

Dental Caries in Children Aged 0 to 6 Years: Impact of Adherence to the School Health Program

Cárie Dentária na Infância de 0 a 6 Anos: Impacto da Adesão ao Programa Saúde na Escola

Caries Dental en la Infancia de 0 a 6 Años: Impacto de la Adhesión al Programa Salud en la Escuela

RESUMO

Objetivo: A cárie dentária na primeira infância ainda é um problema relevante de saúde pública no Brasil. Dados do SB Brasil 2023 indicam que 41,18% das crianças de 5 anos apresentavam ao menos um dente com cárie não tratada. Nesse contexto, políticas públicas como o Programa Saúde na Escola (PSE) e o Brasil Sorridente buscam ampliar o acesso à atenção em saúde bucal. Este estudo teve como objetivo analisar a associação entre a cobertura do PSE e a realização de procedimentos odontológicos nos 5.570 municípios brasileiros, entre 2019 e 2024.

Método: Trata-se de um estudo ecológico, observacional e retrospectivo, baseado em dados secundários sobre procedimentos odontológicos invasivos, não invasivos e ações educativas. Utilizou-se regressão binomial negativa com ajuste para sobredispersão e erro-padrão robusto. **Resultados:** Observou-se que o aumento da cobertura do PSE esteve associado ao crescimento dos procedimentos clínicos, especialmente os não invasivos, enquanto as ações educativas apresentaram menor incremento. **Conclusão:** Conclui-se que, embora o PSE amplie a oferta de cuidados clínicos, é necessário fortalecer ações educativas e integrar os sistemas de informação para promover a saúde bucal desde a infância.

DESCRIPTORES: Cárie Dentária; Odontologia; Saúde Bucal; Saúde Coletiva; Saúde da Criança.

ABSTRACT

Objective: Dental caries in early childhood remains a relevant public health problem in Brazil. Data from SB Brasil 2023 indicate that 41.18% of five-year-old children had at least one untreated decayed tooth. In this context, public policies such as the School Health Program (Programa Saúde na Escola – PSE) and the Brasil Sorridente initiative aim to expand access to oral health care. This study aimed to analyze the association between PSE coverage and the performance of dental procedures in the 5,570 Brazilian municipalities between 2019 and 2024. **Method:** This is an ecological, observational, and retrospective study based on secondary data on invasive and non-invasive dental procedures and educational actions. Negative binomial regression with adjustment for overdispersion and robust standard errors was used. **Results:** An increase in PSE coverage was associated with a rise in clinical procedures, particularly non-invasive ones, while educational actions showed a smaller increase. **Conclusion:** In conclusion, although higher PSE coverage expands the provision of clinical dental care, strengthening educational actions and integrating information systems are necessary to promote oral health from early childhood.

DESCRIPTORS: Dental Caries; Dentistry; Oral Health; Public Health; Child Health.

RESUMEN

Objetivo: La caries dental en la primera infancia sigue siendo un problema relevante de salud pública en Brasil. Datos del SB Brasil 2023 indican que el 41,18% de los niños de cinco años presentaban al menos un diente con caries no tratada. En este contexto, políticas públicas como el Programa Salud en la Escuela (Programa Saúde na Escola – PSE) y la iniciativa Brasil Sorridente buscan ampliar el acceso a la atención en salud bucodental. El objetivo de este estudio fue analizar la asociación entre la cobertura del PSE y la realización de procedimientos odontológicos en los 5.570 municipios brasileños entre 2019 y 2024. **Método:** Se trata de un estudio ecológico, observacional y retrospectivo, basado en datos secundarios sobre procedimientos odontológicos invasivos, no invasivos y acciones educativas. Se utilizó regresión binomial negativa con ajuste por sobredispersión y errores estándar robustos. **Resultados:** Se observó que el aumento de la cobertura del PSE se asoció con un incremento de los procedimientos clínicos, especialmente los no invasivos, mientras que las acciones educativas presentaron un menor crecimiento. **Conclusión:** Se concluye que, aunque el PSE amplía la oferta de atención clínica odontológica, es necesario fortalecer las acciones educativas e integrar los sistemas de información para promover la salud bucodental desde la infancia.

DESCRIPTORES: Caries Dental; Odontología; Salud Bucal; Salud Colectiva; Salud del Niño.

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INTRODUCTION

Early childhood caries (ECC) is one of the most prevalent chronic diseases worldwide. It is estimated that approximately 2 billion people and 532 million children suffer from untreated dental caries in their primary teeth¹. In Brazil, data from the National Oral Health Survey – SB Brasil 2023 indicate that 41.18% of 5-year-old children had at least one tooth with untreated caries, with significant regional inequalities: from 31.30% in the Southeast Region to 57.97% in the North Region. In addition, 13.98% of children in this age group showed clinical consequences of caries, such as pulp involvement, ulceration, fistula, or abscess².

The Bangkok Declaration of the International Association of Pediatric Dentistry (IAPD) proposes a set of strategic measures to reduce the

prevalence of caries, with an emphasis on intersectoral actions. Recommendations include educating caregivers, reducing the consumption of sugary foods and beverages, especially in children under two years of age, daily use of fluoridated toothpaste (>1000 ppm fluoride), and early promotion of oral health by qualified professionals, with a focus on continuity of family-centered care³.

In Brazil, access to oral health care is guaranteed by the Unified Health System (SUS), with guidelines that reinforce the importance of healthy eating, exclusive breastfeeding until six months of age, and delayed introduction of sugar, recommending that it be avoided until two years of age. In addition, the organization of health services seeks to act in a comprehensive and longitudinal manner in caring for the mother-child dyad.

In this context, the School Health

Program (PSE) stands out as an intersectoral strategy between health and education, with actions by Oral Health Teams (eSB) focused on promotion, prevention, and early care for dental needs in school settings^{8, 9}. The school environment, especially in daycare centers and early childhood education institutions, is a privileged place for systematic health monitoring, the promotion of healthy habits, and the prevention of chronic diseases in childhood, such as dental caries, obesity, and diabetes^{10,11}.

Data from the Anísio Teixeira National Institute for Educational Studies and Research (INEP) indicate that Brazil has 76,700 daycare centers in operation, 66.8% of which belong to the public network. In addition, 57.9% of enrolled children attend full-time. In preschool, there are more than 5.3 million children enrolled, with 78.1% of enrollments in

the public system, reflecting progress in universal access to early childhood education¹⁰.

Despite the favorable institutional framework and national guidelines, there is a scarcity of studies evaluating the impact of the PSE on the implementation of oral health actions in young children. Given the strategic role of schools as a place of care, understanding this association is essential to support integrated and effective public policies.

Thus, the present study aims to evaluate the association between coverage of the School Health Program (PSE) and the performance of dental procedures in children aged 0 to 6 years in Brazilian municipalities, which is innovative in terms of this investigation. To this end, the following null hypotheses were formulated: Null hypothesis 1: In municipalities with lower adherence to the PSE, there is no increase in the proportion of invasive procedures performed on children; Null hypothesis 2: In municipalities with higher adherence to the PSE, there is no increase in non-invasive procedures or oral health education actions.

METHODS

Study design

This study was conducted based on recognized guidelines for the analysis of routinely collected observational data, following the precepts of *The Reporting of studies Conducted using Observational Routinely-collected health Data* (RECORD) and the *STrengthening the Reporting of OBservational studies in Epidemiology* (STROBE) extension^{12,13}.

The dependent variables considered were: type of treatment related to cariology (oral health education, non-invasive and invasive treatments, as detailed in Appendix 1) in children aged 0 to 6 years. The independent variables included: (a) Municipal Hu-

man Development Index (MHDI), categorized as very high (0.800–1.000), high (0.700–0.799), medium (0.600–0.699), low (0.500–0.599) and very low (0.000–0.499), according to the IBGE Demographic Censuses of 2000 and 2010; (b) population size of the municipalities, classified as small I (up to 20,000 inhabitants), small II (20,001–50,000 inhabitants), medium (50,001–100,000 inhabitants), large (100,001–900,000 inhabitants), and metropolises (more than 900,000 inhabitants), according to PNAS/2004; and (c) racial/color categorization of the municipality's population, considering the proportions of white, indigenous, and black populations.

Data extraction

The study data were obtained from the Brazilian Ministry of Health, covering the period from January 2017 to December 2024, with data collection performed in February 2025. The outcome variables “types of treatments related to cariology” were derived from the Health Information System for Primary Care, called the Health Information System for Primary Care (SISAB; <https://sisab.saude.gov.br>)¹⁴. The categorization of procedures into three subtypes (health education, non-invasive, and invasive) was based on current concepts of Cariology.

Dental procedures were classified as non-invasive and invasive. Non-invasive procedures included preventive actions without manipulation of dental tissues, such as topical application of fluoride, tooth sealants, plaque disclosure, oral hygiene guidance, and biofilm removal. Invasive procedures involved clinical interventions for the treatment of established caries lesions, with tissue manipulation, such as extractions, crowns, drainages, intracanal medication, dressings, pulpotomies, and restorations. Although sealants are considered micro-invasive internationally, in this study they were

classified as invasive procedures. It was assumed that most of the demand for oral health care in childhood is related to early caries, as evidenced in the literature and in the International Consensus on Cariology¹⁵. Additionally, the analysis of “health education” was added, which is also within the scope of the Oral Health teams. After collection, the data were processed, cleaned, and integrated into a single database for analysis.

The Primary Care Health Information System (SISAB) was established by Ordinance GM/MS No. 1,412, dated July 10, 2013, becoming the current primary care information system for financing and adherence to the programs and strategies of the National Primary Care Policy. The data are collected in e-SUS APS (PEC/CDS) strategy systems or integrated proprietary systems. These data are sent to the e-SUS APS National Centralizer and then to Sisab, after a validation process as described in the Technical Explanatory Note of the Validation Report. The data that arrives at SISAB is structured according to the e-SUS APS CDS form template (available at: <https://sisaps.saude.gov.br/esus/>). Data on nursery schools in Brazil and schools participating in the School Health Program (PSE) were obtained through a request under the Access to Information Act (LAI) from the Ministry of Education.

Data on the Municipal Human Development Index (IDHM) and the population size of municipalities were obtained from official government sources. This sociodemographic information was also collected in February 2025. Specifically, IDHM data were extracted from Atlas Brasil, while information on population size was obtained from the Brazilian Institute of Geography and Statistics (IBGE) website. It is important to note that all variables used were updated based on the most recent data available in 2025.

Data Analysis

Statistical analysis was performed using Stata *software*, version 17.0 (StataCorp., College Station, Texas, USA). Initially, a descriptive analysis of the variables was performed, including absolute and relative frequencies, measures of central tendency and dispersion, with the aim of characterizing the profile of the municipalities in terms of coverage of the School Health Program (PSE) and dental procedures performed (invasive, non-invasive, and educational). Next, negative binomial regression models were adjusted to estimate the association between PSE coverage and the number of dental procedures, considering the total population of the municipalities as an exposure variable. This approach was adopted due to the nature of the data (count) and the presence of overdispersion. The models were adjusted with robust standard error, and the quality of the adjustment was evaluated using log pseudolikelihood, pseudo- R^2 , Wald test, and Akaike (AIC) and Bayesian (BIC) information criteria.

Parts of the text were revised with the help of the ChatGPT language model (OpenAI), used as a support tool for textual correction and fluency improvement, without interfering with the interpretation of the data or the conclusions of the study.

RESULTS

Aggregate data from Brazilian municipalities ($n=5,570$) were analyzed regarding the coverage of the School Health Program (PSE) and the performance of dental procedures in children aged 0 to 6 years, considering the PSE cycles between 2017 and 2024. The results are organized into: (1) general descriptive statistics; (2) temporal analysis by PSE cycles; (3) comparison by coverage levels; (4) bivariate correlations between variables;

and (5) negative binomial regression models adjusted for the municipal population.

The general descriptive statistics of this study indicated that Brazilian municipalities had the following population characteristics for the population aged 0 to 6 years: mean ($\bar{x}$) of 3,579.97, median (Me) of 1,113, and standard deviation (SD) of 18,831.98 [43-1,097,014, 95% CI]. Additionally, coverage data for the PSE Cycles between 2017 and 2024 were analyzed. The mean number of schoolchildren covered ($\bar{x}$) per municipality was 897.64, Me of 391, but the data show great heterogeneity between municipalities, with a high SD of 4,895.34 [0 to 267,451, 95% CI].

When analyzing the dental production data of Brazilian municipalities carried out by eSBs, categorized according to non-invasive, invasive, and health education treatments, this study found the following: $\bar{x}$ of 178.47, Me of 78, SD 480.90 [0 - 32,930, 95% CI] for “invasive procedures”; $\bar{x}$ of 161.14, Me of 42, SD 695.29 [0 - 50,415, 95% CI]; and, in relation to “oral health education” actions, $\bar{x}$ of 98.82, Me of 21, SD 170.84 [0 - 999, 95% CI]. It is interesting to note that, in Brazil, “invasive” procedures have higher means and medians related to “invasive procedures” in Cariology, aimed at populations aged 0 to 6 years, although descriptive data must be interpreted with caution.

The following data evaluate the dental production of eSB in Brazilian municipalities, extracted from SIS-AB and aggregated. The time units of analysis corresponded to the PSE Cycles (2017-2018/2019-2020/2021-2022/2023-2024).

In the 2017-2018 cycle, 777.05 schools in Brazil were covered, with a population of 3,689.48 aged 0 to 6 years. During this period, there were $\bar{x}$ of 259.03 invasive procedures; $\bar{x}$ of 195.72 non-invasive procedures; and $\bar{x}$ of 137.15 oral health education

procedures, as reported by the Basic Health Units (UBS) of the municipalities. In 2019-2020, there was an increase to 853.01 schools participating in the PSE and a coverage of 3,663.78. Regarding the dental production information from the UBS, in this period, the following results were found: $\bar{x}$ of 196.49 invasive procedures, $\bar{x}$ of 96.95 non-invasive procedures, and $\bar{x}$ of 113.40 education procedures. It is important to mention that the variations can be explained by the COVID-19 pandemic. In the 2021-2022 cycle, 939.92 schools were covered and 3,558.61 children, with values of $\bar{x}$ of 123.31 invasive procedures, 135.55 non-invasive procedures, and 78.97 educational procedures, reported by the oral health teams of Brazilian UBS.

In 2023-2024, the number of schools covered reached 1,009.26, with a population of 3,412.25 children aged 0-6 years covered and average production by eSBs of: $\bar{x}$ of 138.61 invasive procedures, $\bar{x}$ of 213.97 non-invasive procedures, and $\bar{x}$ of 68.00 oral health education procedures. Although descriptive data must be interpreted with caution and cannot be extrapolated, it is observed that after the pandemic and greater adherence by schools and children, the procedures performed at the UBS in the municipalities showed a higher average in the “non-invasive” modality.

Figure 1 reflects the evolution of the rates of dental procedures performed by Oral Health teams (eSB) compared to the PSE Cycles in the municipalities, demonstrating that there is a temporal trend and intersection between the two policies. There was a sharp drop in coverage and procedures in the Public Health Emergency scenario caused by the COVID-19 pandemic. Undoubtedly, it was expected that more invasive procedures would be performed after the resumption of eSB activities (pent-up demand), but what is noticeable is an increase in non-invasive procedures in the post-pandemic scenario.

Figure 1. Temporal evolution of dental procedure rates per PSE cycle

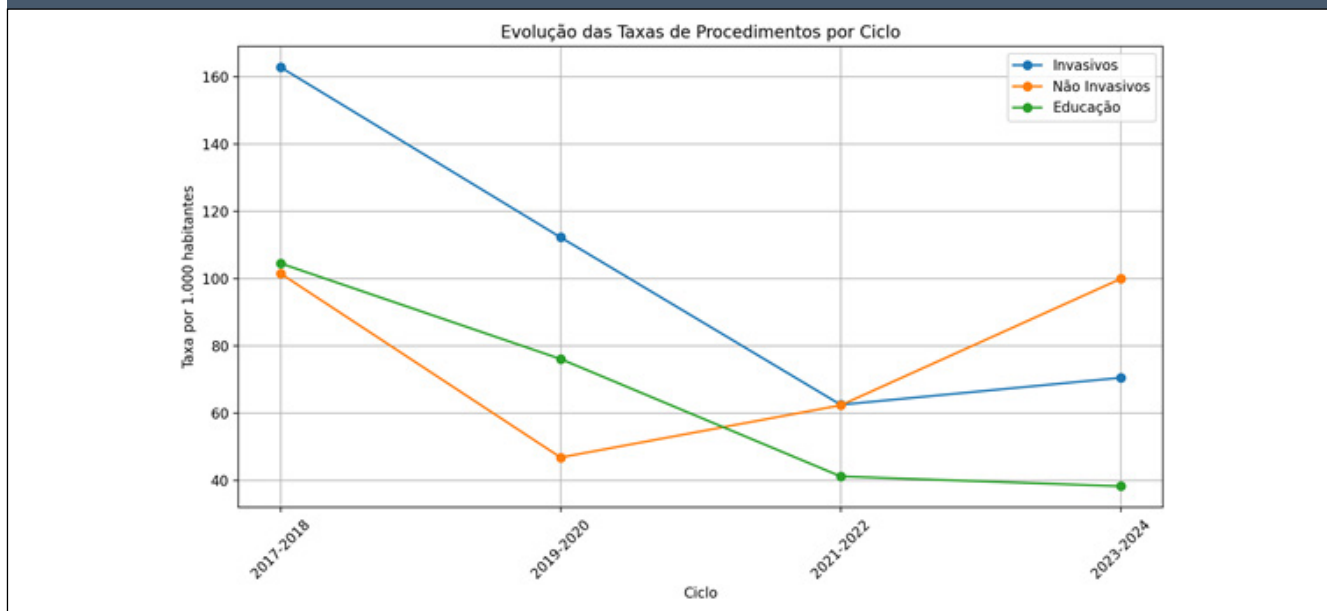


Table 1 shows descriptive data on procedures related to cariology in children aged 0 to 6 years in Brazilian

municipalities according to the level of PSE coverage, classified into tertiles. It can be seen that municipali-

ties with lower PSE coverage perform, on average, more dental procedures in

Table 1. Analysis of procedures related to cariology in children aged 0 to 6 years in Brazilian municipalities, by level of coverage of the School Health Program (PSE) (terciles).

Tertile	Invasive Procedures (average)	Non-invasive procedures (average)	Oral Health Education Procedures (Average)
Municipalities with low coverage ($\leq 38.32\%$)	293,15	282,77	142,51
Municipalities with average coverage (38.33%–56.42%)	152,84	122,98	99,62
Municipalities with high coverage ($> 56.42\%$)	92,50	82,46	57,49

Table 2. Results of negative binomial regression for the count of invasive dental procedures, non-invasive procedures, and oral health education in Brazilian municipalities. The models were adjusted for coverage of the School Health Program (PSE) and municipal population, using robust standard errors.

Variable	Coefficient	Standard Error	p-value	95% CI
Invasive Procedures				
PSE Coverage (%)	0.0110	0.0004	<0.001	[0.0102; 0.0119]
Total population	-3.83e-06	4.11e-07	<0.001	[-4.63e-06; -3.02e-06]
Non-invasive procedures				
PSE Coverage (%)	0.0153	0.0006	<0.001	[0.0140; 0.0166]
Total population	-2.92e-06	3.06e-07	<0.001	[-3.52e-06; -2.32e-06]
Health education				
PSE Coverage (%)	0.0073	0.0007	<0.001	[0.0059; 0.0088]
Total population	-7.16e-06	3.85e-07	<0.001	[-7.91e-06; -6.40e-06]

Table 2 shows that for each percentage point increase in PSE coverage, the rate of invasive procedures increases by approximately 1.1%, keeping the population constant. The population variable has a negative association, indicating that more populous municipalities tend to have proportionally fewer invasive procedures per inhabitant. For each percentage point increase in PSE coverage, the rate of non-invasive procedures increases by 1.53%, with an even more significant effect than for invasive procedures. Population also has a negative effect. PSE coverage is also positively associated with oral health education procedures, with a 0.73% increase in the rate of these procedures for each percentage point of coverage.

Three negative binomial regression models were adjusted to analyze the association between School Health Program (PSE) coverage and dental procedures performed (invasive, non-invasive, and educational), considering the total population of the municipalities as an exposure variable.

The model for invasive procedures had a log pseudolikelihood of -230,592.23 and pseudo- R^2 of 0.0031,

indicating that, although the variance explained by the model is modest, the independent variables have a statistically significant influence on the outcome. The Wald test ($\chi^2 = 797.63$; $p < 0.001$) reinforces the joint significance of the predictors. The AIC and BIC information measures were 461,192.5 and 461,226.8, respectively, providing useful parameters for comparison with alternative models.

Similarly, the model adjusted for noninvasive procedures had a log pseudolikelihood of -216,299.03 and the same pseudo- R^2 of 0.0031, with robust statistical significance ($\chi^2 = 710.27$; $p < 0.001$). The AIC (432,606.1) and BIC (432,640.4) values confirm the adequacy of the model and its consistency with the previous one.

The model for educational procedures obtained a log pseudolikelihood of -187,846.07 and pseudo- R^2 of 0.0010, lower than the previous ones, suggesting a lower capacity to explain the variance of the outcome by the included variables. Even so, the Wald test ($\chi^2 = 458.80$; $p < 0.001$) demonstrated overall statistical significance. The AIC (375,700.1) and BIC (375,734.5)

measures remain within acceptable standards for comparison and interpretation.

Overall, the three models demonstrated statistically significant fit, albeit with low individual explanatory power—a common feature in large-scale population analyses, especially in contexts with multiple unobserved structural and contextual factors. The goodness-of-fit measures suggest consistency between the models and provide support for the interpretation of the identified associations.

Adjusted Negative Binomial Regression Analysis

Negative binomial regression was used to model the count of procedures performed, adjusted for municipal population size (exposure(pop_total)), and using robust errors. Three negative binomial regression models were adjusted to assess the association between the PSE coverage tertile (low, medium, high) and each of the outcomes: invasive procedures, non-invasive procedures, and oral health education actions. All models were adjusted by cycle, municipal population size, and MHDI (Table 3).

Table 3. Negative binomial regression coefficients for the count of invasive and non-invasive dental procedures and oral health education actions. The models were adjusted for tertiles of coverage of the School Health Program (PSE), municipal population (considered as an exposure variable), and cycle, population size, and IDHM, using robust standard errors. The coefficients are expressed on a natural logarithmic scale.

Variable	Invasive Procedures	Non-Invasive Procedures	Oral Health Education
PSE coverage (ref: Low)			
Average	1,087 (1,045–1,131)	1,079 (1,041–1,118)	0,909 (0,867–0,953)
High	1,211 (1,164–1,260)	1,224 (1,182–1,268)	0,606 (0,576–0,638)
Population size (ref: 1)			
2 – >20k	0,877 (0,838–0,917)	0,851 (0,819–0,885)	0,837 (0,803–0,873)
3 – >50k	0,681 (0,638–0,727)	0,664 (0,630–0,699)	0,660 (0,623–0,699)
4 – >100k	0,462 (0,426–0,501)	0,523 (0,496–0,552)	0,420 (0,394–0,448)
MHDI	1,201 (1,159–1,244)	1,117 (1,086–1,149)	0,856 (0,829–0,883)
Cycle (ref: 2017–2018)			
2019–2020	0,618 (0,585–0,653)	0,479 (0,457–0,502)	0,734 (0,698–0,772)
2021	0,777 (0,737–0,820)	0,578 (0,553–0,604)	0,466 (0,445–0,488)
2023	1,030 (0,982–1,080)	0,929 (0,892–0,968)	0,337 (0,321–0,353)

Three negative binomial regression models were adjusted to assess the association between coverage of the School Health Program (PSE) and the outcomes: invasive procedures, non-invasive procedures, and educational actions in oral health. The models considered the municipal population as an exposure variable and included adjustments for cycle, population size, and MHDI, using robust errors. Municipalities with medium and high PSE coverage had a higher frequency of clinical procedures (invasive and non-invasive), with an increase of up to 22% in rates (IRR between 1.079 and 1.224). In contrast, significant reductions were observed in educational activities, especially in locations with high coverage (IRR = 0.606).

Larger municipalities performed fewer procedures in all categories. Those with >100,000 inhabitants had up to 58% fewer educational actions. The MHDI was positively associated with clinical procedures and negatively associated with educational actions, indicating a possible shift in educational activities in UBSs in less developed and less urban municipalities. There was a downward trend in procedures over time, especially in the 2019–2020 and 2021–2022 cycles, with marked declines in educational activities (up to 66% in the most recent cycle), reflecting the COVID-19 pandemic.

All models showed overall statistical significance ($p < 0.001$), with pseudo- R^2 between 0.0093 and 0.0247. Despite their low explanatory power—which is expected in analyses with aggregated data—the models were adequate and revealed important patterns in the relationship between PSE coverage and different types of dental procedures.

DISCUSSION

This analytical, ecological, retro-

spective study, based on aggregated secondary data from Brazilian municipalities, explored the relationship between the coverage percentage of the School Health Program (PSE) for children aged 0 to 6 years and the number of dental procedures performed by the Oral Health teams (eSB) teams at Basic Health Units (UBS), proposing an evaluation approach for procedures related to the management of Early Childhood Caries (ECC), a persistent problem in the Brazilian population. This analysis was based on the categorization of procedures as "non-invasive," "invasive," and "health education," adapted from an International Consensus¹⁵.

The results revealed great heterogeneity among municipalities, which is entirely expected due to regional and social differences in Brazil. Municipalities with lower PSE coverage performed, on average, more invasive and non-invasive procedures and educational actions. Moderate positive correlations were observed between the absolute number of schoolchildren covered and clinical procedures, but negative correlations between the percentage of coverage and the same procedures suggest a possible unequal distribution of efforts.

Among the limitations of the study, the following stand out: the use of aggregated secondary data, which does not allow direct causal inferences; possible inconsistencies in the information system records (SISAB and e-Gestor PSE); the impossibility of directly assessing the impact of oral health actions within the PSE on children aged 0 to 6 years, since the systems do not provide interoperability, which hinders the integrated assessment of PSE and oral health actions. It is also important to note that PSE actions are not exclusively in the field of oral health, but may involve other health promotion issues. Despite all the limitations, the use of adjusted statistical models, cycle analysis, and

broad temporal and geographic coverage lend robustness to the results and allow for interpretations relevant to health planning and future studies.

From a temporal perspective, the data reveal a downward trend in invasive procedures and educational actions throughout the cycles analyzed, while non-invasive procedures showed fluctuating behavior, with a significant increase in the most recent PSE cycle (2023–2024). These results suggest a possible reorientation of health promotion care practices, reflected in the work processes of the teams.

It is worth noting that, in the 2019–2020 and 2021–2022 cycles, the results may have been impacted by a bias resulting from the public health emergency caused by the COVID-19 pandemic. The suspension or limitation of in-person school activities, as well as the reconfiguration of health services, may have compromised both the implementation of the PSE and the regular provision of dental procedures. However, it is important to consider that, even in the face of these limitations, general trends in the data behavior were maintained, especially regarding the association between PSE coverage and the dental outcomes analyzed. This reinforces the robustness of the findings and the relevance of the program as a structuring strategy in promoting children's oral health.

Preventive oral health practices, such as health promotion focused on oral hygiene education and reducing sugar consumption in early childhood, have been widely recognized as effective strategies in reducing the incidence of caries. Among these strategies, daily supervised tooth brushing in schools stands out, whose effectiveness in preventing cavities in dentin is comparable to that obtained with the application of sealants^{16,17}.

Public dental health focuses on the prevention of oral diseases and

the promotion of oral health through organized social efforts. Ensuring universal access to quality dental services and increasing the availability of fluoride are key strategies for improving oral health and reducing inequalities^{18,19,20}. While larger municipalities benefit from better health infrastructure, challenges remain in addressing oral health inequalities related to socioeconomic status and access to services. Public health strategies should continue to integrate oral health into general health initiatives to ensure comprehensive care and more equitable outcomes for all populations.

Larger municipalities, with their higher population densities, face greater demand for complex treatments, such as tooth extraction and endodontic access. This is often due to insufficient preventive care, which is a common problem in areas with high socioeconomic disparities^{21,21,23}.

Despite limitations and biases, the use of secondary databases has several strengths. They allow for the analysis of a large number of municipalities, such as the 5,570 evaluated in this study, providing a broad view of oral health in the country. In addition, these databases enable longitudinal analyses, monitoring changes over time and providing valuable information for the evaluation of public policies. Another positive point is the saving of resources, since large-scale primary data collection would be unfeasible in terms of time and cost.

The results of this study have significant implications for oral health practice and policy, although further studies are needed to confirm the effects of PSE coverage on dental practice performed by eSBs. Identifying differences in dental indicators between municipalities of different sizes can guide the allocation of resources and the development of prevention and treatment strategies. The consistency of preventive practices, such as supervised tooth brushing under

the PSE, highlights the importance of continuing to invest in educational and health promotion actions. In addition, the findings indicate the need to strengthen services in larger municipalities to meet the greater demand for invasive and complex procedures.

In terms of future prospects, it is essential to conduct studies that investigate the causes of variations in oral health practices, considering the Oral Health Care Network, including PSE actions and their impact on the health of residents. Qualitative research could help to understand the challenges faced by municipalities of different sizes in providing dental care. In addition, improving the systems for recording and monitoring oral health indicators would be crucial for obtaining more accurate data and implementing effective policies, with a focus on equity in access and quality of dental services throughout the country. Thus, it is necessary for the Federal Government to articulate strategies for monitoring PHC by integrating systems, such as identifying whether schoolchildren were effectively covered by oral health surveillance actions and educational activities under the PSE and whether the actions have an effect on dental practice at the municipal level.

Regarding the null hypotheses: Null hypothesis 1 (municipalities with lower adherence to the PSE do not perform more invasive procedures) was rejected, as it was observed that municipalities with

greater PSE coverage performed significantly more invasive procedures, even after adjusting for population size and IDHM; Null hypothesis 2 (municipalities with greater adherence to the PSE do not perform non-invasive procedures or oral health education actions) was partially rejected. Greater PSE coverage was positively associated with non-invasive procedures, but negatively as-

sociated with oral health education actions, which were less frequent in municipalities with greater coverage, population size, and IDHM.

CONCLUSION

This study showed that coverage of the School Health Program (PSE) is positively associated with the performance of clinical dental procedures (invasive and non-invasive) in children aged 0 to 6 years in Brazilian municipalities. Municipalities with greater program coverage had up to 22% more clinical procedures, while oral health education actions in UBS were proportionally lower, especially in locations with high coverage (reduction of up to 40%). The results also point to a lower frequency of procedures in municipalities with larger populations and fewer educational activities in contexts with higher IDHM, suggesting that oral health teams perform more procedures in this population, potentially explained by greater investment in primary care policies in large urban centers, but future studies should confirm possible association factors. Despite the low explanatory power of the models, the findings indicate the need to integrate educational actions into the clinical strategies of the PSE and strengthen monitoring systems to promote equity and effectiveness in oral health care in early childhood.

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