



Descriptive analysis of the production of occlusal devices for the treatment of Temporomandibular Disorder by the Brazilian public health system

Análise descritiva da produção de dispositivos oclusais para tratamento da Disfunção Temporomandibular pelo Sistema Único de Saúde

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ABSTRACT

BACKGROUND AND OBJECTIVES: Temporomandibular dysfunction (TMD) has a significant prevalence in the population, and many individuals with this dysfunction depend exclusively on the Brazilian public health system (SUS). Thus, the aim of this study was to analyze the production of occlusal devices (ODs) as treatment for TMD, offered to SUS users from 2014 to 2023.

METHODS: Secondary data from the SUS Outpatient Information System (SIASUS) were used and tabulated using the TAB software for Windows (TabWin), using code 0701070072 (occlusal splint). Information was collected on the quantity and total cost of production of ODs in Brazil and grouped into the variables states, geographic regions, sex and age. The data were presented descriptively.

RESULTS: A total of 26,006 ODs were produced in the country over between the years 2014 and 2022, representing a total cost of R\$612,181.24. Most ODs (76%) were intended for female patients with an average age of 41.23 years. The states of São Paulo and Ceará had the highest production, while some states had no records. The production of ODs varied over the 10 years analyzed, with a large reduction during the COVID-19 pandemic period and a resumption from 2022 onward.

CONCLUSION: The data suggest insufficient production of ODs, which constitute one of the most common therapeutic modalities for TMD. Discrepancies between states demonstrated concentration in some regions and lack of access in others. The implementation of specific public health policies for this dysfunction could expand access for SUS users and reduce regional inequalities.

KEYWORDS: Costs and cost analysis, Dental health services, Temporomandibular joint dysfunction syndrome, Unified Health System.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A disfunção temporomandibular (DTM) apresenta significativa prevalência na população e muitos indivíduos com esta disfunção dependem exclusivamente do Sistema Único de Saúde (SUS). Assim, objetivou-se analisar a produção de dispositivos oclusais (DOs) como tratamento da DTM, ofertados a usuários do SUS no período de 2014 a 2023.

MÉTODOS: Foram utilizados dados secundários provenientes do Sistema de Informações Ambulatoriais do SUS (SIASUS) e tabulados através do programa TAB para Windows (TabWin), utilizando o código 0701070072 (placa oclusal). Coletou-se informações sobre a quantidade e o custo total da produção de DOs no Brasil e esses dados foram agrupados nas variáveis estados, regiões geográficas, sexo e idade. Os dados foram apresentados de forma descritiva.

RESULTADOS: Foram produzidos 26.006 DOs entre os anos de 2014 e 2023, representando um custo total de R\$ 612.181,24. A maioria dos DOs (76%) foram destinados a pacientes do sexo feminino e com idade média de 41,23 anos. Os estados de São Paulo e Ceará apresentaram maior produção, enquanto alguns estados não tiveram registro. A produção de DOs sofreu variações ao longo dos 10 anos analisados, com uma grande redução durante a pandemia da COVID-19 e retomada da produção a partir de 2022.

CONCLUSÃO: Os dados sugerem produção insuficiente de DOs, uma das modalidades terapêuticas mais comuns para DTM. Discrepâncias entre os estados demonstraram concentração em algumas regiões e carência de acesso em outras. A implementação de políticas públicas de saúde voltadas para esta disfunção poderia ampliar o acesso aos usuários do SUS e reduzir as desigualdades regionais.

DESCRIPTORES: Custos e análise de custo, Serviços de saúde bucal, Síndrome da disfunção da articulação temporomandibular, Sistema Único de Saúde.

HIGHLIGHTS

The production of occlusal devices in SUS, Brazilian public health system, has been concentrated in a few states, with no records in others

The occlusal device has been produced mainly for female patients

Public policies need to be implemented in order to increase access to treatment for Temporomandibular Dysfunction and Orofacial Pain and reduce regional inequalities

INTRODUCTION

Temporomandibular disorder (TMD) is a general term used to describe pain and dysfunction of the masticatory muscles, the temporomandibular joint (TMJ) and other associated structures¹. Physical, behavioral and social factors may act as triggering, perpetuating and/or predisposing agents², defining TMD as a condition with a complex and multifactorial etiology²⁻⁴. Among the main etiological factors are stress, anxiety, parafunctional habits, trauma and systemic conditions⁵⁻⁷. Therefore, its symptoms are also varied, including orofacial pain, TMJ clicking, joint hypomobility, ear pain, neck pain, abnormal mandibular function and joint immobility^{5,8}.

As for the epidemiology, it is estimated that the prevalence of TMD in the general population is around 10%-15%¹, with a higher frequency among individuals aged 20-40 and a higher prevalence among females^{6,9-11}. The prevalence of TMD has also been assessed in users of SUS (Brazil's public "Unified Health System")^{4,6,12}. Studies based on anamnesis questionnaires showed that the prevalence of TMD symptoms varied between 55.6%⁴ and 67.2%⁵. Reference authors⁶, using Axis I of the Research Diagnostic Criteria for TMD (RDC/TMD) in a sample of 100 users of Family Health Units (USF - *Unidades de Saúde da Família*), diagnosed TMD in 42% of the participants, with myofascial pain being the most prevalent diagnostic subgroup (14%). Another study, conducted with 1,643 users of Basic Health Units (UBS - *Unidade Básica de Saúde*) and USFs, using the same diagnostic instrument, showed that 36.2% of the population evaluated had some degree of chronic pain related to TMD and 5.1% had pain-related disability, with 29.5% having muscle disorders, 7.9% disc displacements and 39.1% other joint disorders¹².

It has been shown that the signs and symptoms of TMD, especially those related to pain, have a negative impact on the physical and mental well-being of affected individuals^{4,13-16}. Thus, taking into account its high prevalence and the negative impact on quality of life, TMD must be considered a relevant public health condition⁴, and health economic evaluation studies should be carried out in order to measure the costs and impacts of incorporating different technologies to treat this dysfunction in the context of SUS¹⁷.

For the treatment of TMD, conservative and reversible therapies are initially proposed^{18,19}, as they show results that are as effective as more invasive approaches²⁰. These conservative therapies include education and counseling, physiotherapy, pharmacological therapy, psychological intervention, photobiostimulation and occlusal devices (ODs), which can be used alone or in combination, and all of which can be used in Primary Health Care (APS - *Atenção Primária à Saúde*)²¹.

Among the various therapeutic possibilities, the manufacture of DOs is still one of the most widely used modalities^{22,23}, including in public health services^{21,24}. Their main advantages are low cost, simple manufacture and reversibility²⁵⁻²⁷. They are usually made of rigid materials: stabilizing OD or anterior repositioning OD type, depending on the individual's diagnostic subgroup^{2,21}. Both devices must have adequate thickness, so as not to interfere with the vertical dimension of occlusion or the free functional space

and have a smooth surface, ensuring comfort and allowing the antagonist teeth to slide^{21,28}.

Despite the above, the effectiveness of ODs for the treatment of TMD is still uncertain. A systematic review showed no evidence that ODs can reduce TMD-related pain or tooth wear associated with bruxism²⁹. Another systematic review, which gathered data from 57 randomized clinical trials and nearly 3000 participants, showed that ODs can reduce muscle pain during chewing compared to no treatment, but the certainty of the evidence was very low. In addition, it was demonstrated with very low certainty of evidence that the use of ODs was no better than other therapies or no treatment for the outcomes of self-reported joint pain, muscle pain at rest, severity of pain, and frequency of joint noise. The authors of the review concluded by emphasizing the need for new studies with adequate methodological design and number of participants, and with long-term follow-up (3 to 5 years)³⁰.

Thus, the present study's objective was to analyze and describe the national production of ODs in the context of SUS over a 10-year period, evaluating variables such as the number of devices produced, the amount spent (in Brazil's currency, *reais*), gender and age of the patients for whom they were made. This treatment was selected because it is one of the most commonly used therapies for TMD and because of the availability of its registration/code in SIGTAP (Management System for the SUS Table of Procedures, Medicines and Orthoses, Prostheses and Mobility Assistive Devices or *Sistema de Gerenciamento da Tabela de Procedimentos, Medicamentos, e OPM*), allowing the calculation of the amounts passed on by the federal government to the municipalities that produced ODs. Other therapies do not have specific codes that allow them to be directly associated with procedures related to TMD or Orofacial Pain, making it difficult to analyze costs using aggregate data¹⁷.

The aim is to reveal a current panorama of the Brazilian population's access to this treatment modality for TMD in public health services, as well as helping other researchers and health managers to propose improvements in the provision of services.

METHODS

Study design

This study is characterized as a descriptive research, based on the analysis of secondary data extracted from the SUS Outpatient Information System (SIASUS - *Sistema de Informações Ambulatoriais do SUS*).

Data collection

Data was collected using the TAB software for Windows (TabWin), developed by DATASUS - the SUS Information Technology Department. Initially, the data on Outpatient Production was downloaded from SIASUS for all Brazilian states for the period 2014 to 2023 (10 years), available on the DATASUS file transfer page³¹.

The data was then transferred to the TabWin software, allowing the following information of each state to be collected: the number of ODs produced, the amount spent on making these devices, as well as the gender and age of the patients for whom they were intended.

The tabulation process in TabWin consisted of loading the .DEF file and extracting the Outpatient Production data for each Brazilian state. The data was presented in table format, made up of rows, columns and increments. In the rows, the option “procedures performed” was set; in the columns, the variables “gender” and “age” were selected; and in the increment, the options “frequency” and “approved value” were alternated.

The code 0701070072, associated with the ODs, was used to identify the data of interest in the table. The presence of inconsistencies and duplicates was assessed. After analysis, no data referring to the production of ODs was excluded.

Data analysis

The tables produced in the TabWin software were exported to Microsoft Excel. The data relating to the number of ODs and costs over the 10-year period was then evaluated in its entirety and grouped by gender, age, Brazilian states and geographic regions, and presented descriptively using absolute and relative frequencies.

RESULTS

Analysis of the SIASUS data revealed a total of 26,006 ODs produced in the country over the 10-year period (2014 to 2023). The states of Ceará and São Paulo produced the most ODs (8,595 and 8,436, respectively), concentrating around 65.45% of the total production (Figure 1 and Table 1).

An analysis of the production of ODs by region revealed that the Southeast was the region that produced the most devices, with 13,060 devices made, followed by the Northeast, with 9,261. The South came third, with 2,766 devices made, while the North and Midwest recorded the lowest production, with 594 and 325 devices, respectively (Figure 2).

Table 1 shows that the total cost of producing ODs was R\$612,181.24. The states of Ceará and São Paulo had the highest costs, at R\$202,326.30 and R\$198,583.44 respectively. On the other

Table 1. Values spent (in reais) on the production of ODs for each Brazilian state between 2014 and 2023.

States	Quantity	Value (R\$)
Acre	0	0
Alagoas	0	0
Amapá	65	1530.10
Amazonas	94	2212.76
Bahia	99	2330.46
Ceará	8595	202326.30
Distrito Federal	258	6073.32
Espírito Santo	83	1953.82
Goiás	67	1577.18
Maranhão	8	188.32
Mato Grosso	0	0
Mato Grosso do Sul	0	0
Minas Gerais	3137	73844.98
Pará	433	10192.82
Paraíba	138	3248.52
Paraná	1761	41453.94
Pernambuco	414	9745.56
Piauí	0	0
Rio de Janeiro	1404	33050.16
Rio Grande do Norte	6	141.24
Rio Grande do Sul	754	17742.16
Rondônia	0	0
Roraima	2	47.08
Santa Catarina	251	5908.54
São Paulo	8436	198583.44
Sergipe	1	23.54
Tocantins	0	0
Total	26006	612181.24

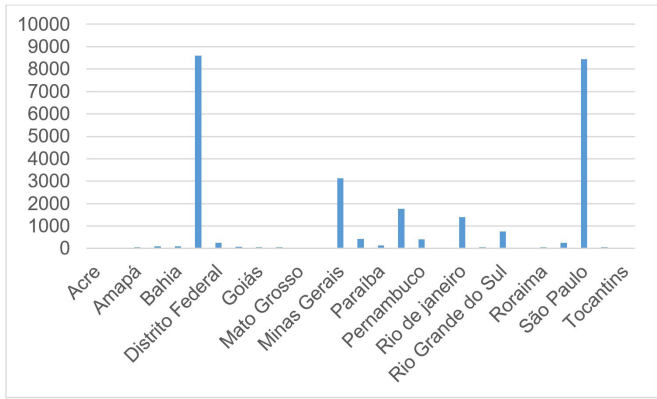


Figure 1. Number of occlusal devices produced for each Brazilian state between 2014 and 2023.

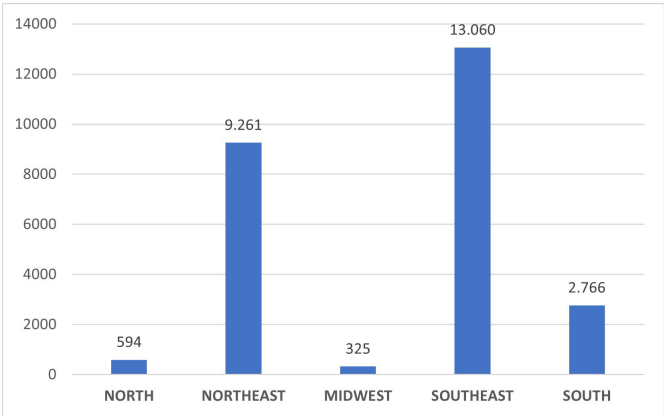


Figure 2. Number of occlusal devices for each Brazilian geographic region from 2014 to 2023.

hand, the states of Acre, Alagoas, Mato Grosso, Mato Grosso do Sul, Piauí, Rondônia and Tocantins had no registered production and, consequently, no costs for making ODs in the period evaluated.

The distribution of the number of ODs produced by gender is shown in Figure 3. It can be seen that 76% of the ODs produced in the analyzed period were for female patients. The mean age of patients who received ODs was 41.23 years.

Analysis of the annual production of ODs showed variations over the 10-year period considered. The year 2020 had the lowest registered production, with 1,400 devices, followed by 2021, with 1,967 devices made. After 2021, there was an increase in the production of ODs, with 2023 being the year with the highest number of devices produced (3,295) (Figure 4).

DISCUSSION

Based on secondary data recorded in SIASUS, in the period from 2014 to 2023 (10 years), around 26,000 ODs were produced in Brazil, representing a total cost of around R\$612,000, which was passed on by the federal government to the states.

SIASUS is important in the planning, programming, regulation and evaluation of outpatient care provided by SUS. In addition,

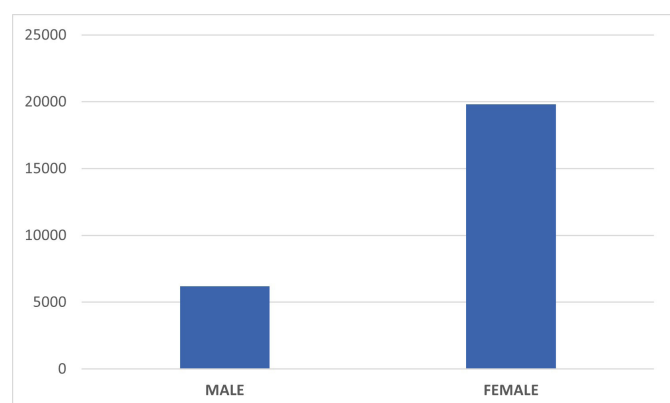


Figure 3. Number of occlusal devices by gender between 2014 and 2023.

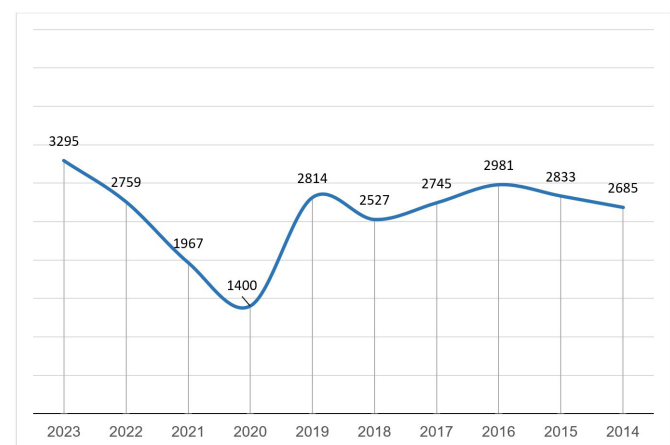


Figure 4. Number of ODs produced per year from 2014 to 2023.

it supports the General Programming of Health Actions and Services (*Programação Geral das Ações e Serviços de Saúde*) processes, providing essential information for monitoring and analyzing expenses on outpatient care. It also provides valuable input for the qualitative and quantitative evaluation of health actions, contributing to better decision-making and the continuous improvement of the public health system³².

According to information from the 2019 National Health Survey (PNS - *Pesquisa Nacional de Saúde*), around 150 million Brazilians depended exclusively on the SUS for access to health treatment³³. Thus, it is essential that prevalent diseases and conditions such as TMD receive special attention from health managers in order to ensure adequate access to diagnostic, treatment and prevention services. However, present results showed a low production of ODs in Brazil, which are one of the most common treatment modalities for TMD²²⁻²⁴.

These data have clinical relevance, as TMD has a significant impact on quality of life, especially the subgroups of diagnoses related to pain^{4,13-16,34}. In addition, recent studies have shown that the disorder can have a significant impact on health systems and loss of productivity³⁵⁻³⁷, especially associated with presenteeism³⁶, in which workers experience a reduction in productivity due to their health condition³⁸.

When comparing the number of ODs produced by geographic region, there is a significant difference between them, with the highest production recorded in the Southeast, summing up 50.26% of the total. According to data from the 2022 demographic census, the Southeast is home to approximately 41.8% of the Brazilian population, as well as to three of the most populous states in the country: São Paulo, Minas Gerais and Rio de Janeiro³⁹. This data may justify the high quantity of ODs produced in this region. On the other hand, the Midwest region had the lowest production of ODs, with only 1.25% of the total. This can be explained by the fact that it is the least populous region in Brazil, comprising around 8% of the total population³⁹.

As for the Northeast region, despite being the area of the country with the second highest percentage of production (35.62%), this production was concentrated, with the state of Ceará accounting for 92.81% of the total. The low production of ODs observed in most of the other northeastern states contrasts with the high prevalence of TMD reported in two studies carried out with a sample of the population from this region^{4,6}.

The production of ODs in the South was registered in all three states, but unevenly, with Paraná accounting for the largest share. The same situation can be seen when analyzing production data from the North, where Pará accounted for 72.90% of total production in this region, while the other three states had no records.

This inequality in the production of ODs in various Brazilian states may indicate the absence of a structured network of care for patients with TMD and Orofacial Pain in the country. This is important, as recent studies have shown a high prevalence of this dysfunction in the population^{4-6,12,40}, and a significant percentage of individuals with TMD show a need for treatment⁴. These patients need to have access to adequate care and treatment guaranteed in public health services. It is therefore necessary to draw up public policies that promote comprehensive care for patients with TMD,

such as training Primary Health Care (APS - *Atenção Primária à Saúde*) professionals to enable these patients to be received and treated initially in APS and the structuring of a secondary and tertiary care network to receive refractory patients and/or those with more complex conditions^{21,41}.

In addition, a recent study sought to assess the level of knowledge of APS dental surgeons about TMD and Orofacial Pain, and found limited knowledge related to these conditions, as well as difficulties in referring these patients to specialized services⁴². This finding may help to explain the low production of ODs in various areas of the country, since limited knowledge of the condition can lead to a lack of, or referral to, appropriate treatment. The study also revealed that the majority of dental surgeons did not know of any public services for referring TMD patients, and the majority of oral health managers confirmed that these services did not exist in their towns, which suggests a shortage of specialized TMD and Orofacial Pain services in the SUS referral system.

The present study results indicated that the majority of ODs (76%) were made for female patients. This shows that women were the ones most affected by TMD, or at least the ones who sought treatment the most. This finding is in line with what is described in the literature about the higher prevalence of TMD in women^{40,43,44}. The possible causes of this dysfunction's predilection for females range from fluctuations in estrogen levels⁴⁵ to greater susceptibility to psychosocial distress, one of the triggers for TMD⁹.

Another interesting variable in the study was the age of the patients who received ODs. In order to compare the mean age of these patients with the means reported in other studies, a simple arithmetic mean was calculated using the ratio between the sum of the patients' ages and the total number of patients who got ODs treatments. In this study, the mean age was 41.23 years. This value was very similar to that described in previous studies^{6,10,46}.

The low cost of making ODs is one of their main advantages as initial treatment for signs and symptoms of TMD²⁵. When analyzing the amount approved by SUS for the manufacture of ODs, it was found that the total amount invested over 10 years was R\$612,181.54. The average unit value of each device was R\$23.54, apparently remaining fixed over the last decade. This was verified through calculations that considered the amount spent in each state, annually, divided by the number of devices produced.

However, a recent study found that although ODs are part of the list of offered procedures, the cost of making these devices, including materials and professional salaries, is a lot higher than the amount passed on by the federal government (R\$149.81)⁴². This may explain the lack of production in many Brazilian municipalities and states, as municipal governments have to bear most of the costs of ODs production. An increase in the percentage of funding from the federal level could encourage the implementation of public services for the treatment of TMD, with a larger transfer for the production of ODs and the establishment of codes and values for other treatment modalities¹⁷.

Another point of interest in the research was the evaluation of the production of ODs on an annual basis, in order to identify possible variations in the volume of production over the years. This study showed that until 2020, the production of ODs maintained similar values, but diminished dramatically in the year of the

COVID-19 pandemic, registering the lowest production of these devices among the ten years analyzed. In the following year (2021), production increased subtly, but was still the second lowest.

The COVID-19 pandemic, which occurred in 2020, has drastically altered the dynamics of health service and the daily lives of most of the world's population. In that period, many elective services were suspended, including dental services, during the beginning of the lockdown, mobilizing the entire workforce in actions to contain COVID-19. In addition, TMD was not included in the definition of an emergency, so many patients were unable to seek treatment for this dysfunction⁴⁷. This conjecture may justify the lower production of ODs in 2020 and 2021.

On the other hand, the sudden change in daily life and social isolation has negatively affected many people. A study from 2020 carried out simultaneously in Israel and Poland, through online questionnaires, identified that the pandemic has significantly affected the psycho-emotional state of the population in these countries, which could result in the intensification of TMD and Orofacial Pain symptoms⁴⁸. Due to the magnitude of the COVID-19 pandemic and its global consequences, it is possible that the results observed in the present study can also be expected in other countries, such as Brazil. Supporting this possibility, a study carried out in the country using online questionnaires suggested an increase in cases of Orofacial Pain during the health crisis⁴⁹.

The impacts caused by the pandemic may be related to the gradual increase in the production of ODs after 2020, with 2023 being the year of the largest production. Thus, it is likely that the coming years will also see an increase in the production of these devices, possibly driven by the greater demand for TMD treatments, an indirect reflection of the pandemic.

Study limitations

As this is a survey based on information previously recorded in the SIASUS, the results end up being extremely influenced by the correct and continuous feeding of this system. SIASUS data is fed through information processed by municipal and state health departments, referring to outpatient care provided by public and private providers contracted or agreed to by SUS. The continuous entry of outpatient production data into SIASUS is mandatory and is provided for by Ordinance SAS/SE/MS No. 49 of July 04, 2006⁵⁰. Thus, it is to be expected that the data was up-to-date and accurately reflected SUS outpatient production, guaranteeing the reliability of the information relating to the procedure of interest. However, it is worth noting that there may be flaws in the way the system is fed, which could result in distortion of the obtained data.

Moreover, the analysis considered only one of the several treatment options available for TMD: ODs. Therefore, it was possible to show an overview of the population's access to this specific type of treatment, which is one of the most commonly performed, including in public health services.

Knowing that there are several conservative treatments available²¹, further research is needed to elucidate the scope of different types of TMD treatment offered by SUS. In this way, by expanding knowledge about these options, it will be possible to better comprehend the real needs of the population and more

efficiently direct public health policies and think about organizing a network of care for patients with TMD and Orofacial Pain in the country.

CONCLUSION

Analysis of the data on the production of ODs in SUS over a 10-year period revealed insufficient production of this treatment modality, as well as low financial investment. This data is important because ODs are still one of the most widely used options for treating TMD, a condition with a high prevalence in Brazil.

Inequality in production was observed between the states, with a few concentrating most of the devices manufactured. The majority of ODs were produced for female patients, with a mean age of 41.23 years. Production was not linear during the period analyzed, with a sharp drop in 2020 and 2021, followed by an upward trend in the years following the COVID-19 pandemic.

This panorama suggests a lack of access to this therapeutic modality in various locations of the country, which highlights the need for better planning of public health policies in this area, with a focus on expanding access to TMD treatment for SUS users and reducing regional inequalities.

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