount importance as a therapeutic way to prevent the progression of the lesion [25]. However, guidance and reinforcement regarding personal oral hygiene and dietary care are a coordinated way to treat the disease [2]. A minimal intervention approach uses this philosophy to preserve the dental structure as much as possible, focusing on healing injuries and the health-disease process [2].

The present study noted that although the expansion of the offer of non-invasive and micro-invasive procedures in primary care is evident, this growth has been slow. This is possibly due to the health financing model in Brazil, which has higher funding for oral health at the municipal level than at the federal level [26]. In addition, the Ministry of Health's initial investment at the federal level has been higher for OHT implementation (41.8%) than for operating costs (33.1%). Therefore, a program that provides more financial resources for performance becomes essential to encourage the maintenance and improvement of services already offered and not just in the search for the growth of new teams.

Considering Brazil's territorial dimensions, its heterogeneity in the socioeconomic and cultural field is known, which directly interferes with the management capacity of public health services, even within the SUS [27]. In this sense, the search for the principle of universality, where everyone has the right to use the service, is not yet the Brazilian reality, which less than 50% of the population has been covered with oral health [28] and, therefore, strategies to assist those most in need have been adopted.

Public policies in Brazil have increasingly sought to reduce historical regional disparities, including those in health. There has been a reduction in inequalities from the beginning of the 21st century, explained by the combination of social and economic policies, with growth in income and schooling associated with regional development strategies [27]. This topic was identified in the present study, where the North and Northeast regions showed an evident reduction in disparity among other Brazilian areas. Studies have pointed to a worrying trend toward decreasing preventive procedures and increasing curative procedures throughout Brazil, especially in the Northeast region [29]. It is necessary to search for the reasons for this inversion since preventive measures are one of the central axes established by the SUS [7]. Added to this is Constitutional Amendment No. 95/20 of 2016, which froze spending on health and education for 20 years. Therefore, surveillance and monitoring of the availability of inputs and offers of procedures is essential so that there is no retreat from the paths already taken concerning reducing regional disparities since there is still a long way to go. In addition, another possibility to explain the lack of preventive actions in certain regions is due to the lower socioeconomic status of these populations since these individuals require numerous treatments of different levels of complexity, and professionals need to adapt the provision of services to local reality [30].

The limitations of the study must be considered. The work was based on a secondary database, where it was impossible to include the inputs and procedures in all cycles due to variations in the data collection methodology. However, it is noteworthy that the study adapted the variables to compare the data. The PMAQ-

AB demonstrated a qualification process in the evaluation process at each cycle concerning the measurement of items in general, including an improvement process in the format of the questions, making them more straightforward, for example, including only the responses of inputs in usable conditions or always available. The evaluation of minimally invasive clinical practices was not well covered since it does not include items with proven effectiveness in stopping caries disease within the philosophy of minimal intervention, such as the use of cariostatic materials [31], a technique of atraumatic restoration (ART) [32], or the non-restorative control of cavities, among other items [2].








Another limitation is that PMAQ-AB presents results only for the OHTs that voluntarily joined the program; therefore, it may overestimate the results by including the teams that had better performance and felt more prepared for the external evaluation. Although it was verified over the cycles that, while in the first cycle, there was a limit of adherence to the program restricted to 50% of the health unit per municipality, there was no such limitation in the subsequent cycles [11]. Therefore, there was a significant increase in the number of teams that joined the program, with adherence higher than 90% of the OHT registered in the third cycle.

It is also worth mentioning that the PMAQ-AB was a program with an evaluation instrument with funding for performance, which generated a mobilization between managers and professionals to adapt the infrastructure and work process to achieve better indicators, being valuable for the maintenance of the access and quality of oral health in Primary Care [33]. However, since 2019, the PMAQ-AB has been replaced by the Federal Government by “*Previne Brasil*” (Ordinance No. 2979, of November 12, 2019). Considering the simplification in the evaluation process of the new program, the data presented here may be used shortly as a basis for assessing the positive or negative impact of substantial changes in the PC performance evaluation process [26].

Conclusion

There was an increase in the supply of inputs and the performance of non-invasive and micro-invasive procedures for dental caries prevention or treatment in Primary Care in Brazil. This was reduced despite the maintenance of regional inequalities during the evaluation years. The supply of inputs and non-invasive procedures expanded more in the North and Northeast regions, and the inputs for micro-invasive procedures expanded in the Northeast region. However, it is still possible to verify disparities regarding the sealant between the North and Northeast and the South, Southeast, and Midwest regions.

Authors' Contributions

MFSJ	 https://orcid.org/0000-0001-8897-5912	Conceptualization, Methodology, Validation, Formal Analysis, Data Curation, Writing - Original Draft and Writing - Review and Editing.
LYI	 https://orcid.org/0000-0002-6068-8295	Data Curation and Writing - Review and Editing.
LSA	 https://orcid.org/0000-0002-4603-7090	Data Curation and Writing - Review and Editing.
LP	 https://orcid.org/0000-0003-4837-4960	Data Curation and Writing - Original Draft.
NABB	 https://orcid.org/0000-0002-8365-0978	Data Curation and Writing - Review and Editing.
ACRC	 https://orcid.org/0000-0001-7072-9444	Conceptualization, Writing - Review and Editing and Supervision.
ASM	 https://orcid.org/0000-0001-6345-8412	Conceptualization, Methodology, Validation, Data Curation, Writing - Review and Editing and Supervision.

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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References

- [1] GBD 2017 Oral Disorders Collaborators; Bernabe E, Marcenes W, Hernandez CR, Bailey J, Abreu LG, et al. Global, regional, and national levels and trends in burden of oral conditions from 1990 to 2017: A systematic analysis for the Global Burden of Disease 2017 Study. *J Dent Res* 2020; 99(4):362-373. <https://doi.org/10.1177/0022034520908533>
- [2] Schwendicke F, Splieth C, Breschi L, Banerjee A, Fontana M, Paris S, et al. When to intervene in the caries process? An expert Delphi consensus statement. *Clin Oral Investig* 2019; 23(10):3691-3703. <https://doi.org/10.1007/s00784-019-03058-w>
- [3] Reis IC, França AKA, Duarte ML, Letieri AS, Soares TRC. Tratamento minimamente invasivo de lesões cáries em odontopediatria. *Rev Uningá* 2020; 57(4):129-143. <https://doi.org/10.46311/2318-0579.57.4.129-143> [In Portuguese].
- [4] Giacaman RA, Muñoz-Sandoval C, Neuhaus KW, Fontana M, Chałas R. Evidence-based strategies for the minimally invasive treatment of carious lesions: Review of the literature. *Adv Clin Exp Med* 2018; 27(7):1009-1016. <https://doi.org/10.17219/acem/77022>
- [5] Vettore MV, Marques RAA, Peres MA. Social inequalities and periodontal disease: multilevel approach in SBBrazil 2010 survey. *Rev Saúde Pública* 2013; 47(Suppl. 3):29-39. <https://doi.org/10.1590/S0034-8910.2013047004422>
- [6] Silva-Junior MF, Sousa MLR, Batista MJ. Reducing social inequalities in the oral health of an adult population. *Braz Oral Res* 2019; 33:e102. <https://doi.org/10.1590/1807-3107bor-2019.vol33.0102>
- [7] Pucca GA Jr, Gabriel M, de Araujo ME, de Almeida FC. Ten years of a National Oral Health Policy in Brazil: Innovation, boldness, and numerous challenges. *J Dent Res* 2015; 94(10):1333-1337. <https://doi.org/10.1177/0022034515599979>
- [8] Silva HEC, Gottens LBD. The interface between primary and secondary care in dentistry in the Unified Health System (SUS): An integrative systematic review. *Cienc Saude Colet* 2017; 22(8):2645-2657. <https://doi.org/10.1590/1413-81232017228.22432015>
- [9] Narvai PC, Frazão P, Roncalli AG, Antunes JLF. Cárie dentária no Brasil: declínio, iniquidade e exclusão social. *Rev Panam Salud Publica* 2006; 19(6):385-393. <https://doi.org/10.1590/S1020-49892006000600004> [In Portuguese].
- [10] Amorim LP, Senna MIB, de Paula JS, Rodrigues LG, Chiari APG, Ferreira RC. Oral health work process: Disparity between teams in Brazil, 2014. *Epidemiol Serv Saúde* 2021; 30(1):e2019533. <https://doi.org/10.1590/S1679-49742021000100013>
- [11] Cavalcanti P, Fernandez M. National Program for Access and Quality Improvement in Primary Care: An analysis of the main regulatory changes. *Physis* 2020; 30(3):e300323. <https://doi.org/10.1590/S0103-73312020300323>
- [12] Murdoch-Kinch CA, McLean ME. Minimally invasive dentistry. *J Am Dent Assoc* 2003; 134(1):87-95. <https://doi.org/10.14219/jada.archive.2003.0021>
- [13] Banerjee A. Minimal intervention dentistry: Part 7. Minimally invasive operative caries management: Rationale and techniques. *Br Dent J* 2013; 214(3):107-111. <https://doi.org/10.1038/sj.bdj.2013.106>
- [14] Fejerskov O, Kidd E. Cárie Dentária: A Doença e seu Tratamento Clínico. 2nd. ed. São Paulo: Santos; 2011. [In Portuguese].
- [15] Govindaiah S, Bhoopathi V. Dentists' levels of evidence-based clinical knowledge and attitudes about using pit-and-fissure sealants. *J Am Dent Assoc* 2014; 145(8):849-855. <https://doi.org/10.14219/jada.2014.51>
- [16] Mota KR, Oliveira AC do N, Heimer MV, Moreira AR de O, Pugliesi DMC, Santos Junior VE. Políticas públicas de saúde bucal para crianças: Perspectiva histórica, estado da arte e desafios futuros. *RSD* 2020; 9(11):e3529119869. <https://doi.org/10.33448/rsd-v9i11.9869> [In Portuguese].
- [17] Valença AMG, Dantas ELA, Protasio APL, Limão NP, Ribeiro ILA, Santiago BM, et al. Atenção em Saúde Bucal ofertada a crianças e adolescentes na Atenção Básica. *RSD* 2021; 10(6):e17710615669. <https://doi.org/10.33448/rsd-v10i6.15669> [In Portuguese].
- [18] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. SB Brasil 2010: Pesquisa Nacional de Saúde Bucal: resultados principais. Brasília, DF: SVS; 2012. 116p. [In Portuguese].
- [19] Costa RC, Ribeiro ILA, Rodrigues LV, Valença AMG. Brazilian oral health coverage characteristics and the populational access to public dental services. *Rev Fam Ciclos Vida Saúde Contexto Soc* 2018; 6(2):212-219. <https://doi.org/10.18554/refacs.v6i2.2818>

- [20] Shimazu K, Ogata K, Karibe H. Caries-preventive effect of fissure sealant containing surface reaction-type pre-reacted glass ionomer filler and bonded by self-etching primer. *J Clin Pediatr Dent* 2012; 36(4):343-347. <https://doi.org/10.17796/jcpd.36.4.n444r730r773un53>
- [21] Wright JT, Tampi MP, Graham L, Estrich C, Crall JJ, Fontana M, et al. Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars: A systematic review of randomized controlled trials - A report of the American Dental Association and the American Academy of Pediatric Dentistry. *J Am Dent Assoc* 2016; 147(8):631-645. <https://doi.org/10.1016/j.adaj.2016.06.003>
- [22] Lopes C, Wambier L, Chibinski A, Reis A, Wambier D. Are glass carbomer sealants more efficient in preventing carious lesions in children's permanent molars when compared to other sealant materials? A systematic review and meta-analysis. *Rev Científ CRO-RJ* 2021; 5(2):16-35. <https://doi.org/10.29327/24816.5.2-3>
- [23] Saito CM, Lima EP, Mello AMD, Mello FAS. Selante resinoso: Tratamento preventivo e minimamente invasivo. *Rev Gest Saúde* 2014; 11:10-17. [In Portuguese].
- [24] Amorim RG, Frencken JE, Raggio DP, Chen X, Hu X, Leal SC. Survival percentages of atraumatic restorative treatment (ART) restorations and sealants in posterior teeth: an updated systematic review and meta-analysis. *Clin Oral Investig* 2018; 22(8):2703-2725. <https://doi.org/10.1007/s00784-018-2625-5>
- [25] Papageorgiou SN, Dimitraki D, Kotsanos N, Bekes K, van Waes H. Performance of pit and fissure sealants according to tooth characteristics: A systematic review and meta-analysis. *J Dent* 2017; 66:8-17. <https://doi.org/10.1016/j.jdent.2017.08.004>
- [26] Sobrinho JEL, Santo ACGE. ost analysis of oral health in primary care provided in the city of Vitória de Santo Antão, Pernambuco, Brazil. *Arq Odontol* 2013; 49(1):26-31. <https://doi.org/10.7308/aodontol/2013.49.1.04>
- [27] Albuquerque MV, Viana ALA, Lima LD, Ferreira MP, Fusaro ER, Iozzi FL. Regional health inequalities: changes observed in Brazil from 2000-2016. *Ciênc Saúde Colet* 2017; 22(4):1055-1064. <https://doi.org/10.1590/1413-81232017224.26862016>
- [28] Pucca Junior GA, Gabriel M, Almeida Carrer FC, Paludetto Junior M, Lucena EHG, Melo NS. Acesso e cobertura populacional à saúde bucal após a implementação da Política Nacional de Saúde Bucal "Brasil Sorridente". *Tempus* 2020; 14(1):29-43. <https://doi.org/10.18569/tempus.v14i1.2629> [In Portuguese].
- [29] Silva SE da, Araújo JHP de, Laureano ICC, Farias L, Alencar CRB de, Cavalcanti AL. Characterization of the primary care model in oral health in northeast region in the period 2015-2017. *Arch Health Invest* 2018; 7(10):402-407. <https://doi.org/10.21270/archi.v7i10.3154>
- [30] Soares FF, Chaves SCL, Cangussu MCT. Inequalities in oral health care use in the primary care setting and associated factors in two Brazilian municipalities. *Rev Panam Salud Publica* 2013; 34(6):401-406.
- [31] Chibinski AC, Wambier LM, Feltrin J, Loguercio AD, Wambier DS, Reis A. Silver diamine fluoride has efficacy in controlling caries progression in primary teeth: A systematic review and meta-analysis. *Caries Res* 2017; 51(5):527-541. <https://doi.org/10.1159/000478668>
- [32] Dorri M, Martinez-Zapata MJ, Walsh T, Marinho VC, Sheiham Deceased A, Zaror C. Atraumatic restorative treatment versus conventional restorative treatment for managing dental caries. *Cochrane Database Syst Rev* 2017; 12(12):CD008072. <https://doi.org/10.1002/14651858.CD008072.pub2>
- [33] Facchini LA, Tomasi E, Thumé E. Acesso e Qualidade na Atenção Básica Brasileira: Análise Comparativa dos Três Ciclos da Avaliação Externa do PMAQ-AB 2012-2018. São Leopoldo: Oikos; 2021. 224p. [In Portuguese].