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Coverage of vestibular/otoneurological tests in outpatient services of the Brazilian Unified Health System: analysis from 2012 to 2022

Cobertura de testes vestibulares/otoneurológicos nos serviços ambulatoriais do Sistema Único de Saúde no Brasil: análise de 2012 a 2022

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ABSTRACT

Purpose: To estimate the coverage of vestibular/otoneurological testing within the Brazilian Unified Health System (SUS). **Methods:** This epidemiological, exploratory, mixed ecological study analyzed data at the national, regional, state, and capital levels across calendar years. Coverage of vestibular/otoneurological procedures performed between 2012 and 2022 was estimated using secondary data from the Outpatient Information System (SIA-SUS) to obtain the number of procedures performed (code 02.11.07.035-1), from the Brazilian Institute of Geography and Statistics (IBGE) to obtain population data, and from the National Supplementary Health Agency (ANS) to identify the population covered by private health insurance. Coverage was calculated considering the population aged 15 years or older without private health insurance. **Results:** Coverage increased by 33.3% in Brazil over the study period. The Central-West region showed the highest coverage (50.5 per 100,000 inhabitants in 2021), whereas the Northeast presented the lowest (2.3 per 100,000 inhabitants in 2020). Only 12 federative units (44.4%) performed the procedures every year, with Goiás showing the highest coverage (107.7 per 100,000 inhabitants in 2021). Among state capitals, 44.4% did not perform the procedure in at least one year. **Conclusion:** Coverage of vestibular testing in Brazil remains low, with marked regional disparities and limited progress over the 10-year period, highlighting barriers to access and the need to expand service availability.

Keywords: Vestibular function tests; Health Information Systems; Ambulatory care; Unified Health System; State health care coverage

RESUMO

Objetivo: estimar a cobertura de testes vestibulares/otoneurológicos do Sistema Único de Saúde. **Métodos:** estudo epidemiológico, exploratório, de desenho ecológico misto, no qual as unidades de análise foram Brasil, regiões, Unidades da Federação, capitais e ano-calendário. Foi estimada a cobertura de procedimentos de testes vestibulares/otoneurológicos entre 2012 e 2022. Utilizaram-se dados secundários do Sistema de Informações Ambulatoriais, para obtenção do número de procedimentos realizados (código 02.11.07.035-1); do Instituto Brasileiro de Geografia Estatística, para obtenção da população residente e da Agência Nacional de Saúde Suplementar, para identificação da população beneficiária de planos de saúde. A cobertura foi estimada considerando a população não coberta por plano de saúde com idade igual ou superior a 15 anos. **Resultados:** no Brasil, a cobertura apresentou aumento de 33,3% no período; nas regiões, a Região Centro-Oeste apresentou maior cobertura (50,5/100.000 habitantes em 2021); já a Região Nordeste, a menor cobertura (2,3/100.000 habitantes em 2020). Apenas 12 Unidades da Federação (44,4%) realizaram os testes em todos os anos, sendo Goiás o estado com maior cobertura (107,7/100.000 habitantes em 2021). Entre as capitais, 44,4% não realizaram o procedimento em pelo menos um dos anos. **Conclusão:** a cobertura de testes vestibulares no Brasil é baixa, com disparidades regionais e pouco avanço em dez anos, evidenciando barreiras ao acesso e necessidade de ampliação da oferta.

Palavras-chave: Testes de função vestibular; Sistemas de Informação em Saúde; Assistência ambulatorial; Sistema Único de Saúde; Cobertura de serviços públicos de saúde

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INTRODUCTION

Body balance is maintained by combining the function of three systems: proprioceptive, visual, and vestibular. The latter, formed by central and peripheral structures, detects head movements to adjust body position. When the integration of the three systems is impaired, signs and symptoms appear, among which dizziness stands out[1].

Dizziness is the main symptom reported by people who experience altered body balance, including various sensations of disturbance, and can be defined as a mistaken perception of body or environmental movement[2]. Changes in body balance can result from various health conditions, such as chronic diseases, external causes, and a decline of the Central Nervous System (CNS), including conditions affecting the vestibular system, like Meniere's syndrome. These health conditions manifest differently among various population groups, with older adults being the most frequently affected[1].

Aging may progressively impair the CNS's ability to process vestibular, visual, and proprioceptive signals, which are responsible for maintaining body balance, and reduce the capacity for adaptive reflex modifications[1]. A representative sample of 1,901 inhabitants of the city of São Paulo in 2012 revealed a 42% prevalence of dizziness in the population[3], including individuals of both sexes aged 18 years or older. Prevalence was calculated as the ratio of individuals who reported dizziness to the total population, to analyze variables such as sex, education level, occupation, and age. The highest prevalence was observed among individuals aged 46 to 55 years (49%), followed by those aged 65 and older (44%). Dizziness impacts the patient's quality of life, affecting their activities of daily living and resulting in social and economic costs for both the individual and the healthcare system[3].

The diagnosis of balance disorders involves various professionals and different tests, highlighting instrumental and non-instrumental tests performed by speech-language-hearing pathologists and otolaryngologists. The currently most widely used instrumental test is generally the vector electronystagmography (VENG), the only procedure with a code available in the Management System of the Table of Procedures, Medications and Orthoses, Prostheses and Special Materials (SIGTAP) of the Brazilian Unified Health System (SUS)[4]. This test evaluates the vestibular function[5] by recording eye movements to capture the corneal-retinal potential with surface electrodes.

Early identification of balance disorders and timely, appropriate treatment prevent adverse outcomes[5], such as falls. Brazil reported 372,000 hospitalizations due to falls among older adults in 2019, with an average length of stay of 4-6 days, 7,529 deaths, a mortality rate of 2.02%, and a total cost of R$ 411,567,761.24[5].

According to the Brazilian National Policy for Specialized Health Care (PNAES), services must be planned, structured, and provided to ensure the coordination and continuity of care[6]. However, finding specialized care can be an exhausting process, leading people to abandon the search. After the patient reports vestibular symptoms, the healthcare professional checks if a vestibular evaluation is recommended and, in that case, a return visit to the same service may be necessary. If the service does not offer such an evaluation due to a lack of equipment or specialists, the patient is referred to another service[7].

Different areas of the health system can develop strategies for preventing balance disorders. Primary healthcare is privileged in this aspect thanks to its guidelines focused on health surveillance, assigned population, longitudinal care, coordinated care, organized networks, prevention, health education, and social participation[5]. Furthermore, the Ministry of Health Ordinance GM/MS No. 635, of May 22, 2023, reinforces that the presence of speech-language-hearing pathologists in primary healthcare, especially in multidisciplinary teams (e-Multi), has proven fundamental for the development of actions focused on hearing and balance health, expanding access to and the effectiveness of these interventions[8].

Efficiency in coordinating and ensuring continuity of care, especially in specialized care, also depends on effective management of patient information, whose records are kept in health information systems. Specifically, specialized care services are recorded in the Outpatient Information System (SIA-SUS), which allows for the monitoring of outpatient procedures within the SUS. In addition, SUS's SIGTAP manages the table of SUS procedures and materials, classifying and controlling resources used in patient care[9]. These systems are fundamental for healthcare planning, as their use enables continuous monitoring of care, analysis of demands, and identification of gaps, aiding evidence-based decision-making and the efficient allocation of resources[10].

This data-driven management is also crucial for speech-language-hearing clinical practice, especially when seeking to promote greater equity in access to health services. Although the literature lacks specific studies on the coverage and access to vestibular/otoneurological tests in the Brazilian public system, it is possible to observe a trend of annual growth in the number of outpatient procedures, with a reduction in 2020 due to the COVID-19 pandemic[4]. The scarcity of studies implies the need to better understand the gaps in the regional distribution of these tests and the impact of barriers to accessing them, thus generating information to better plan policies aimed at fall prevention, a fundamental component for comprehensive and preventive care. Early diagnosis by specialized care is the best approach to reduce the number of hospitalizations and the mortality rates. Hence, this study aimed to estimate the coverage of vestibular/otoneurological testing procedures in outpatient services within the SUS network between 2012 and 2022.

METHODS

The study used secondary data, available on a publicly accessible platform; therefore, submission to the Research Ethics Committee was not required, in accordance with Resolutions of the Brazilian National Health Council No. 466/2012[11] and 674/2022[12]. Nevertheless, it carefully respected all ethical principles involved in the data analysis.

This is an epidemiological, exploratory study with a mixed ecological design (spatial and temporal), whose units of analysis were Brazil, its regions, federative units, and capitals, and the calendar year. The coverage of vestibular/otoneurological testing procedures was estimated for 2012 to 2022.

The study used secondary data from three data sources: SIA-SUS, to obtain the number of vestibular/otoneurological testing procedures; the Brazilian Institute of Geography and Statistics (IBGE), to obtain population data; and the National

Supplementary Health Agency (ANS), to identify the population covered by health plans. These data were obtained through the TabNet of the SUS Department of Information and Informatics (DATASUS), extracted in February 2025. Data sources, location, and period analyzed are described in Chart 1.

According to SIGTAP, procedure 02.11.07.035-1 corresponds to medium-complexity vestibular/otoneurological tests with vector nystagmography, vector electronystagmography, electromyotagmography, and caloric labyrinthine tests with or without electronystagmography recording[9].

The coverage of vestibular/otoneurological testing procedures was estimated per year, region, state, and capital city, calculated using the formula Vest_Cov = (nVest/(PopSUS))X100,000, where "nVest" is the number of approved vestibular/otoneurological tests, and "PopSUS" is the population aged 15 years or older exclusively dependent on the SUS, obtained from the difference between the resident population (PopIBGE) and the population covered by health insurance (PopANS). Although dizziness is more commonly reported by older individuals, vestibular/otoneurological tests can be performed on people of different age groups; however, they are rarely used in children due to the challenges of performing them in this population[13]. Therefore, the age of 15 was chosen as the starting point for analysis.

The proportional variation (PV)[14] was calculated to analyze the variation in coverage through the formula PV = ((CoeffLY-CoeffFY)/CoeffFY)X100, where "CoeffLY" is the coverage coefficient of the last calendar year of the study, and "CoeffFY" is the coverage coefficient of the first calendar year of the study. For regions, states, and capitals without records of the procedure in 2012 or 2022, the PV was calculated considering the first and last year with records.

The temporal trend of the procedures was analyzed using joinpoint regression, which identifies the occurrence of changes in trend patterns and the annual percentage change (APC). Segmented models were fitted for each geographic region, and the statistical significance of the changes in trends was assessed using Monte Carlo permutation tests and APC calculation, at a 95% confidence interval.

The data were organized and analyzed in Excel; the Joinpoint Regression Program software, version 4.8.0.1, was used for trend analysis, and the maps were created in QGIS software.

RESULTS

Altogether, 229,413 vestibular/otoneurological tests were performed in Brazil between 2012 and 2022. The lowest coverage in the country was in 2020 (11.3/100,000 inhabitants), and the highest was in 2022 (21.2 procedures;100,000 inhabitants). There was a 33.3% increase in coverage from the first to the last year (2012 to 2022) of the analysis.

Regarding the distribution by regions of Brazil, the highest coverage in all years was found in the Central-West, especially in 2021, with 50.5/100,000 inhabitants, while its lowest coverage was in 2013, with 19.1/100,000 inhabitants. Next were the Southeast, the North, and the South, all with the highest coverage in 2022: 30.2, 27.4, and 16.4/100,000 inhabitants, respectively. The lowest coverage was in the Northeast, reaching 2.3/100,000 inhabitants in 2020 and 11.2/100,000 inhabitants (its highest) in 2012 (Figure 1). Furthermore, this was the only region whose coverage decreased from 2012 to 2022 (PV = -56.3%). Conversely, the largest increase was seen in the South (PV = +331.6%), followed by the North (PV = +146.8%), the Central-West (PV = +42.8%), and the Southeast (PV = +32.5%).

Only 12 (44.4%) federative units conducted vestibular/otoneurological tests in all years analyzed (Figure 2): Amazonas, Pará, Ceará, Pernambuco, Sergipe, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Rio Grande do Sul, Goiás, and the Federal District. Goiás stood out for its higher coverage during the period, reaching 107.7/100,000 inhabitants in 2021 and a minimum of 38.4/100,000 inhabitants in 2013. Furthermore, its coverage increased from the first to the last year analyzed (PV = +49.7%). The Federal District also stood out with coverage of 101.3/100,000 inhabitants in 2017, although its coverage decreased in the last two years, reaching 4.3/100,000 inhabitants in 2022 (PV = -78.4%).

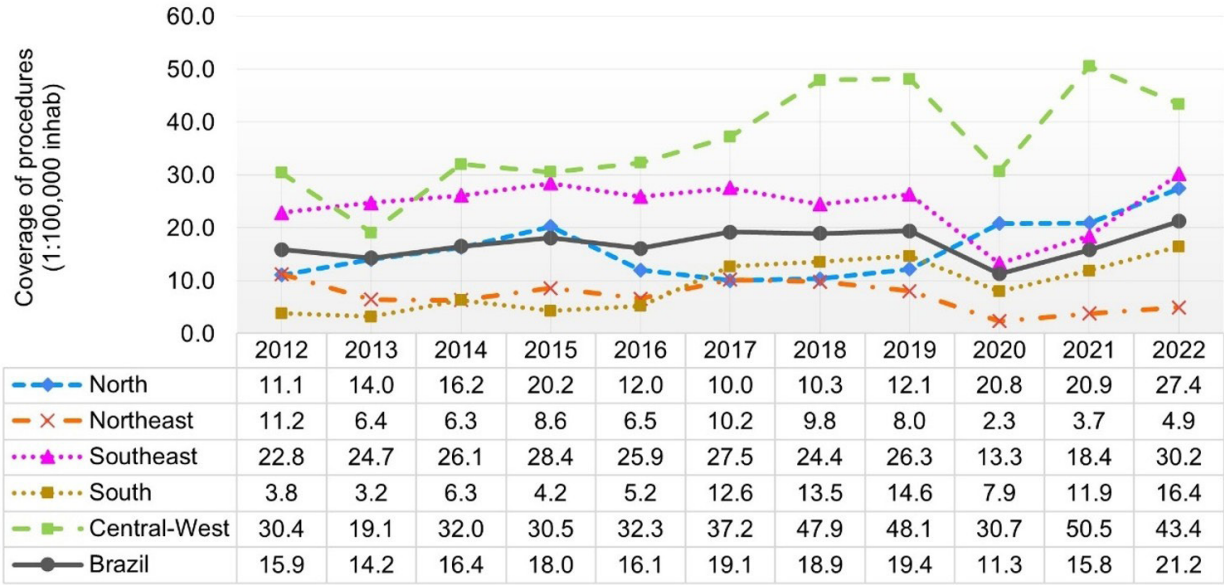
More than half of Brazilian federative units (n = 14; 51.9%) did not perform the procedure in at least one of the years analyzed. These states are Rondônia, Acre, Roraima, Amapá, Maranhão, Piauí, Rio Grande do Norte, Paraíba, Alagoas, Espírito Santo, Paraná, Santa Catarina, Mato Grosso do Sul, and Mato Grosso. The highest coverage among these states was 17.2/100,000 inhabitants in 2019 in Rio Grande do Norte. Moreover, Tocantins was the only state that did not register the performance of vestibular/otoneurological testing between 2012 and 2022 (Figure 2).

Furthermore, only 11 (40.7%) capital cities carried out the procedure in all the years analyzed: Manaus, Belém, Fortaleza, Recife, Aracaju, Salvador, Belo Horizonte, Rio de Janeiro, São Paulo, Goiânia, and Brasília. Among these capitals, the lowest coverage was in Rio de Janeiro, at 0.4/100,000 inhabitants in 2020 and 5.6/100,000 inhabitants in 2013 (its highest).

Chart 1. Data sources, location, and period analyzed

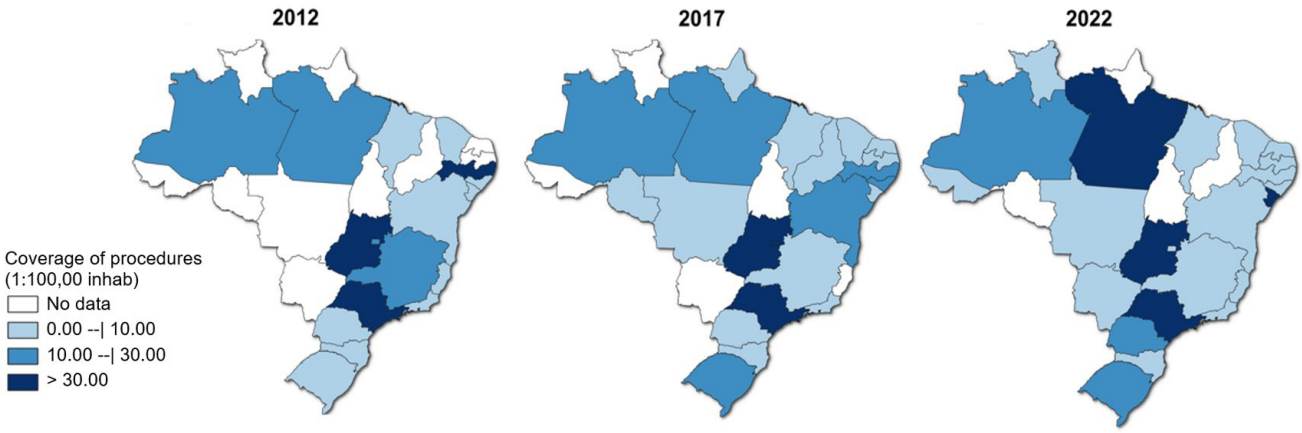
Data source	Data obtained	Location	Period
SIA-SUS	Number of approved vestibular/otoneurological testing procedures (code 02.11.07.035-1)	Regions, federative units, and capitals	2012 to 2022
IBGE	Resident population (15 years or older)	Regions, federative units, and capitals	2012 to 2022
ANS	Population covered by health insurance plans (15 years or older)	Regions, federative units, and capitals	2012 to 2022

Subtitle: SIA-SUS = Outpatient Information System of the Brazilian Unified Health System; IBGE = Brazilian Institute of Geography and Statistics; ANS = National Supplementary Health Agency



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
North	11.1	14.0	16.2	20.2	12.0	10.0	10.3	12.1	20.8	20.9	27.4
Northeast	11.2	6.4	6.3	8.6	6.5	10.2	9.8	8.0	2.3	3.7	4.9
Southeast	22.8	24.7	26.1	28.4	25.9	27.5	24.4	26.3	13.3	18.4	30.2
South	3.8	3.2	6.3	4.2	5.2	12.6	13.5	14.6	7.9	11.9	16.4
Central-West	30.4	19.1	32.0	30.5	32.3	37.2	47.9	48.1	30.7	50.5	43.4
Brazil	15.9	14.2	16.4	18.0	16.1	19.1	18.9	19.4	11.3	15.8	21.2

Figure 1. Coverage of vestibular/otoneurological tests (per 100,000 inhabitants) in Brazil and its regions, 2012 to 2022



Source: Outpatient Information System (SIA-SUS), Brazilian Institute of Geography and Statistics (IBGE), and National Supplementary Health Agency (ANS).

Figure 2. Map of vestibular/otoneurological test coverage (per 100,000 inhabitants) by federative unit in 2012, 2017, and 2022

The highest coverage during the analysis period was 375.7/100,000 inhabitants in Recife, in 2012, whereas its lowest coverage occurred in the last three years: 6.6, 4.5, and 7.3/100,000 inhabitants in 2020, 2021, and 2022, respectively. Aracaju also stood out, with coverage of 149.0/100,000 in 2022, compared to 0.7/100,000 inhabitants in 2012, an increase of 21,185.7%, the largest among all capitals (Table 1).

Of the 27 capital cities, 12 (44.4%) did not perform vestibular/otoneurological tests in at least one year of the analysis. These cities are Rio Branco, Boa Vista, Macapá, São Luís, Teresina, Natal, João Pessoa, Maceió, Florianópolis, Curitiba, Vitória, and Porto Alegre. The highest coverage among these capitals was 118.9/100,000 inhabitants in Porto Alegre in 2014. This capital had its highest coverage in the first six years of analysis, but it decreased in recent years, reaching zero records in 2022. The lowest coverage was 0.4/100,000 inhabitants in 2014 in Macapá, which had low coverage throughout the period, reaching its maximum of 6.2/100,000 inhabitants in 2016; moreover, it did not perform any procedures in the last two years of analysis. It is also noteworthy that four capital cities (14.8%) did not perform the procedure in any of the years analyzed, namely: Porto Velho, Palmas, Campo Grande, and Cuiabá (Table 1).

Table 1. Coverage of vestibular/otoneurological tests by capital city and year of service, from 2012 to 2022

Capital	Coverage per year of service (per 100,000 inhabitants)											PV (%)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012-2022*
Total	**49.0**	**44.2**	**41.1**	**41.2**	**42.2**	**46.4**	**38.3**	**36.5**	**16.5**	**20.0**	**23.5**	**-52.0**
North												
Porto Velho	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Rio Branco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	1.0	-64.3
Manaus	53.2	110.5	102.9	82.2	28.5	31.8	22.4	12.8	15.8	2.3	59.2	11.3
Boa Vista	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Palmas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Belém	57.5	23.6	13.8	7.8	24.7	17.8	21.8	67.1	64.5	60.2	62.8	9.2
Macapá	0.0	0.0	0.4	2.9	6.2	4.6	1.3	4.6	1.2	0.0	0.0	200.0
Northeast												
São Luís	15.4	12.1	21.9	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.9	-94.1
Teresina	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	-
Fortaleza	19.8	21.2	3.5	19.0	22.3	19.8	17.5	25.4	18.2	29.2	26.8	35.3
Natal	0.0	0.0	41.7	15.6	13.1	29.7	37.4	84.6	18.5	5.5	17.0	-59.2
João Pessoa	0.0	0.0	0.0	1.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	-10.0
Recife	375.7	126.7	89.2	123.4	27.7	17.9	23.9	15.0	6.6	4.5	7.3	-98.1
Maceió	25.1	31.1	10.2	0.0	38.4	48.1	52.3	24.5	0.5	38.4	16.9	-32.6
Aracaju	0.7	4.6	26.2	19.0	19.3	21.5	33.3	47.8	19.6	52.3	149.0	21185.7
Salvador	35.0	30.6	49.8	55.4	57.1	84.6	70.9	42.7	5.6	7.0	2.1	-94.0
Southeast												
Belo Horizonte	129.0	123.4	89.8	54.4	37.3	28.8	28.0	53.9	17.4	23.0	11.0	-91.4
Vitória	0.0	20.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Rio de Janeiro	5.3	5.6	4.9	1.1	2.8	3.9	4.3	2.5	0.4	0.9	3.3	-37.7
São Paulo	74.8	91.7	84.1	103.6	109.1	110.3	92.1	82.3	34.7	54.0	50.5	-32.5
South												
Curitiba	1.1	0.0	0.0	1.8	5.5	6.1	3.4	3.8	2.5	5.5	33.4	2936.4
Florianópolis	1.0	0.0	0.0	0.0	0.0	3.7	2.4	0.4	0.0	0.0	37.4	3640.0
Porto Alegre	96.0	93.7	118.9	51.1	42.3	44.9	20.0	8.0	0.6	1.2	0.0	-98.8
Central-West												
Campo Grande	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Cuiabá	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Goiânia	76.1	66.0	66.2	44.6	43.4	53.9	24.2	30.4	19.4	23.0	22.9	-69.9
Brasília	19.9	11.1	2.8	13.1	77.1	101.3	75.2	69.5	37.5	9.9	4.3	-78.4

*For regions, states, and capitals with no record of the procedure in 2012 or 2022, the proportional variation (PV) was calculated considering the first and last year with a record.
Source: Outpatient Information System (SIA-SUS), Brazilian Institute of Geography and Statistics (IBGE), and National Supplementary Health Agency (ANS)
Subtitle: PV = proportional variation; % = percentage

Table 2. Temporal trend of vestibular/otoneurological test coverage by region

Region	Period	APC1	95% CI	Period	APC2	95% CI
Brazil	2012 to 2022	0.97	-3.38 – 5.64	-	-	-
North	2012 to 2018	-4.61	-30.15 – 6.29	2018 to 2022	25.22*	4.25 – 77.35
Northeast	2012 to 2022	-7.92	-18.89 – 4.51	-	-	-
Southeast	2012 to 2022	-1.81	-6.63 – 3.38	-	-	-
South	2012 to 2022	16.38*	3.95 – 30.24	-	-	-
Central-West	2012 to 2022	6.42*	1.78 – 11.37	-	-	-

*Growth trend
Subtitle: APC = annual percentage change; CI = confidence interval; % = percentage

The temporal trend analysis for Brazil showed an increase from 2012 to 2022 (APC = 0.97; 95% CI -3.38 to 5.64), although not significant. The analysis by region between 2012 and 2022 showed a growth trend in the South (APC = 16.38; 95% CI 3.95 to 30.24) and Central-West (APC = 6.42; 95% CI 1.78 to 11.37). There was a growth trend in the North (APC = 25.22; 95% CI 4.25 to 77.35) only for the period from 2018 to 2022 (Table 2).

DISCUSSION

Vestibular/otoneurological testing coverage in Brazil increased by more than 30% in the last decade. However, this growth was uneven across regions, states, and capitals, with the worst situations in the Northeastern states. Although the Central-West had the highest coverage, this result was positively influenced by the high rates in Goiás over the last decade. Conversely, in the same region, Mato Grosso and Mato Grosso do Sul registered significantly low coverage and did not perform the procedure in all the years analyzed, not directly impacting the region's coverage due to the high number of registrations in Goiás.

The pattern of influence on state coverage was similar in the capital cities. Recife, which had the highest coverage among the analyzed capitals, directly impacted Pernambuco's numbers in 2012. Likewise, Aracaju's coverage in 2022 positively influenced Sergipe's data. On the other hand, Porto Alegre registered high coverage until 2018, but it decreased significantly in the last four years of analysis, though not negatively impacting the overall rates of Rio Grande do Sul, which maintained growth since 2017 and thus boosted the increase in regional variation in the South, while Paraná and Santa Catarina had reduced coverage.

These variations demonstrate that state-level coverage cannot be attributed solely to the performance of capital cities, revealing geographical barriers to service access. The need to travel to large urban centers can mask regional inequalities, restricting access for the population in more remote areas. Although Recife and Aracaju had high coverage rates, their influence was insufficient to reverse the situation in the Northeast, which maintained the lowest rates in the country[7].

The results also indicate the impact of the COVID-19 pandemic, with a reduction in coverage in 2020 and 2021. This was observed in a study with data from SIA-SUS, which verified a 12.9% drop in the performance of diagnostic procedures when comparing the period from January 2018 to June 2019 (pre-pandemic) with the period from January 2020 to June 2021 (after the start of the pandemic)[15].

The low coverage of vestibular/otoneurological tests and the uneven coverage between regions may be related to the presence of speech-language-hearing pathologists in the services, who most commonly perform vestibular/otoneurological tests. However, there was a greater availability of such pathologists in the Southeast between 2007 and 2016, although the relative increase during the period was greater in the North and Northeast[14].

Public initiatives point to federal and state recognition of the need for fall prevention among older adults, which could provide a basis for more specific otoneurological care policies. Bill 4376/24, currently under consideration in the Brazilian Chamber of Deputies, proposes establishing the National Policy for Fall Prevention among Older Adults (PNPQPI), with actions that include training for healthcare professionals, risk protocols, and comprehensive care for those who have suffered falls. This could favor the inclusion of balance assessments in healthcare workflows[16].

The Federal Speech-Language-Hearing Council, through Resolution CFFa No. 656/2022, established criteria for staffing levels for speech-language-hearing pathologists in hospital units. Although it does not specifically address otoneurology, this type of regulation needs to be adapted to include vestibular assessment, favoring a more appropriate allocation of specialized personnel[17].

Finally, these policies and regulations, when implemented in a coordinated manner at the federal, state, and municipal levels, have the potential to mitigate the inequalities observed in access to vestibular/otoneurological tests, conditioning the financing, training, and hiring of professionals, primarily where there is the greatest need and the lowest coverage.

It is important to note that, even disregarding the pandemic period, the coverage of vestibular/otoneurological tests is still low compared to other procedures also performed by speech-language-hearing pathologists, such as tonal audiometry (364.2/100,000 inhabitants in 2019) and short, medium, and long-latency auditory evoked potentials (30.2/100,000 inhabitants in 2019)[18].

It is known that hearing impairments are more prevalent than balance disorders; however, the magnitude of the difference highlights a significant gap in care. This disparity may be related to the greater consolidation of auditory procedures within the healthcare network, both in terms of funding and the availability of equipment and professional training. Vestibular examinations, on the other hand, require specific infrastructure, longer execution times, and adequate training for performing vector nystagmography[5]. Moreover, otoneurology was only recently created as a speech-language-hearing specialty in 2023[19].

Furthermore, while audiological procedures play an essential role in screening programs and early diagnosis, vestibular tests are usually indicated in specific cases, which may result in lower prioritization in health policies. The World Health Organization (WHO) establishes recommendations focused on hearing health; however, it does not present specific guidelines or public policies for vestibular assessment. Thus, despite its relevance in the diagnosis of balance disorders, no national or international policies directly addressing this area have been identified[20].

Despite efforts to expand the healthcare system and correct inequalities in the distribution of specialized services, differences in coverage persist between regions, such as the North and Northeast. Therefore, access to healthcare has not yet reached equitable levels compared to the South and Southeast[14]. Throughout history, the distribution of accredited medium- and high-complexity hearing services has been uneven, with a greater predominance in the Southeast and less in the North[18]. However, contrary to what these authors claim[18], the present study observed that coverage of vestibular/otoneurological testing procedures predominated in the Central-West, with low coverage in the Northeast.

This difference in coverage reflects the distinct geographic areas of Brazil, with varied demographic, economic, social, cultural, and health characteristics, and significant internal disparities. This was reflected in the implementation of the SUS, challenged by the concentration of health services in the most developed regions of the country[18].

Identifying these demographic characteristics is extremely relevant in the context of vestibular/otoneurological tests, since the older population is more susceptible to balance disorders[1]. According to data from the 2010 and 2022 censuses[21], the population aged 60 and over grew from 10.8% in 2010 to 15.8% in 2022. Conversely, the population aged 0 to 14 years decreased from 24.1% to 19.8% during the same period, thus highlighting an increasingly aging population. These data reinforce the need for public policies that guarantee greater access to the diagnosis and rehabilitation of balance disorders, especially given the aging trend of the Brazilian population.

Moreover, according to the 2013 National Health Survey, the Northeast had the highest percentage of people aged 60 or older who had fallen in the previous 12 months (17.4%), followed by the Central-West (15.9%), North (15.4%), Southeast (14.9%), and South (14.3%). However, despite the higher fall rates in the Northeast, this region, along with the Central-West, had the second-highest percentage of people who sought care and were unsuccessful on the first attempt (6.3%), second only to the North (6.4%). The two regions with the lowest percentages were the Southeast and South (both at 3.7%), indicating better accessibility to basic services[22].

This study investigated only the coverage of vestibular/otoneurological testing procedures, defined in SIGTAP as vector nystagmography, vector electronystagmography, electromyotamography, and caloric labyrinthine tests with or without electronystagmography recording, the only procedure related to body balance assessment identified in the SIGTAP list[23]. However, this should not be the only procedure included in the evaluation. For comparison purposes, seven examination codes related to body balance assessment were identified in the ANS standardization of codes and nomenclature of medical procedures[9].

The lack of access to these balance assessments in public health is reflected in fall prevention, a fundamental component of comprehensive and preventative care, especially among older people. Prevention is an important step in avoiding health problems that result in a reduction in activities of daily living in this population[3]. Regulation No. 483/2014[24], which focuses on the management of people with chronic diseases, has contributed to the expansion of specialized services. Nonetheless, this study observed that vestibular/otoneurological test coverage progressed slowly and unevenly throughout the analyzed period.

The slow expansion of this coverage also reflects the budgetary constraints imposed by Constitutional Amendment No. 95/2016[25], which established a ceiling for public spending for 20 years and reduced the margin for increasing investments in essential areas such as health and education. However, the spending growth limit does not consider each region's population increases or changes in the social demands, exacerbating the vulnerability of those who are already in a fragile situation. Thus, the reduction of essential investments for the population in areas such as public health increases the challenges of guaranteeing equitable access to specialized services.

Telehealth is an alternative to reduce gaps in access to healthcare in Brazil, encompassing pre-clinical care, support, consultations, monitoring, and diagnosis within the SUS, supplementary health services, and private healthcare. Although discussed since 1960, it gained momentum during the COVID-19 pandemic with Law No. 13.989/2020[26], authorizing telemedicine in various areas. Later, Law No. 14.510/2022[27] consolidated and expanded regulations, authorizing the practice of telehealth throughout the national territory. However, adapting this technology is challenged by healthcare professionals' acceptance, technological barriers, and infrastructure inequalities between regions, especially in those furthest from large urban centers[28].

In the context of vestibular/otoneurological testing, telehealth can link primary and specialized care, optimizing the screening, referral, and follow-up of patients with diagnosed impairments. This approach is fundamental for fall prevention, a central element for comprehensive and preventive care, especially among older adults who are the most frequently affected, also considering the exponential growth of the aging Brazilian population[29]. However, for this strategy to be effective, there must be public investment in connectivity, infrastructure, continuing education, and specific policies that incorporate the diagnosis and care of balance disorders within the scope of telehealth. Despite the already consolidated experiences in hearing assessment within the SUS, there are still no equivalent initiatives for otoneurological assessment[30].

Also noteworthy is the scarcity of studies analyzing the evolution of vestibular/otoneurological test coverage over time. Hence, this study can provide a foundation for future research in the area, broadening understanding and fostering new scientific initiatives.

This study provided an overview of vestibular/otoneurological testing coverage in Brazil, by region, state, and capital city over the past 10 years. However, the use of secondary data has limitations. The quality of data recording can vary, potentially resulting in inaccurate and outdated information. Furthermore, there is the possibility of underreporting or duplicate entries in information systems, which vary between regions, compromising data completeness and influencing the accuracy of estimates. Finally, the study is limited to procedures performed only within public healthcare, excluding private and insurance-covered services. Therefore, it does not provide a comprehensive view of vestibular/otoneurological testing coverage in Brazil.

One limitation is the inability to standardize the coverage coefficient, which would be important to neutralize the effect of age, since the age composition of the population can influence the results. However, the data extracted by age group showed that approximately 80% of the records were listed as "not informed/not required." This limitation impacts the external validity of the findings, making it difficult to generalize the results. Furthermore, a detailed analysis considering other variables, such as sex and education level, could generate additional information that would help to understand the specific needs of different population groups. The analysis would also allow for a more detailed assessment of regional and age disparities, contributing to more efficient and equitable planning of public health policies, especially regarding vestibular/otoneurological test provision and coverage.

CONCLUSION

Vestibular/otoneurological testing coverage is low across the country, with little increase in the last 10 years. Furthermore, inequalities were observed between regions and states, with the worst situations in the Northeast. These disparities reflect not only demographic and economic issues, but also historical inequalities in the distribution of health services, exacerbated by the concentration of resources and professionals in the Southeast. In addition, the challenges posed by the COVID-19 pandemic contributed to the reduction in testing coverage in 2020.

Given these regional inequalities, it is imperative to prioritize the training and development of professionals specializing in balance health heterogeneously throughout the country, considering each region's needs and age composition. Continuing education programs, combined with teleconsultations, are a viable and adaptive solution, especially in remote areas, ensuring that patients have access to appropriate guidance.

Moreover, the diagnosis of balance disorders should not be limited to a single procedure. It is essential to create new codes in SIGTAP related to the diagnosis, expanding categorization,

and enabling more detailed analyses. Finally, health information systems must incorporate age range, among other updated variables, to better understand and meet the specific needs of each region and improve planning and resource allocation.

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