

Eleven-Year Analysis (2010 to 2020) of Dental Implant Procedures in the Unified Health System (SUS)

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ABSTRACT

Objective: To analyze the number of dental implants performed at dental specialty centers of the Unified Health System (SUS) between 2010 and 2020, in the Brazilian macro-regions. **Material and Methods:** A retrospective, quantitative, longitudinal study was conducted using publicly available data from the DATASUS/TABNET platform. The total number of annual dental implants was calculated by macro-region. The Kruskal-Wallis and Mann-Whitney nonparametric tests were applied, with 95% confidence intervals and a significance level of 5%. **Results:** A total of 146,875 dental implant procedures were performed from 2010 to 2020. When comparing regions, the South performed 88,034 (59.94%) procedures, while the North performed 1,173 (0.80%; $p < 0.0001$). The South region showed statistical significance compared with Central-West ($p = 0.0019$), Northeast ($p = 0.041$), and Southeast regions ($p = 0.0006$). Annual comparisons of total procedures between regions indicated a statistical significance ($p < 0.05$) for dental implants. Also, statistical significances were observed between 2010 *vs.* 2016 ($p = 0.0476$), 2010 *vs.* 2017 and 2010 *vs.* 2018 ($p = 0.0079$), 2010 *vs.* 2019 and 2010 *vs.* 2020 ($p = 0.0476$), 2011 *vs.* 2017 ($p = 0.0159$), and 2012 *vs.* 2017 and 2017 *vs.* 2020 ($p = 0.0317$). **Conclusion:** Therefore, differences in the number of dental implants across regions may be associated with barriers to access or the unavailability of services.

Keywords: Surgery, Oral; Periodontal Diseases; Dental Implants; Public Health Dentistry.

■ Introduction

The *Brasil Sorridente* program was incorporated into the Brazilian Unified Health System (SUS) in 2004 [1-6] and, from 2010, implemented dental implant procedures in Dental Specialty Centers (*Centros de Especialidades Odontológicas* - CEO) [7]. The Department of Informatics of the SUS (DATASUS) [8] monitors these procedures, allowing the development and design of new policies for attention and prevention [4,9]. Also, this program is essential, as oral diseases are considered a global health problem [10,11] that negatively impacts human health [11-13] and requires integration into health systems [14,15].

Although the *Brasil Sorridente* program for oral health care is universal, integral, and free [16,17], its territorial dimension and regional differences highlight the complexity of health practices [18]. Thus, considering the need to expand healthcare centered on basic care [3-5,12,13], the presence of the CEO is an effort to extend coverage in specialized care [17,19-22], which was monitored by the Program for Improving Access and Quality of CEO (PMAQ-CEO) [23-25].

In this context, dental implant procedures performed by the CEO represent a significant achievement for oral health in Brazil, and access to information on data monitoring is essential to developing and expanding this specialized care. Thus, this study analyzed the number of dental implants performed in the SUS from 2010 to 2020.

■ Material and Methods

The study was reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Design and Context

A retrospective, quantitative longitudinal study was conducted to analyze dental implant procedures performed at the CEO of the SUS from 2010 to 2020. The Brazilian Unified Health System began offering dental implant procedures in 2010 through the CEO, marking a significant advancement in oral health care. Considering the benefits of this service, analyzing the number of dental implants and specialized centers allows us to assess the progress of treatment coverage to develop new oral health policies.

Variables

The following variables were included: dental procedures performed from January 2010 to December 2020; dental implants performed from January 2010 to December 2020; the number of CEO between 2014 and 2018; the number of specialists between 2014 and 2018; and macro-regions (Central-West, North, Northeast, South, and Southeast). The results from the two PMAQ-CEO cycles (2014 and 2018) were also used to support the analysis.

Data Source

The number of dental implants performed in the SUS was collected from the TABNET/DATASUS public database [10] on June 20, 2021, while the numbers of CEOs and specialists were collected from the PMAQ-CEO.

Data Analysis

The collected data were exported and plotted in an Excel (version 2013) spreadsheet, and statistical analysis was conducted using Prism (version 9; GraphPad Software, La Jolla, CA, USA), including time-series analysis. Data from DATASUS showed non-normal distributions (Shapiro-Wilk test) for the procedure, year, and region variables; the Kruskal-Wallis and Mann-Whitney nonparametric tests were applied, with 95% confidence intervals and a significance level of 5%.

Results

A total of 146,875 dental implant procedures were performed from 2010 to 2020. When comparing regions, the South performed 88,034 (59.94%) procedures, while the North performed 1,173 (0.80%; $p < 0.0001$). The South region showed statistical significance compared with Central-West (11.35%, $p = 0.0019$), Northeast (21.18%, $p = 0.041$), and Southeast regions (6.74%, $p = 0.0006$) (Table 1).

Annual comparisons of total procedures between regions indicated a statistical significance ($p < 0.05$) for dental implants (Table 1). Also, statistical significances were observed between 2010 *versus* 2016 ($p = 0.0476$), 2010 *versus* 2017 and 2010 *versus* 2018 ($p = 0.0079$), 2010 *versus* 2019 and 2010 *versus* 2020 ($p = 0.0476$), 2011 *versus* 2017 ($p = 0.0159$), and 2012 *versus* 2017 and 2017 *versus* 2020 ($p = 0.0317$).

Table 1. Number of dental implants performed from 2010 to 2020 by macro-regions.

Period	Macro-Regions					Total
	Central-West	Northeast	North	Southeast	South	
2010	0	0	0	0	0	0 ^e
2011	42	16	0	150	1,931	2,139 ^{df}
2012	1	43	0	317	4,913	5,274 ^{bf}
2013	1,173	55	0	783	8,041	10,052 ^{af}
2014	657	21	0	1,345	8,151	10,174 ^{af}
2015	2,980	3,296	0	1,208	6,602	14,086 ^{af}
2016	1,669	10,353	0	1,009	12,710	25,741 ^{af}
2017	6,843	13,998	806	2,133	22,848	46,628 ^a
2018	1,290	1,419	367	1,341	9,899	14,316 ^{af}
2019	1,412	1,288	0	1,335	9,678	13,713 ^{af}
2020	604	613	0	274	3,261	4,752 ^{cf}
Total	16,671 ^B	31,102 ^B	1,173 ^C	9,895 ^B	88,034 ^A	146,875
Percentage	11.35	21.18	0.80	6.74	59.94	100.0

Source: Brazilian Ministry of Health – Ambulatorial Information System of the SUS (SIA/SUS), 2021; Lowercase Letters: Annual Comparison; Uppercase Letters: Comparison between Regions; Different letters represent statistical significance ($p < 0.05$).

Considering the CEO as places to perform dental procedures and the number of specialists, the first and second PMAQ-CEO cycles were used as references. During the first cycle, 932 types I, II, and III CEO with 10,153 specialists in several areas were active in Brazil. In the second cycle, the number of types I, II, and III CEO increased to 1,060, while the number of specialists in the same areas decreased to 6,249. The comparison between both cycles showed an increase in CEO and a decrease of 3,904 specialists (Table 2).

Table 2. Number of CEO and specialists in the first and second cycles of the PMAQ-CEO.

Macro-Region	Number of CEO – First Cycle			Number of CEO – Second Cycle		
	CEO I	CEO II	CEO III	CEO I	CEO II	CEO III
Central-West	14	40	8	18	39	14
Northeast	144	164	49	187	169	162
North	24	26	10	25	29	12
Southeast	112	199	26	36	202	36
South	55	45	16	62	49	20
Total CEO	349	474	109	328	488	244
Specialists Total	2,923	5,342	1,888	1,859	3,176	1,214

Source: Brazilian Ministry of Health, Program for Improving Access and Quality of Dental Specialty Centers (PMAQ-CEO), 2021.

In the first cycle, 27 implant specialists were identified, increasing to 34 in the second cycle. Regarding CEO distribution and specialists per region, the 34 implant specialists (second cycle) were allocated to 27% of the total CEO performing dental implants in the macro-regions. The South region had 9% (12) of its total CEOs performing dental implants, while the Southeast region had 91% (249), the Central-West had 8% (6), the Northeast had 3% (14), and the North had 2% (1) (Table 3).

Table 3. Number and percentage of CEO, CEO performing implants, implant specialists, and implants performed in 2018 by macro-region.

Macro-Region	CEO	CEO Implants	% of CEO Implants/CEO	Implant Specialists	Implants Performed
	N (%)	N (%)		N (%)	N (%)
Central-west	71 (7.0)	6 (2.0)	8	4 (12.0)	1,290 (9.0)
Northeast	518 (49.0)	14 (5.0)	3	12 (35.0)	1,419 (10.0)
North	66 (6.0)	1 (0.35)	2	0 (0.0)	367 (3.0)
Southeast	274 (26.0)	249 (88.0)	91	6 (18.0)	1,341 (9.0)
South	131 (12.0)	12 (4.0)	9	12 (35.0)	9,899 (69.0)
Total	1,060	282	27	34	14,316

Source: Brazilian Ministry of Health, Program for Improving Access and Quality of Dental Specialty Centers (PMAQ-CEO), 2021.

Discussion

Despite broad coverage and integration of public oral health services, disparities in provision were observed across regions [1]. Also, a low representation of dental implants was observed when considering the general framework of dental procedures performed in the SUS [26].

Although dental implant procedures began in 2010, they were recorded only from 2011, totaling 146,875 implants during the studied period. The South region presented the highest number of implants (59.94%, 88,034), followed by the Northeast (21.18%, 31,102), Central-West (11.35%, 16,671), Southeast (6.74%, 9,895), and North (0.80%, 1,173) (Table 1).

The North region had records of dental implants only between 2017 and 2018 (806 and 367 implants, respectively). The Northeast increased the number of implants from 2015 to 2017, but decreased in 2018 to the same number as in 2014. Simultaneously, the Southeast region maintained a standard level of implant provision during the studied period. Also, the COVID-19 pandemic may have contributed to the decrease in procedures in 2020, as it temporarily disrupted dental care services [27].

The South region concentrated most of the implant procedures performed during the timeframe. However, its records were audited by the Brazilian Ministry of Health between 2015 and 2019 due to potential irregularities related to the high number of procedures in municipalities with low population density, which may influence the results by increasing the number of procedures in this region [28].

When associating the number of dental implants with the CEO offering the procedures, 282 centers were identified (2010 to 2020) [25] of the 932 CEO in the first cycle and 1,060 in the second cycle of the PMAQ-CEO, with 27 implant specialists in 2014 and 34 in 2018, highlighting the low productivity related to total procedures. However, outsourced services not registered in the PMAQ-CEO and difficulty in accessing the CEO performing the procedures by the population may have influenced the number of specialists [24].

Although all CEOs who meet the minimum mandatory criteria (i.e., oral diagnosis, specialized periodontics, minor surgeries, endodontics, and care for patients with special needs) can perform dental implants, challenges persist in providing services involving rehabilitation with prosthesis over implants. Such challenges may occur because rehabilitation treatment is a priority for patients with complete edentulism and insufficient

alveolar ridges, which impair the use of a total dental prosthesis, with a transfer value of R\$ 260.00 for the surgical phase per implant and R\$ 300.00 for the prosthesis, regardless of the number of implants [17].

The financial incentive to the CEO as a strategy to improve management may influence the number of specialized procedures [29]. However, the PMAQ-CEO, conducted between 2014 and 2018, was discontinued and replaced by a new evaluation method, *Previne Brasil*, without a new survey, limiting data comparison across new periods [30]. When using public data, the reliability of the results depends on the responsibility of each specialist within the CEO and healthcare units, and mechanisms for verification should be incorporated to enhance this reliability [8].

Conclusion

The difference in the number of dental implant procedures across Brazilian regions may be associated with barriers to access or service unavailability, increasing the discrepancy among regions.

Authors' Contributions

JO	 https://orcid.org/0000-0003-2828-4634	Conceptualization, Investigation, and Project Administration.
SVR	 https://orcid.org/0000-0002-7107-9575	Validation, Investigation, and Data Curation.
CVGRT	 https://orcid.org/0000-0001-9864-6894	Methodology, Data Curation, and Visualization.
MHT	 https://orcid.org/0000-0002-6594-2301	Conceptualization, Methodology, Data Curation, Writing - Review and Editing, and Supervision.
All authors declare that they contributed to the 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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