

Endodontic treatment in the Unified Health System in the North and Southeast regions of Brazil: 15-year evaluation

Tratamento endodôntico no Sistema Único de Saúde nas regiões Norte e Sudeste do Brasil: 15 anos de avaliação

Tratamiento de endodoncia en el Sistema Único de Salud de las regiones Norte y Sudeste de Brasil: evaluación a 15 años

RESUMO

Objetivo: Avaliar o acesso ao Endodontista e ao tratamento endodôntico radical por usuários do SUS nas regiões Norte e Sudeste do Brasil nos últimos 15 anos. Método: Foi realizado um estudo ecológico utilizando dados secundários do SUS. A quantidade de especialistas em Endodontia e de tratamentos endodônticos radicais em dentes decíduos e permanentes realizados por tais especialistas entre 2008 e 2022 foram recuperadas e analisadas com nível de significância de 5%. Resultados: Houve uma tendência temporal crescente na quantidade de especialistas em Endodontia nas regiões Norte e Sudeste ($p < 0,05$). Entretanto, não houve uma tendência temporal crescente na quantidade de tratamentos endodônticos radicais na região Norte ($p > 0,05$), somente na Sudeste ($p < 0,05$). Conclusão: O acesso ao Endodontista por usuários do SUS aumentou nas regiões Norte e Sudeste do Brasil, mas a realização de tratamentos endodônticos radicais por tais especialistas aumentou somente na região Sudeste.

DESCRITORES: Endodontia; Sistema único de saúde; Serviços de saúde bucal; Assistência odontológica.

ABSTRACT

Objective: To evaluate access to Endodontist and radical endodontic treatment by SUS users in the North and Southeast regions of Brazil in the last 15 years. Method: An ecological study was carried out using secondary data from SUS. The number of specialists in Endodontics and radical endodontic treatments in primary and permanent teeth performed by such specialists between 2008 and 2022 were recovered and analyzed with a significance level of 5%. Results: There was an increasing temporal trend in the number of specialists in Endodontics in the North and Southeast regions ($p < 0.05$). However, there was no increasing temporal trend in the number of radical endodontic treatments in the North region ($p > 0.05$), only in the Southeast ($p < 0.05$). Conclusion: Access to the Endodontist by SUS users increased in the North and Southeast regions of Brazil, but the performance of radical endodontic treatments by such specialists increased only in the Southeast region.

KEYWORDS: Endodontics; Unified health system; Oral health services; Dental care.

RESUMEN

Objetivo: Evaluar el acceso al endodoncista y al tratamiento endodôntico radical por los usuarios del SUS en las regiones Norte y Sudeste de Brasil en los últimos 15 años. Método: Se realizó un estudio ecológico utilizando datos secundarios del SUS. Se recuperó el número de especialistas en Endodoncia y los tratamientos de endodoncia radical en dientes deciduos y permanentes realizados por dichos especialistas entre 2008 y 2022 y se analizaron con un nivel de significación del 5%. Resultados: Hubo una tendencia temporal creciente en el número de especialistas en endodoncia en las regiones Norte y Sudeste ($p < 0,05$). Sin embargo, no hubo una tendencia temporal creciente en la cantidad de tratamientos endodônticos radicales en la región Norte ($p > 0,05$), sólo en la Sudeste ($p < 0,05$). Conclusión: El acceso a endodoncistas por parte de los usuarios del SUS aumentó en las regiones Norte y Sudeste de Brasil, pero la realización de tratamientos endodônticos radicales por dichos especialistas sólo aumentó en la región Sudeste.

DESCRIPTORES: Endodoncia; Sistema Único de Salud; Servicios de salud bucal; Atención odontológica.

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INTRODUCTION

Understanding access to the Endodontist and their procedures is one way to measure the supply and demand for oral health services. In Brazil, the Unified Health System (SUS) incorporates Endodontics among the specialties of oral health care in the public sector. However, although there is no regulatory restriction regarding the performance of endodontic procedures among dental surgeons, Endodontists are often linked to the level of secondary care, working in Dental Specialty Centers (DSCs) to provide such assistance^{1,2}. Between 1999 and 2017, considering the out-patient productivity of SUS, approximately 3.5 billion dental procedures were recorded, of which endodontics represented 0.5%².

Still, it is known that the dynamics of supply and demand for oral health services depends, among other factors, on the population size and coverage achieved in the assigned territory, in addition to management and problem-solving capacity, and it is possible to observe micro- and

macro-regional disparities in Brazil in access to procedures and specialties*. Regarding the North and Southeast regions of Brazil, Chisini et al. (2019) reported that there was no positive linear trend in the number of endodontic procedures over the last 19 years, indicating a stationary behavior. In contrast, the other macro-regions of Brazil showed a significant growth trend. However, it was observed that these authors did not distinguish endodontic procedures performed specifically by specialists in Endodontics, accounting for all the productivity of dental surgeons in SUS in relation to the procedures that were categorized in this specialty².

In parallel, it is known that the Southeast region, despite a significant expansion between 2002 and 2016, has insufficient coverage in oral health care at the primary level (Family Health Strategy; FHS), which can generate demands for the secondary level, such as CEOs^{1,4}. In addition, although it has one of the largest numbers of CEOs in Brazil, the goal related to Endodontics has not been satisfactory in this Brazilian region in most of them^{5,6}. With regard to

the North region, it is known that it was the macro-region with the second highest expansion of oral health teams in the FHS after the implementation of Brasil Sorridente⁴. However, the achievement of goals related to Endodontics in secondary care also showed a significantly decreasing trend between 2008 and 2018⁶.

However, the performance of dental surgeons specialized in Endodontics in the SUS in the North and Southeast regions has not been fully evaluated in recent years, such as the number of professionals working and their productivity over time in relation to radical endodontic procedures. It is reasonable to question the behavior of these variables over time, seeking to understand how they relate to the evaluations of CEOs in these macro-regions and to the panorama of public policies and oral health services in these territories in the public sector.

Therefore, the objective of this study was to evaluate the access to Endodontist and radical endodontic treatment by SUS users in the North and Southeast regions of Brazil in the last 15 years. The alternati-

ve hypotheses examined were: (H1) - there was an increasing temporal trend in the number of dentists specializing in Endodontics working in SUS in the North and Southeast regions of Brazil; (H2) - there was an increasing temporal trend in the number of radical endodontic treatments performed by dentists specializing in Endodontics in SUS in the North and Southeast regions of Brazil; (H3) - there was an increasing temporal trend in the productivity (radical endodontic treatments) of dentists specializing in Endodontics in SUS in the North and Southeast regions of Brazil.

METHOD

This was an epidemiological study, using an ecological, longitudinal, retrospective and quantitative approach, configuring a time series⁷. Data were collected and analyzed from the SUS Outpatient Information System (SIA/SUS), provided by the SUS Informatics Department (DATASUS) in open access, characterizing the public domain of the information source. Thus, according to the national resolution number 510/2016 of the National Health Council, there was no need for submission and ethical appreciation⁸. There is no data related to any individual, establishing the population nature of the approach. The *STROBE* (*Strengthening the Reporting of Observational Studies in Epidemiology*) checklist was used to structure and enhance the scientific report of the study⁹.

Regarding the variables, the following were collected: (1) average annual quantity of dental surgeons specialized in Endodontics who attended in the North and Southeast regions of Brazil, (2) number of radical endodontic treatments performed by these professionals and (3) population projection (residents) of the Brazilian Institute of Geography and Statistics. Temporarily, data were collected for the period between 2008 and 2022 (last 15 full years; n = 15). There were no restrictions in relation to health services, considering all out-patient production in SUS.

(2) amount of radical endodontic treatments performed by these professionals



In addition, data referring to Brazil (national) were collected in parallel to generate comparison parameters, following the same procedure as the North and Southeast macro-regions.



and (3) population projection (residents) of the Brazilian Institute of Geography and Statistics. Temporarily, data were collected for the period between 2008 and 2022 (last 15 full years; n = 15). There was no restriction in relation to health services, considering all outpatient production in the SUS.

The average annual number of dental surgeons specialized in Endodontics who worked in SUS for each year was obtained by the respective code in the Brazilian Classification of Occupations (#223212; inserted as a filter) and by the filter "meets in SUS", considering a simple average between the months of January, June and December, without restricting the type of service or level of health care, acting as a proxy measure. Regarding the radical endodontic treatments evaluated, pulpctomies in deciduous or permanent teeth (including retreatment procedures) performed by dental surgeons specialized in Endodontics were considered.

The codes used to identify and group them in the SIA/SUS were: # 0307020037 (ENDODONTIC TREATMENT OF PRIMARY TOOTH), # 0307020061 (ENDODONTIC TREATMENT OF PERMANENT TOOTH UNIRADICULAR), # 0307020045 (ENDODONTIC TREATMENT OF PERMANENT TOOTH BIRADICULAR), # 0307020053 (ENDODONTIC TREATMENT OF PERMANENT TOOTH WITH THREE OR MORE ROOTS), # 0307020100 (ENDODONTIC RETREATMENT OF PERMANENT UNI-RADICULAR TOOTH), # 0307020088 (ENDODONTIC RETREATMENT OF PERMANENT BI-RADICULAR TOOTH) and # 0307020096 (ENDODONTIC RETREATMENT OF PERMANENT TOOTH WITH THREE OR MORE ROOTS).

Data collection was performed between January and April 2023, using the TabNet tool (after qualitative training). The same research collected the data used in the study, following a systematic procedure based on a guideline on the use

of the SIA/SUS to monitor oral health activities¹⁰ and on a study with a similar method¹¹. Considering the population factor, the number of dental surgeons specialized in Endodontics and radical endodontic treatments in each year were described and analyzed in a row and normalized approach for every 100,000 residents in Brazil, to correct the effect of demographic changes over the last 15 years. Productivity was obtained by the simple ratio between the number of procedures and professionals working at the SUS (annual average of radical endodontic treatments performed by dental surgeons specialized in Endodontics).

The collected data were stored in spreadsheets to receive statistical treatment. PAST software (version 4.3, Oslo, Norway) was used to perform statistical analyses, with a significance level of 5% ($\alpha = 0.05$). The Shapiro-Wilk test (W) and the Q-Q plot were used to test the hypothesis of normality of the residues. Durbin-Watson (DW) statistics were used to examine the influence of serial autocorrelation. Data were described by the mean (measure of central tendency) and the standard deviation (measure of variability). Where feasible, minimum and maximum values were presented. The Kruskal-Wallis test was used to compare quantitative variables with non-normal distribution between three independent groups, followed by the Dwass-Steel-Critchlow-Fligner post hoc test. Magnitude (effect size; m) was examined in pairwise comparison by the point-biserial correlation coefficient. Kendall's tau coefficient (τ) was used to examine the significance, meaning and intensity of correlations between quantitative variables

The temporal trend in non-normal data was examined by the Mann-Kendall S coefficient. In the productivity variable, the hypothesis of first-order serial autocorrelation was rejected in all macro-regions and in the national estimate ($p > 0.05$ in all analyzes). After logarithmic transformation into base ten (\log_{10}), taking into

Table 1. Average annual number of dentists specializing in Endodontics who worked at the SUS between 2008 and 2022 in the North and Southeast regions of Brazil (2023).

Variable	North region		Southeast region	
	Quantitative	Quantitative /100.00 residents	Quantitative	Quantitative /100.00 residents
Mean estimate	125	0,71	690	0,81
Standard deviation (\pm)	14,6	0,04	58,8	0,04
Minimum (year)	93 (2008)	0,58 (2008)	559 (2008)	0,69 (2008)
Maximum (year)	147 (2022)	0,78 (2021)	766 (2022)	0,86 (2022)
S	90	50	92	84
p	< 0,001*	0,014*	< 0,001*	< 0,001*
Trend	Growing	Growing	Growing	Growing

S: Mann-Kendall S statistic. *: statistically significant p (<0.05).
Source: Ministry of Health (Brazil) - Department of Informatics of the Unified Health System (DATASUS).

Table 2. Average annual number of radical endodontic treatments performed by dentists specializing in Endodontics who worked at the SUS between 2008 and 2022 in the North and Southeast regions of Brazil per 100,000 residents.

Variable	North region		Southeast region	
	Quantitative	Quantitative /100.00 residents	Quantitative	Quantitative /100.00 residents
Mean estimate	40.784	234	225.517	256
Standard deviation (\pm)	13.645	73,4	180.720	200
Minimum (year)	24.113 (2021)	128 (2021)	65.506 (2020)	74 (2020)
Maximum (year)	81.783 (2022)	431 (2022)	779.224 (2022)	803 (2022)
S	-19	-29	61	58
p	0,373	0,165	0,002*	0,004*
Trend	Estacionária	Estacionária	Crescente	Crescente

S: Mann-Kendall S statistic. *: statistically significant p (<0.05).
Source: Ministry of Health (Brazil) - Department of Informatics of the Unified Health System (DATASUS).

account the assumption of normality of the residuals after the Shapiro-Wilk test ($p > 0.05$), the angular coefficients (β_1) were obtained by linear regression using the ordinary least squares method to estimate the temporal trend.^{12,13}

RESULTS

Regarding the projection of residents by the IBGE in the evaluated period, an increase was observed in the North region, from 15,658,112 in 2008 to 18,983,716 in 2022. The same outcome was observed in the Southeast region,

from 80,904,319 in 2008 to 89,589,414 in 2022. In the North region, a gross increase of 3,325,604 residents was projected between 2008 and 2022, representing approximately 21.2%. In the Southeast region, the projected gross increase was 8,685,095 residents, representing an approximate increase of 10.7%. When evaluating the average annual number of dental surgeons specialized in Endodontics who worked at the SUS, Table 1 presents the panorama of the North and Southeast regions of Brazil for every 100,000 residents in each macro-region.

It was observed that both macro-regions presented an increasing temporal trend, pointing to the progressive increase in the gross value and normalized by the population factor over the last 15 years, portraying the statistically significant increase in the number of dental surgeons specialized in Endodontics who worked at the SUS. It is noteworthy that the greater gross increase in the projection of residents in the North region reduced the magnitude of the increase in the analysis normalized by the Mann-Kendall S statistic during the normalized analysis, as well as none of the macro-regions reached the mark of one professional per 100,000 residents. Even so, both macro-regions followed the increasing trend observed nationally in the raw ($S = 100$, $p < 0.001$) and normalized ($S = 92$, $p < 0.001$) analysis in Brazil. Therefore, it is possible to understand that there was an increase in the number of dental surgeons specialized in Endodontics who worked at the SUS in the North and Southeast regions of Brazil.

In addition, there was a statistically significant, positive and weak correlation between the average number of dental surgeons specialized in Endodontics who worked at the SUS in the last 15 years (per 100,000 residents) between the North and Southeast regions of Brazil ($\tau = 0.494$, $p = 0.012$). The same outcome was observed between the North region and Brazil ($\tau = 0.484$, $p = 0.014$). On the other hand, there was a very strong correlation between the Southeast region and

Table 3. Average annual productivity of radical endodontic treatments performed by dentists specializing in Endodontics who worked in the SUS between 2008 and 2022 in the North and Southeast regions of Brazil per 100,000 residents.

Variable	North Region	Southeast Region
Average estimate (annual)	392	317
Standard deviation (\pm)	97,6	233
Minimum (year)	165 (2021)	87 (2020)
Maximum (year)	556 (2022)	939 (2022)
β^1	-0,011	0,030
R^2	0,150	0,256
p	0,144	0,056
Trend	Stationary	Stationary

R^2 : determination coefficient.

Source: Ministry of Health (Brazil) - Department of Informatics of the Unified Health System (DATASUS).

Brazil ($\tau = 0.940$, $p < 0.001$). Comparatively, the quantity of the North region was statistically lower when compared to the Southeast region ($m = 0.835$, $p < 0.001$) and Brazil ($m = 0.862$, $p < 0.001$), which also differed from each other ($m = 0.542$, $p = 0.030$). Thus, it is possible to understand that, despite the advance, the North region has a lower number of dental surgeons specialized in Endodontics who worked at the SUS for every 100,000 residents when compared to the Southeast region and Brazil, whose difference presented a high magnitude. Finally, the Southeast region was also lower than the national parameter, with moderate magnitude.

In 2008, based on the average estimate of professionals and residents, 42.6% of Endodontists who worked at the SUS were in the Southeast region and 7.1% in the North region. In 2022, 37.1% in the Southeast region and 7.1% in the North region. However, evaluating proportionally (%) the national increase, it is observed that the North region showed a stationary trend ($p = 0.268$) and the Southeast region significantly reduced its proportion of professionals in relation to Brazil over the last 15 years ($S = -91$, $p < 0.001$). Still, this scenario is relatively compatible with the population projection in the North and Southeast regions,

in which approximately 8.8% and 41.7% of residents in Brazil are in these macro-regions, respectively.

When evaluating the number of radical endodontic treatments performed by dental surgeons specialized in Endodontics in the SUS, it was observed that 11,330,045 procedures were performed in Brazil, 3,382,767 (approximately 29.8%) in the Southeast region and 611,762 (approximately 5.4%) in the North region between 2008 and 2022. Table 2 and Figure 1 present, respectively, the descriptive and visual overview of this quantity over the last 15 years for every 100,000 residents in each macro-region. It was observed that the North region showed a stationary temporal trend in the raw and normalized analysis, while the Southeast region showed a significantly increasing temporal trend, indicating a progressive increase in the number of radical endodontic treatments performed in this macro-region, either in the raw and normalized analysis.

In addition, unlike the average number of professionals, there was no statistically significant correlation in the number of radical endodontic treatments per 100,000 residents between the North and Southeast regions of Brazil ($p = 0.812$). Both regions were not correlated with Brazil ($p = 0.060$ and $p = 0.082$, respecti-

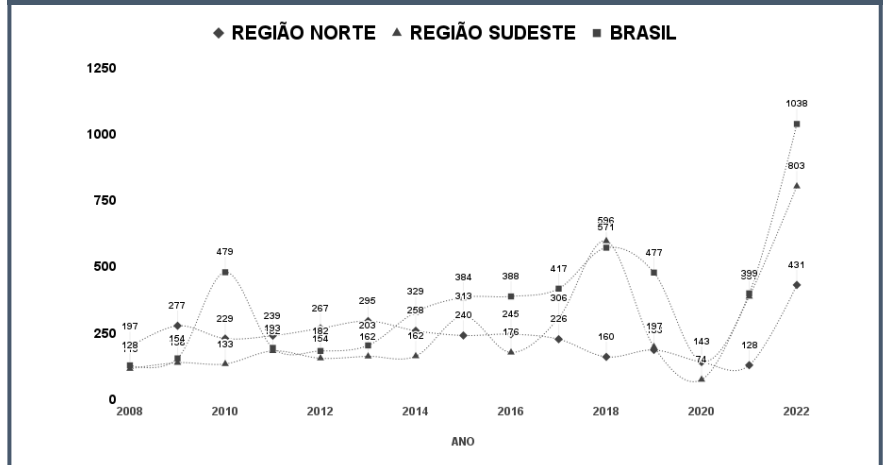
vely). When comparing them quantitatively, there was also no statistically significant difference ($p = 0.425$). This outcome is understandable for the high variability over the last 15 years in this variable.

At last, with regard to the productivity of dental surgeons specialized in Endodontics who have worked at the SUS in the last 15 years, considering radical endodontic treatments, Table 3 and Figure 2 present, respectively, the descriptive and visual panorama of this variable. It is possible to observe that the North region had a higher productivity in the initial years evaluated compared to the Southeast region, showing a decline in 2017. On the other hand, the Southeast region increased its productivity over time, with a significant decline only in 2020. However, there was no statistically significant difference in productivity between them, including the comparison of both with the national estimate ($p = 0.195$). On the other hand, the productivity of the North region was not correlated with that of the Southeast region ($p = 0.920$) or Brazil ($p = 0.532$). Between the Southeast region and Brazil, there was a significant, positive and moderate correlation ($\tau = 0.593$, $p = 0.001$) in productivity.

Although both time trends are stationary, as is the national estimate ($p = 0.056$), it is noteworthy that after removing the productivity of the years 2020 and 2021 (outliers), the time trend of the North region remains stationary ($p = 0.738$), while the Southeast region shows a significantly increasing trend over the last 15 years ($p = 0.002$), as does the national estimate ($p = 0.001$). In addition, it was observed that the number of radical endodontic treatments increased significantly in 2022 in both macro-regions, as well as in Brazil.

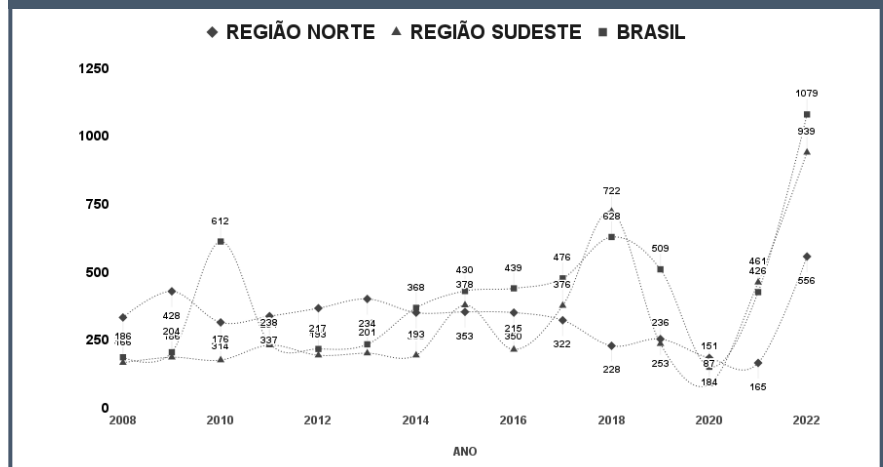
The productivity outcome is a reflection of the behavior related to the number of professionals and procedures performed. In the North region, there was an increase in dental surgeons specialized in Endodontics working in the SUS, but there was no increase in the number of radical endodontic treatments performed by them, causing a stationary productivity with a negative angular coefficient (remaining after the removal of outliers related to the years 2020 and 2021). In the Southeast region and in Brazil, in addition to the increase in professionals, there was an increase in the number of procedures, resulting in a stationary productivity with a positive angular coefficient in a first analysis.

Figure 1. Average annual number of radical endodontic treatments performed by dentists specializing in Endodontics who worked at the SUS between 2008 and 2022 in the North and Southeast regions of Brazil per 100,000 residents.



Source: Ministry of Health (Brazil) - Department of Informatics of the Unified Health System (DATASUS).

Figure 2. Average annual productivity of radical endodontic treatments performed by dentists specializing in Endodontics who worked in the SUS between 2008 and 2022 in the North and Southeast regions of Brazil per 100,000 residents.



Source: Ministry of Health (Brazil) - Department of Informatics of the Unified Health System (DATASUS).

After the removal of the outliers, in a secondary analysis, it was observed that there would be an increasing productivity when disregarding the data for the years 2020 and 2021.

DISCUSSION

This study evaluated access to Endodontist and radical endodontic treatment

by SUS users in the North and Southeast regions of Brazil in the last 15 years. The first alternative hypothesis examined (H1) was fully accepted, since there was a significantly increasing temporal trend in the raw and normalized values (per 100,000 residents) of dental surgeons specialized in Endodontics working at SUS in both macro-regions between 2008 and 2022. The second (H2) was partially accepted, since there was no significant temporal trend in the number of radical endodontic treatments performed by dental surgeons specialized in Endodontics who worked at the SUS between 2008 and 2022 in the North region, only in the Southeast region. The third (H3) was rejected, since there was no increasing temporal trend in productivity related to radical endodontic treatments performed by dental surgeons specialized in Endodontics in SUS in the North and Southeast regions of Brazil.

It is important to note that the behavior of the Southeast region was correlated with that of Brazil in relation to professional quantity and productivity. In addition, the number of dental surgeons specialized in Endodontics who worked at the SUS per 100,000 residents was significantly lower in the North region when compared to the Southeast region and Brazil (influenced by the significant increase in the projection of residents between 2008 and 2022), although the mark of one professional per 100,000 residents was not reached in any of them.

In the first analysis, it is important to recognize that the advance in the number of Endodontists attending SUS in the North and Southeast regions is an important perspective. With data from 2014, Rios and Colussi (2019) reported that the North region was the macroregion with the lowest number of CEOs in the country (6%), presenting the worst relationship between the number of CEOs and active dental surgeons per resident compared to the other regions. In addition, the North region presented the worst scenario in relation to the adequacy of the minimum specialties. Regarding the Southeast region, the authors observed that it was the second largest holder of CEOs in the country (36%).



On the other hand, it had the largest resident population among Brazilian macro-regions, although the concentration of professionals and specialties working in CEOs is better when compared to other regions, such as the North of Brazil¹⁴.



The advances demonstrated here may suggest an advance in such parameters evaluated in 2014.

In addition, a previous study (2012) reported that only 54.5% and 40.4% of CEOs in the North and Southeast region met the goals related to Endodontics in secondary oral health care, respectively. In the same study, 66.7% and 49.4% of the CEOs of these regions were categorized as very poor, poor and regular in the evaluation of productivity performance reported in the SIA/SUS, respectively¹⁵. Thus, it is reasonable to understand that the scenario demonstrated in our approach suggests the need to reassess these parameters in recent years in the North and Southeast of Brazil, hypothesizing that the significant increase in the number of Endodontists and their procedures in the SUS may influence the performance criteria by specialties in this region of Brazil, producing a different panorama of the evaluations in 2012 and 2014 mentioned^{14,15}.

It is important to consider that the implementation of CEOs is a relatively recent measure in Brazil, considering that the National Oral Health Policy (PNSB) was launched in 2004 by the Ministry of Health. With the national guidelines, CEOs and their specialties must be guided by the demand that is not met by Primary Health Care (PHC), based on reference and counter-reference systems, reducing spontaneous demand. Nonetheless, there is no effective consolidation of these systems, and the criteria for evaluating the productivity of specialists, such as Endodontists, still need to be adjusted, especially the need to be guided by the epidemiological profile of the population enrolled in the territory^{6,16}.

In addition, there is no minimum number of specialists who worked at the SUS for each consolidated epidemiological and demographic scenario. Therefore, it is possible to question whether the number of dental surgeons specializing in Endodontics who work in the North and Southeast regions of Brazil, even if increasing in the last 15 years, is sufficient for the demands of the resident population

and has positively impacted productivity goals. This questioning is supported, in the light of the evidence, by the perspective that productivity targets in the Endodontics area were unsatisfactory at the national level for most CEOs in 2012 and 2014^{14,15}, ten years after the launch of the PNSB in Brazil.

The increase in the number of radical endodontic treatments performed by dental surgeons specialized in Endodontics in the Southeast region is also an important perspective, especially when we hypothesize that the increase in the number of these professionals working at the SUS would not directly imply this outcome. It is important to consider that dental treatment has costs and recent economic crises negatively impact access to it with individual resources (private sector), increasing the burden on the public sector by users of health systems around the world, such as SUS in Brazil, in addition to being associated with the reduction of oral health indicators*.

It is known that radical endodontic treatment has evolved in recent years, but there is a significant associated cost to perform it, whether in the public or private sector¹⁹. From this perspective, it is hypothesized that such an increase in the number of procedures may result, among other factors, in the impossibility of accessing private oral health services due to the reduction in purchasing power in recent years. On the other hand, the North region, which did not have an increasing temporal trend, had significant barriers in accessing dentistry at the SUS, including difficulties in scheduling appointments and high waiting time to access specialists, with the lowest frequency of users who did not go to the dentist in relation to the other macro-regions of the country²⁰, in addition to the lower number of Endodontists working at the SUS in relation to the Southeast and Brazil, as demonstrated in this study.

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When understanding such outcomes, it is also worth considering that the occurrence and prevalence of oral health conditions that may require radical endodontic treatments (e.g. caries and dentoalveolar trauma) have different dynamics in the Brazilian territory, whether at the micro- or macro-regional level.”

Socioeconomic status, education, sex and age group, in addition to access to oral health services, present disparities between regions of Brazil, triggering a heterogeneity of oral health needs^{21,22}. Thus, it is possible that the need for endodontic treatment (ENT) may be distinct between them. However, the NTE was not systematically evaluated and measured in

the Brazilian regions. In parallel, it is also possible that efforts to replace the “mutilating” culture by the adoption of increasingly efficient restorative and rehabilitative therapies encourage the population to seek endodontic treatments more frequently, avoiding radical conducts, such as tooth extraction

At last, there was a sharp decline in the number of radical endodontic procedures and the productivity of Endodontists between 2020 and 2021, years strongly associated with the negative effects of the COVID-19 pandemic¹¹, in addition to the significant increase in 2022 (two years after the beginning of the restrictive measures). Oral health in SUS was strongly impacted by the measures adopted to deal with the pandemic context in the dental environment, such as the suspension of elective procedures and reduction of aerosol generation. It is possible that this measure, together with the users' fear of seeking health services, were the main drivers for the reduction in the number of endodontic procedures observed in the pandemic period^{24,25}. As a consequence, it is reasonable to hypothesize that unsupplied demands during this period are triggering a higher NTE in SUS in the North and Southeast regions of Brazil today, which also requires systematic investigations.

It is important to consider the limitations of the present study when applying the results and perspectives discussed. The number of specialists in Endodontics who worked at the SUS was recovered by the CNES. Therefore, professionals without the official registration of the specialty can influence the outcome reported here. In parallel, no restrictions were made in relation to the type of service or level of health care in which the Endodontists worked, including CEOs and others linked to SUS. In addition, it is possible that there is some degree of underreporting of the amount of radical endodontic treatments in deciduous and permanent teeth, since they depend on the adequate completion of the Outpatient Production Bulletin (BPA) by he-

alth services. In the future, new studies may continue to monitor access to the specialist in Endodontics and its procedures, correlating them with local oral health indicators.

CONCLUSION

It is possible to conclude that there was an increase in the number of Endodontists working at the SUS in the

North and Southeast regions in the last 15 years. However, only the Southeast region showed a significant increase in the amount of radical endodontic treatments in primary or permanent teeth performed by these professionals. The relationship between the number of procedures per professional (productivity) remained stationary in both macro-regions.

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