

Disparities in dental prosthesis provision in Primary Health Care in Brazil

Desigualdades na instalação de prótese dentária na Atenção Primária à Saúde no Brasil

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Resumo

Introdução: A oferta de próteses na Atenção Primária à Saúde (APS) reflete capacidade do sistema público de responder às necessidades reabilitadoras. **Objetivo:** Avaliaram-se a ocorrência de instalação de próteses dentárias e as taxas anuais de instalação entre adultos (19-59) e pessoas idosas (≥ 60 anos) em 2023, e analisou-se a relação desses indicadores com características sociodemográficas e dos serviços de saúde bucal. **Material e método:** Estudo ecológico com dados dos 5.570 municípios brasileiros, classificados em com (≥ 1 procedimento) e sem registros de procedimentos de instalação de próteses. As taxas anuais foram calculadas por 1.000 indivíduos com necessidade estimada, para os dois grupos etários. **Resultado:** Dos 1.898 municípios (34,08%) com instalação de próteses, maior percentual foi observado naqueles com > 100 mil habitantes, desde que com Laboratório Regional de Prótese Dentária (LRPD). Maior percentual de municípios com instalação foi observado dentre aqueles com LRPD, quando sem Centro de Especialidade Odontológica (CEO). Maior cobertura de saúde bucal na APS foi associada à maior chance de oferecer instalação de próteses. As taxas médias foram 10,76 ($\pm 19,74$) para adultos e 26,89 ($\pm 41,05$) para pessoas idosas, sendo maiores entre municípios com até 20 mil habitantes, com LRPD, sem CEO e com baixa e média vulnerabilidade social. Observou-se correlação negativa com porte populacional e número de CEO, e positiva com a cobertura de saúde bucal. **Conclusão:** A instalação de próteses é desigual, e baixa frente à demanda. LRPD e maior cobertura em saúde bucal favorecem a oferta, sobretudo nos municípios maiores e em territórios sem serviços especializados.

Descritores: Prótese dentária; atenção primária à saúde; serviços de saúde bucal; sistemas de informação em saúde; avaliação de serviços de saúde; Sistema Único de Saúde.

Abstract

Introduction: The provision of dental prostheses in primary health care (PHC) reflects the capacity of the public system to meet rehabilitation needs. **Objective:** This study evaluated the occurrence of dental prosthesis placement and the annual placement rates among adults (19–59 years) and older adults (≥ 60 years) in 2023, as well as the relationships between these indicators and sociodemographic and oral health service characteristics. **Material and method:** This ecological study used data from 5,570 Brazilian municipalities, which were classified as having ≥ 1 recorded procedure or no records of dental prostheses placement. Annual rates were calculated per 1,000 individuals with estimated needs in the two age groups. **Result:** Among the 1,898 municipalities (34.08%) that provided dental prostheses, a higher proportion was observed among those with populations exceeding 100,000 inhabitants, provided they had a Regional Dental Prosthesis Laboratory (Laboratório Regional de Prótese Dentária, LRPD). A higher percentage of municipalities with prostheses placement was also found among those with an LRPD



but without a Dental Specialty Center (Centro de Especialidades Odontológicas, CEO). Greater coverage of oral health in PHC was associated with an increased likelihood of prostheses placement. The mean annual rates were 10.76 ($\pm$ 19.74) for adults and 26.89 ($\pm$ 41.05) for older adults, and these rates were higher in municipalities with up to 20,000 inhabitants, those with an LRPD, those without a CEO, and those with low or medium social vulnerability. Negative correlations were observed with population size and the number of CEOs, while a positive correlation was found with coverage of oral health. **Conclusion:** Compared with the estimated demand, prostheses placement in PHC remains uneven and limited. The presence of an LRPD and higher coverage of oral health favor service provision, particularly in larger municipalities and in areas lacking specialized services.

Descriptors: Dental prosthesis; primary health care; dental health services; health information systems; health services research; Unified Health System.

INTRODUCTION

Tooth loss is a public health problem in Brazil and worldwide. In 2021, an estimated 353 million individuals were edentulous¹. In Brazil, the prevalence of edentulism decreased from 53.34% in 2003 and 53.38% in 2010 to 36.32% in 2023, however this improvement did not follow the growth of the older population, indicating that many Brazilians continue to age without teeth². Tooth loss compromises functions such as chewing, speech and aesthetics, leading to social, psychological and physical consequences.³ In this context, rehabilitation with dental prostheses aims to restore these functions, promote social reintegration and improve quality of life⁴.

This scenario has posed challenges for the public sector in providing oral rehabilitation services, as most affected individuals face barriers, particularly financial ones, to prosthetic replacement⁵. Following the creation of the National Oral Health Policy (Política Nacional de Saúde Oral, PNSB) in 2004, services were expanded, and the model of was reoriented. Within primary health care (PHC), Oral Health Teams (Equipes de Saúde Bucal – eSB) are expected to address the most common problems and coordinate care across the network. The provision of prostheses was incorporated in PHC through the implementation of Regional Dental Prostheses Laboratories (Laboratório Regional de Próteses Dentárias - LRPD), based on the principles of resoluteness and comprehensiveness⁶.

The 2023 National Oral Health Survey revealed that 53.57% of adults (35–44 years) and 75.2% of older adults (65–74 years) required dental prostheses⁷. This high prevalence indicates an accumulated need and may reflect difficulties in consolidating prostheses provision within PHC. Previous studies have identified political challenges (limited funding and insufficient support from municipal health departments), structural challenges (shortages of materials and prosthetic technicians) and process challenges (difficulty in meeting targets, the need for training of dentists and the absence of organized production flows)^{8,9}. In addition, gaps remain in the monitoring and systematic analysis of health indicators related to dental prostheses provision in PHC¹⁰.

Historically, such indicators have not been included in federal initiatives to evaluate PHC¹⁰. The absence of specific guidelines and goals for rehabilitation compromises the planning, monitoring and prioritization of public policies in this area. A systematic analysis of indicators could inform the development of strategies to expand equitable access to dental prostheses, an important goal in a country marked by substantial regional inequalities.

Contextual factors including structural and organizational conditions as well as the sociodemographic and territorial characteristics of municipalities should be considered in this analysis^{11,12}. Population size reflects administrative capacity and resources availability, both of which influence service organization. Studies have shown differences in the characteristics of PHC teams^{11,12}, in their performance regarding PHC indicators^{12,13}, and in the number of eSBs in the family health strategy (Estratégia Saúde da Família - ESF)¹¹ according to municipality size. The Social Vulnerability Index (Índice de Vulnerabilidade Social, IVS) captures socioeconomic contexts that affect health and may signal additional challenges in the management and prioritization of municipal oral health actions. Structurally, eSB coverage within the ESF indicates the extent of oral

health care in a given territory and the capacity of local actors to respond to population needs¹⁴. The presence of an LRPD represents a strategic component that may facilitate or constrain prostheses production, depending on the LRPD availability and location within the care network^{8,15}.

Given this context, the study aimed to estimate the proportion of municipalities in which dental prostheses were installed in PHC and the annual rates of prostheses placement among adults and older adults in 2023. Additionally, the study examined the relationships between these indicators and sociodemographic as well as oral health service characteristics in Brazilian municipalities.

MATERIAL AND METHOD

This ecological study was based on secondary data obtained from 5,570 Brazilian municipalities.

Indicators of the Production of Dental Prostheses in PHC

The occurrence of dental prostheses placements and the annual rate of prostheses placement were analysed separately for adults and older people.

The number of procedures for the placement of any type of dental prostheses performed in PHC in 2023 was used to classify municipalities according to occurrence of prostheses placement (≥ 1 procedure *versus* none) and to calculate the annual rate of dental prostheses placement¹⁶. These data were obtained from the “Health/Production” report available in the Primary Care Health Information System (Sistema de Informação em Saúde para a Atenção Básica - SISAB)¹⁷. The following filters were applied: geographic unit (Brazil), period (months of 2023), row (municipalities), column (dental care–oral health procedures), team type (eSB), professional category (dentist + technician and oral health assistant), age group (19–59 or ≥ 60 years), and procedure (placement of dental prostheses, according to the Unified Health System Table of Procedures, Medications and Orthosis, prosthesis and special materials, including total, removable and fixed partial maxillary and/or mandibular prostheses. The option “ignore” was selected for the filters referring to sex, place of care, type of consultation, type of care, oral health surveillance, and conduct, so that all procedures were included. Applying these filters reduced the number of procedures due to possible missing records in these fields¹⁶.

The annual rate of dental prostheses placement¹⁸ in each municipality was calculated by dividing the number of prostheses placement procedures (for adults or older individuals separately) by the number of people who were estimated to need prostheses in the same age group and municipality in 2023. The denominator was the estimated population with the need for prostheses, which was calculated by multiplying the population of each age group (19–59 years and ≥ 60 years), according to the 2022 census, for each municipality by the prevalence of the need for prostheses observed in the respective Brazilian state, according to the SB Brazil 2023⁷. The prevalence of the need for prostheses for each state, which was used to estimate the denominator of the rate, is presented in a supplementary file that is available at <https://doi.org/10.5281/zenodo.17114392>¹⁹.

Sociodemographic and Oral Health Services Characteristics

The population variables and social vulnerability index (Índice de Vulnerabilidade Social - IVS) were collected for each municipality. The population was obtained from the 2022 census²⁰ and categorized into the following population sizes according to Ordinance GM/MS 3493/2024: up to 20, 20–50, 50–100 and $> 100,000$ inhabitants²¹. The IVS was obtained from the appendix of the aforementioned ordinance and was classified as indicating very low (0–0.20), low (>0.20 –0.30), medium (>0.30 –0.40), high (> 0.40 –0.50) or very high levels of social vulnerability (>0.50)²¹.

The variables of oral health services included the presence of a Dental Specialty Center (Centro de Especialidade Odontológica - CEO), the presence of a regional dental prosthesis laboratory (Laboratório Regional de Prótese Dentária - LRPD), and coverage of oral health services in PHC. The list of accredited CEOs was obtained from the website of the Secretariat of Primary Health Care²². The municipalities were classified as “without service” (0 CEO) or “with service” (≥ 1 CEO), regardless of type (I, II or III). The report of municipalities with an accredited LRPD was obtained from the website of the Secretariat of Primary Health Care²³. The listed municipalities were categorized as “with service”, regardless of the number of laboratories, whereas the others were categorized as “without service”. Both reports are available separately for each Brazilian state and were consulted in December 2024. The coverage of oral health services in primary health care (PHC) as of December 2023 was obtained from the public reports available on the *e-Gestor AB* platform²⁴. Higher values represent greater coverage.

Data Processing and Analysis

The reports were structured in Excel®, exported to Stata® v. 18 (StataCorp LLC) and linked by the geocode key variable. Subsequently, variables of interest were created, including the occurrence of prostheses placement, estimate of the population in need of prostheses by age group, calculated placement rate, categorized population size, and presence of a CEO or LRPD. Given that the SISAB production report lists only the municipalities in which procedures were performed, it was assumed that prostheses placement procedures were not performed during this period in municipalities not appearing in this list. Information on population, IVS and coverage of oral health in HPC was available for all municipalities. Municipalities not listed in the accredited CEO or LRPD reports were considered to lack the respective service. A flowchart detailing the data extraction and processing steps is presented as a supplementary file¹⁹. The descriptive analysis included the proportion of municipalities in which prostheses placement was performed in 2023, as well as the mean and standard deviation of placement rates by age group in Brazil, by region and state. Associations between sociodemographic characteristics (population size and IVS) and oral health services (CEO, LRPD and coverage of oral health in PHC) and the occurrence of prostheses placement in each municipality were investigated by performing both simple and multiple logistic regression, including estimates of odds ratios (ORs) and 95% confidence intervals (95% CIs). Interactions between the explanatory variables (population size#IVS, population size#presence of CEO, population size#presence of LRPD, and presence of CEO#presence of LRPD) were tested. When statistically significant, these interactions were interpreted using marginal estimates from the adjusted model, which represent the adjusted average probabilities of prostheses placement according to the levels of the explanatory variables. Model fit was evaluated using the Hosmer–Lemeshow goodness-of-fit test, where non-significance indicates adequate model fit²⁵. Multicollinearity among variables included in the model was assessed using the variance inflation factor (VIF), with values >10 indicating high multicollinearity, values between 5 and 10 indicating moderate multicollinearity, and values <5 indicating acceptable multicollinearity²⁵.

Differences in prostheses placement rates according to sociodemographic and service characteristics were tested using the Mann–Whitney or Kruskal–Wallis test, with $\alpha = 0.05$. The correlation between placement rates and quantitative variables (population, number of CEOs, number of LRPD, coverage of oral health) was evaluated by Spearman correlation, and the correlations among the ordinal variables (IVS) were evaluated by polychoric correlation. To verify the consistency of the findings, the analyses were repeated after the exclusion of extreme rate values using the blocked adaptive computationally efficient outlier denominator (BACON) algorithm. The percentile parameter adopted was 0.15 because it is considered to be appropriate for different situations and provides plausible results²⁶. The processed database is in a public repository¹⁹. Because this research relied on secondary data in the public domain, there was no need for the submission of the research protocol to the research ethics committee, according to CNS Resolution No. 510/2016.

RESULT

In 2023, the placement of dental prostheses in PHC was recorded in 1747 (31.36%) municipalities for adults and in 1380 (24.78%) for older individuals. In 3672 (65.92%) municipalities, no records of prostheses placement were available for either age group. Among the 1,898 (34.08%) municipalities with placement records, 1,229 (64.75%) recorded prostheses placement in both age groups. A higher percentage of municipalities recording prostheses placement in adults was observed in the North region and, for older adults individuals were observed in the Central-West and Southeast regions. Variations among the states were also evident (Figure 1).

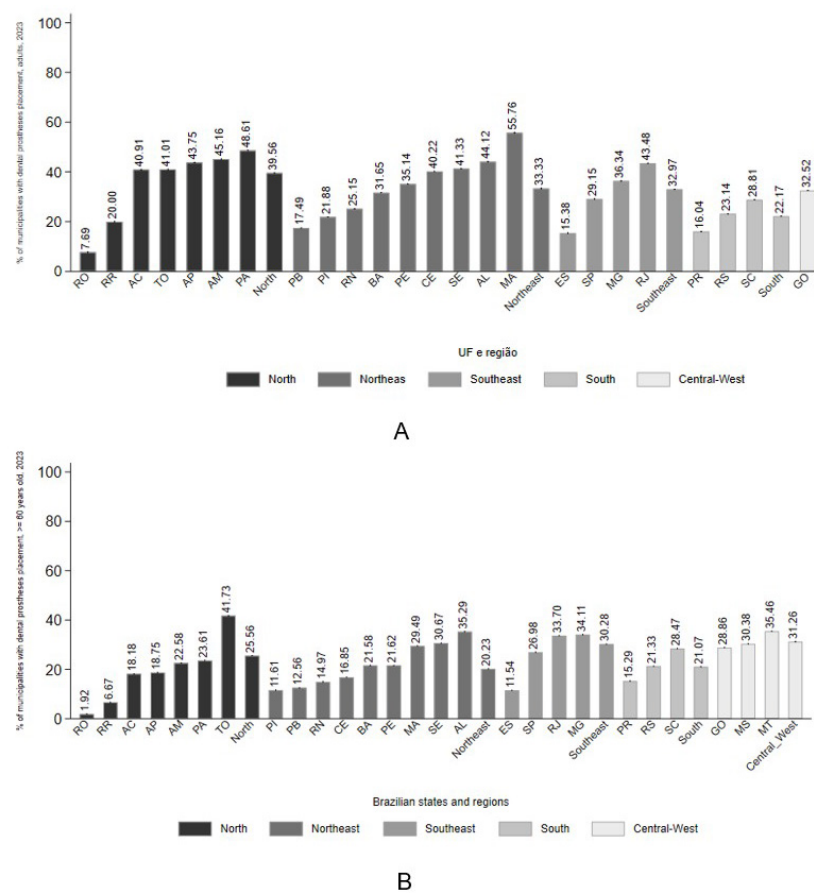


Figure 1. Percentage of municipalities with records of dental prostheses placement in adults (A) and older people (B) according to Brazilian states and regions in 2023.

Table 1 presents the variables associated with the placement of dental prostheses in PHC. The percentage of municipalities with records of dental prostheses placement in adults and/or older adults was higher among those with larger populations, and a significant interaction with the presence of an LRPD was observed. Municipalities with > 100,000 inhabitants showed a greater predicted probability of having prostheses placement records when an LRPD was present (Figure 2). The percentage of municipalities with prostheses placement records was higher among those with very low levels of social vulnerability compared to those with very high level. Regarding oral health service characteristics, a significant interaction was observed between the presence of an LRPD and the presence of a CEO. A higher percentage of municipalities had prostheses placement records in PHC when an LRPD was present but a CEO was not. When a CEO was present, no differences were observed in the proportion of municipalities with prostheses placement records, regardless of LRPD presence (Figure 2). Municipalities with greater coverage of oral health were more likely to have prostheses placement records (Table 1).

Table 1. Association between sociodemographic and oral health services characteristics and dental prostheses placement in adults and/or older adults in the context of PHC in Brazil (n = 5570)

Occurrence of prostheses placement in the municipality (adults and/or older adults)			
Variable	n (%)	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)*
Sociodemographic characteristics			
<i>Population size</i>			
Up to 20,000 inhab. (n=3863)	1219 (31.56)	1	1
> 20,000-50,000 inhab. (n=1050)	374 (35.62)	1.20 (1.04; 1.39)	1.60 (1.26; 2.02)
> 50,000-100,000 inhab. (n=338)	141 (41.72)	1.55 (1.24; 1.95)	3.37 (2.23; 5.09)
> 100,000 inhab. (n=319)	164 (51.41)	2.29 (1.82; 2.89)	4.68 (2.85; 7.68)
<i>Social Vulnerability Index (IVS)</i>			
Very low vulnerability (n=630)	180 (28.57)	1	1
Low vulnerability (n=1700)	572 (33.65)	1.27 (1.04; 1.55)	1.24 (0.99; 1.53)
Medium vulnerability (n=1259)	391 (31.06)	1.13 (0.91; 1.40)	1.00 (0.80; 1.25)
High vulnerability (n= 1178)	413 (35.06)	1.35 (1.09; 1.67))	1.07 (0.86; 1.35)
Very high vulnerability (n=803)	342 (42.59)	1.85 (1.48; 2.32)	1.54 (1.22; 1.95)
Characteristics of oral health services			
<i>Dental Specialty Center (CEO) in the municipality</i>			
Without the service (n=4606)	1538 (33.40)	1	1
With the service (n=964)	360 (37.34)	1.19 (1.03; 1.37))	1.32 (0.95; 1.84)
<i>Regional Dental Prostheses Laboratory (LRPD) in the municipality</i>			
Without the service (n=2698)	383 (25.44)	1	1
With the service (n=2872)	1212 (42.20)	2.14 (1.91; 2.40)	2.35 (2.03; 2.71)
<i>Coverage of oral health in PHC (median and interquartile range)</i>			
CEO in the municipality #LRPD in the municipality		-	
With CEO#With LRPD		-	0.31 (0.20; 0.46)
<i>Population size#Existence of LRPD</i>			
> 20,000 to 50,000 inhab.# with LRPD		-	0.96 (0.70; 1.31)
> 50,000 to 100,000 inhab.#with LRPD		-	0.92 (0.54; 1.55)
> 100 thousand inhab.#with LRPD		-	2.01 (1.12; 3.63)

*Hosmer and Lemeshow: Pearson χ^2 (1864.4). Prob > χ^2 = 0.3897. The interactions between population size and IVS and between population size and the presence of CEO were not statistically significant. The VIF values ranged from 1.20 to 2.59 (no collinearity was observed among the variables of the regression model).

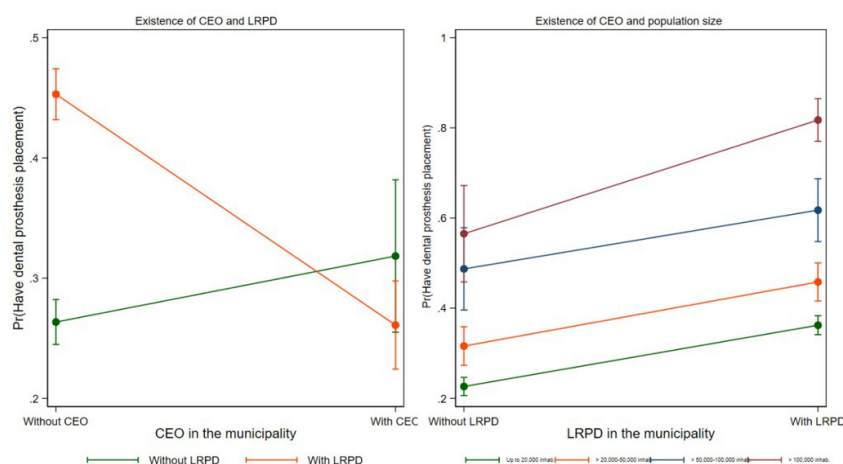


Figure 2. Estimated probability of dental prostheses placement for adults and/or older adults in municipalities according to the existence of an regional dental prostheses laboratory (LRPD) in municipalities with and without a Dental Specialty Center (CEO) and according to the population size of municipalities with and without an LRPD.

The average rate of dental prostheses placement was 10.76 (SD = 19.74) for adults and 26.89 (SD = 41.05) for individuals ≥ 60 years old (per 1000), although variations were observed across different states and regions (Table 2). The highest rates for both age groups were observed in municipalities with up to 20,000 inhabitants ($p < 0.001$). In terms of the IVS, the lowest rates were observed in municipalities with high or very high levels of vulnerability ($p < 0.001$) (Table 2). The annual rates were higher in municipalities without a CEO but with an LRPD ($p < 0.001$). The negative correlation coefficients indicate that the larger the total population and the greater the social vulnerability or the number of CEOs in the municipality, the lower the rates of dental prostheses placement. The positive correlation coefficients indicate that the greater the number of LRPDs or coverage of oral health are, the greater the annual rates of dental prostheses placement in adults and older adults (Figure 3).

Table 2. Mean annual rate of dental prostheses placement in adults and older adults (per 1000 users with an estimated need for prostheses) according to region and states and comparison of rates according to sociodemographic and oral health services characteristics in Brazil, 2023

Variable	Average annual rate of dental prostheses placement among adults	Average annual rate of dental prostheses placement among older adults
Geographic location		
<i>North Region</i>	7.86 (19.46)	26.61 (42.35)
Acre	0.43 (0.51)	1.97 (0.17)
Amapá	1.59 (2.34)	8.63 (7.48)
Amazonas	2.11 (7.15)	11.70 (26.08)
Pará	0.74 (1.60)	4.83 (7.94)
Rondônia	0.24 (0.36)	-
Roraima	0.41 (0.38)	-
Tocantins	22.31 (29.24)	46.42 (50.77)
<i>Northeast Region</i>	4.30 (10.09)	11.60 (19.57)
Alagoas	8.88 (12.81)	18.79 (22.97)
Bahia	4.19 (8.81)	9.90 (16.52)
Ceará	1.53 (4.48)	7.25 (13.83)
Maranhão	2.10 (4.79)	7.28 (13.02)
Paraíba	14.37 (22.11)	25.82 (26.93)
Pernambuco	3.01 (7.24)	8.96 (15.78)
Piauí	4.20 (10.32)	13.04 (24.37)
Rio Grande do Norte	3.67 (7.99)	10.01 (16.89)
Sergipe	4.38 (10.59)	12.24 (28.99)
<i>Central-West Region</i>	14.01 (18.36)	34.75 (35.34)
Goiás	16.19 (20.69)	38.56 (35.63)
Mato Grosso	13.45 (17.90)	34.71 (39.79)
Mato Grosso do Sul	9.09 (9.12)	25.03 (20.98)
Distrito Federal	-	-
<i>Southeast Region</i>	12.93 (19.90)	27.95 (33.98)
Espírito Santo	6.77 (9.93)	16.19 (17.42)
Minas Gerais	17.78 (23.62)	32.96 (35.82)
Rio de Janeiro	0.85 (2.79)	1.78 (5.32)
São Paulo	7.90 (11.62)	24.85 (31.81)
<i>South Region</i>	20.92 (29.29)	42.46 (65.30)
Paraná	17.86 (38.28)	45.48 (105.34)
Rio Grande do Sul	19.98 (22.75)	37.39 (36.00)
Santa Catarina	24.42 (29.23)	46.62 (55.46)

Table 2. Continued...

Variable	Average annual rate of dental prostheses placement among adults	Average annual rate of dental prostheses placement among older adults
Sociodemographic characteristics		
<i>Population size</i>		
Up to 20,000 inhab.	15.78 (22.91)	36.27 (45.89)
> 20,000-50,000 inhab.	2.53 (5.41)	8.88 (14.07)
> 50,000-100,000 inhab.	0.98 (2.03)	4.44 (8.14)
> 100,000 inhab.	0.39 (1.18)	2.05 (6.01)
p value (Kruskal–Wallis)	0.0001	0.0001
<i>Social Vulnerability Index</i>		
Very low vulnerability	11.55 (18.21)	25.74 (31.27)
Low vulnerability	14.26 (21.06)	32.05 (38.75)
Medium vulnerability	13.15 (24.42)	32.35 (58.38)
High vulnerability	9.00 (18.11)	22.50 (35.19)
Very high vulnerability	4.24 (10.34)	12.50 (19.36)
p value (Kruskal–Wallis)	< 0.001	< 0.001
Characteristics of oral health services		
<i>Dental Specialty Center (CEO) in the municipality</i>		
Without the service	12.93 (21.18)	31.28 (43.23)
With the service	1.28 (4.59)	4.16 (10.62)
p value (Mann–Whitney)	<0.001	<0.001
<i>Regional Dental Prostheses Laboratories (LRPD) in the municipality</i>		
Without the service	7.19 (17.55)	21.76 (47.62)
With the service	12.69 (20.58)	29.29 (37.38)
p value (Mann–Whitney)	<0.001	<0.001

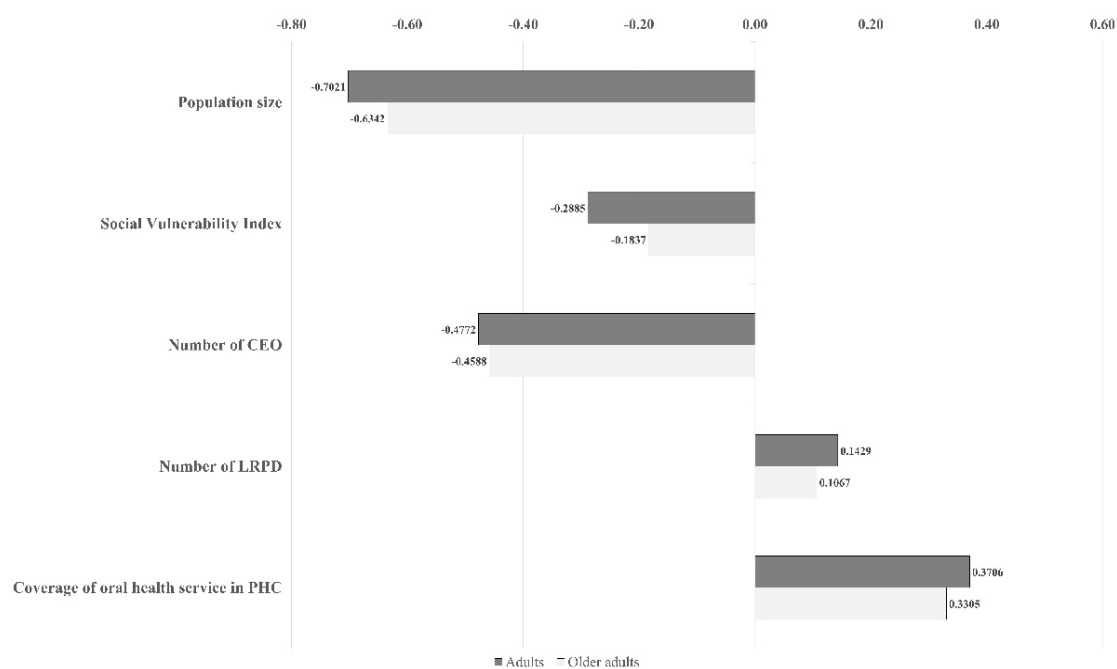


Figure 3. *Spearman* correlation coefficients and polychoric correlations of sociodemographic variables and characteristics of oral health services with the annual rates of dental prostheses placement in the adult and older adults. CEO = Dental Specialty Center; LRPD = Regional Dental Prostheses Laboratories.

Regarding the rate of prostheses placement, extreme values were identified in 300 municipalities for adults and in 268 municipalities for older adults. The exclusion of these values did not change the consistency of the analyses¹⁹.

DISCUSSION

The findings of this study indicate the existence of regional disparities in the placement of dental prostheses in PHC, thus highlighting challenges pertaining to territorial coverage and the responsiveness of services to the prosthetic rehabilitation needs of the population. Variation was observed according to the sociodemographic profile of the municipalities (population size and IVS) and the structure of the oral health care network in the PHC (presence of LRPDs and CEOs).

Despite the high prevalence of the need for prostheses identified in the 2023 national survey (53.57% of adults and 75.2% of older adults)⁷, more than 65% of the municipalities did not have records of prostheses placement in PHC. This finding suggests low coverage and capillarity in the supply of prostheses, as well as unequal territorial distribution of this procedure in PHC. The procedure was more frequent in the North and Northeast regions of the country, which exhibited the highest percentages of municipalities with placement records in 2023. This component of the PNSB needs to be strengthened in order to improve the ability of the population to access prosthetic rehabilitation.

The average annual rate of prostheses placement (approximately 10 and 25 per 1,000 adults and older adults, respectively, with an estimated need) can be considered insufficient given the magnitude of the corresponding demand. Studies that have relied on data from the Outpatient Information System (Sistema de Informações Ambulatoriais - SIA/SUS) (which includes primary and secondary care) have reported an average of 7.56 prostheses installed per month in 2013 (x100,000 inhabitants aged ≥ 15 years)¹⁵, and for the older adults, the rates of total removable prosthesis placement ranged from 301.5 (2010) to 680.8 (2021) per 100,000²⁷. Although the sources and calculation methods have differed, the results suggest that the total production of prostheses in the SUS is greater than the rate recorded exclusively in PHC. This trend is corroborated by a study conducted in Bahia, which revealed that 66.49% of the prostheses produced in 2016 were produced in municipalities with CEOs, compared with 33.51% that were produced in municipalities without CEOs²⁸.

Although the North and Northeast regions of Brazil feature more municipalities with registered placements, they also exhibited the placement lowest rates in the two age groups. This unequal territorial distribution may reflect not only differences in the organization of municipal services but also a low level of responsiveness to the needs of the population. These findings are consistent with the pattern of expansion of eSBs in PHC observed after the implementation of the PNSB (2001–2013)²⁹ and between 2008 and 2016¹². These regions have always featured the highest rates of tooth loss and need for rehabilitation^{7,30}. In 2010, the Northeast region exhibited the highest prevalence of the need for prostheses among older adults (82.9%), followed by the North region (67.1%)³¹. This inequality remained in 2023, thus indicating a persistent trend⁷.

In terms of population size, more than half of the municipalities with $>100,000$ inhabitants registered placements, but approximately 1/3 of the $<20,000$ municipalities did. Paradoxically, placement rates were greater in smaller municipalities. This finding can be explained by reference to the complexity of services in large centres, which, even with more structure, face difficulties in terms of PHC coverage, thus limiting access to rehabilitation at this level of care. This finding corroborates the results of a previous study that revealed lower coverage and greater rates of tooth extraction in large municipalities than in those featuring up to 5,000 inhabitants¹². Another study in Pernambuco revealed that greater coverage of oral health in PHC was associated with more first dental visits, a greater mean number of basic procedures, a greater proportion of supervised brushing and a lower index of tooth extractions, suggesting more organized work³².

A greater proportion of municipalities with prostheses placement records was also observed among those with greater coverage of oral health in PHC, which also had greater placement rates. This finding suggests more consolidated processes, more structured teams and greater planning capacity, which favour the supply of prostheses. One study reported that the incorporation of eSBs in the ESF increased the use of services, as measured by a greater number of clinical procedures performed in PHC³³. In addition, the more intense use of public services by members of smaller municipalities may explain the higher rates in these locations. A previous study revealed a lower percentage of users of SUS oral health services in municipalities featuring >100,000 inhabitants³⁴.

Among the municipalities that exhibited a very high level of social vulnerability, a greater percentage of municipalities with records of prostheses placement in PHC was observed, regardless of population size. These data may reflect the effort of public policies to expand access in regions of greatest need, signalling equity effects. However, in these same municipalities, the placement rates were lower than those observed in locations with less vulnerability. Although the placement of some types of prostheses is more common in more vulnerable locations, the ability to respond to this need seems limited. This result could be attributed to several factors, such as the greater severity of oral diseases in groups with greater social vulnerability^{1,2,35}, in addition to the greater proportion of users of public services, which results in greater demand in relation to the resolute capacity of the services in these places.

With respect to the health care network, the results indicate that the presence of an LRPD is conducive to the placement of prostheses in PHC, especially in municipalities featuring > 100,000 inhabitants and in those without a CEO. A greater proportion of municipalities with records of prostheses placement were observed among municipalities with an LRPD, even when they lacked a CEO. The proportion of municipalities with placement records among those with >100,000 inhabitants was greater when these municipalities had an LRPD. In addition, the prostheses placement rate was greater in municipalities with an LRPD and in those that lacked a CEO. No studies have compared the placement of prostheses in PHC with the production of prostheses in the CEO while taking into account the structure of the network. However, data provided by previous studies have indicated that the total production of dental prostheses—including those in PHC and medium-complexity services—tends to be greater in municipalities with an LRPD^{15,28}. This finding reinforces the importance of the structure of the service network because the production of prostheses, both in PHC and in CEOs, depends on the availability of a dedicated or outsourced reference laboratory that is located inside or outside the municipality⁶. In municipalities with a CEO, PHC may exhibit a lower level of responsiveness, thereby directing the demand for rehabilitation to specialized care, especially in contexts involving low levels of coverage of oral health services. Thus, the decentralization of LRPDs may represent a strategy that can be used to expand the population's access to prosthetic rehabilitation through PHC, particularly in areas that lack a CEO or where this factor is insufficient to meet the corresponding demand⁸. However, challenges in the territorial distribution of LRPDs and consolidation of services, such as a lack of dental technicians, low prioritization of prosthetic rehabilitation by managers, a lack of professional training and the absence of organized production flows, have been reported⁸.

This study has several limitations. The analysis conducted for this research was based on aggregated data, thus preventing the researchers from making inferences regarding individuals or specific eSBs. The estimated need for prostheses was based on mean state values, which may distort the real demand at the municipal level. Another limitation of this research pertains to the impossibility of mapping the territorial coverage of the CEOs and LRPDs, as well as that of identifying whether these services were located in the municipality itself or whether the service occurred through referral to other municipalities. The use of secondary data in this research may lead to inaccuracies because of recording problems. The data on prostheses placement analysed in this study were those recorded in the e-SUS PHC system. Even if a user is registered with a given eSB, underreporting may occur, resulting from financial transfers being based solely on the production recorded in the laboratory. Notably, the data recorded in the e-SUS PHC are not used to monitor the service, whether or not they are combined with LRPD production data.

The financial transfer for the production of prostheses in the SUS is performed indirectly, as the Ministry of Health transfers the resources to the municipalities, which are then responsible for transferring them to the registered LRPDs, according to the registered production ranges.

This study reinforces the importance of guiding decisions and promoting the planning of public policies based on health indicators, particularly by taking into account sociodemographic and structural differences in services. The current PHC co-financing policy seems to represent a move in this direction, given the financial allocation according to social vulnerability and population size. In a context characterized by high demand for prosthetic rehabilitation and limited availability of these procedures in PHC, the inclusion of specific indicators for this service could strengthen monitoring, support network reorganization, and improve work processes related to prostheses production in PHC. Future research should further explore provision of prostheses in PHC while taking into account the path taken by the user in the network, the performance and work process of the eSB in the manufacture of prostheses, their integration with professionals working in LRPDs and specialized services, the protocols and models associated with prostheses supply, and the coexistence of public and private laboratories providing services to the SUS. Monitoring postplacement consultations, user satisfaction and the quality of prostheses offered is also essential to ensure the continuity of care and effectiveness of rehabilitation. Additionally, longitudinal studies are needed to evaluate relevant trends in services provision and to inform strategies that can consolidate prosthetic rehabilitation within PHC.

CONCLUSION

The production of dental prostheses in Brazil reveals regional inequalities and a limited capacity of health services to meet the population's estimated needs. The presence of LRPDs contributes to increased prostheses provision, particularly in more populous municipalities and those lacking secondary care services. Furthermore, higher levels of oral health coverage in PHC are associated with greater prostheses production at this level of care.

AUTHORS' CONTRIBUTIONS

Priscila Moraes Gomes: Conceptualization, Data analysis, Research, Methodology, Writing of the original manuscript, Editing. Andrea Clemente Palmier: Data analysis, Research, Methodology, Review, Editing. Hernane Braga Pereira: Data analysis, Methodology. Renata Maria Mendes de Oliveira: Research, Editing. Maria Inês Barreiros Senna: Receipt of funding, Research, Review, Editing. Raquel Conceição Ferreira: Conceptualization, Receipt of funding, Data analysis, Research, Methodology, Writing of the original manuscript, Review, Editing.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

DATA AVAILABILITY

The data supporting the findings of this research are available in the manuscript: <https://doi.org/10.5281/zenodo.17636020>.

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