

## Outpatient Production of Audiovestibular Examinations in the Pre and Post Covid-19 Pandemic Periods

Produção Ambulatorial de Exames Audiovestibulares nos Períodos Pré e Pós Pandemia de Covid-19

Producción Ambulatoria de Exámenes Audiovestibulares en los Períodos Pre y Post Pandemia Covid-19

### RESUMO

**Objetivo:** Estudar a produção ambulatorial dos exames auditivos e vestibulares nos períodos pré, durante e pós pandemia. **Métodos:** Estudo ecológico com dados secundários fornecidos pelo Sistema de Informações Ambulatoriais do Sistema Único de Saúde, incluindo exames auditivos e vestibulares produzidos no Brasil e nas cinco regiões federativas entre os anos de 2018 a 2023. Os dados coletados foram analisados de forma descritiva, tabulados e apresentados em gráficos e tabelas. **Resultados:** Verificou-se queda nacional na produção de exames auditivos (-27,9%) e vestibulares (-30,7%) durante a pandemia, permanecendo negativo (-3,9%) também no período pós pandemia nos exames auditivos, entretanto com crescimento nos exames vestibulares (+3,6%). A região Sudeste apresentou os maiores índices de produção para ambos os exames, já a região Norte os menores. **Conclusão:** Os achados apontam que a produção ambulatorial dos exames audiovestibulares seguiram a dinâmica do confinamento com queda na produção e posterior aumento, em especial dos exames vestibulares.

**DESCRITORES:** Covid-19; Audição; Sistema Vestibular; SUS; Pandemia.

### ABSTRACT

**Objective:** To study the outpatient production of auditory and vestibular exams in the pre-pandemic, during-pandemic, and post-pandemic periods. **Methods:** Ecological study with secondary data provided by the Ambulatory Information System of the Unified Health System, including auditory and vestibular exams conducted in Brazil and the five federal regions between the years 2018 and 2023. The collected data were analyzed descriptively, tabulated, and presented in graphs and tables. **Results:** A national decrease in the production of auditory (-27.9%) and vestibular (-30.7%) exams was observed during the pandemic, with a continued negative trend (-3.9%) in the post-pandemic period for auditory exams, but with an increase in vestibular exams (+3.6%). The Southeast region showed the highest production rates for both exams, while the North region had the lowest. **Conclusion:** The findings suggest that the outpatient production of audiovestibular exams followed the dynamics of confinement, with a decrease in production followed by a subsequent increase, especially in vestibular exams.

**DESCRIPTORS:** Covid-19; Hearing; Vestibular System; SUS; Pandemic.

### RESUMEN

**Objetivo:** Estudiar la producción ambulatoria de los exámenes auditivos y vestibulares en los períodos pre-pandemia, durante la pandemia y post-pandemia. **Métodos:** Estudio ecológico con datos secundarios proporcionados por el Sistema de Información Ambulatoria del Sistema Único de Salud, que incluyen los exámenes auditivos y vestibulares realizados en Brasil y en las cinco regiones federativas entre los años 2018 y 2023. Los datos recolectados fueron analizados de forma descriptiva, tabulados y presentados en gráficos y tablas. **Resultados:** Se observó una caída nacional en la producción de exámenes auditivos (-27,9%) y vestibulares (-30,7%) durante la pandemia, manteniéndose negativa (-3,9%) también en el período post-pandemia para los exámenes auditivos, aunque con un crecimiento en los exámenes vestibulares (+3,6%). La región Sudeste presentó los índices más altos de producción para ambos los exámenes, mientras que la región Norte tuvo los índices más bajos. **Conclusión:** Los hallazgos apuntan a que la producción ambulatoria de los exámenes audiovestibulares siguió la dinámica del confinamiento, con una caída en la producción seguida de un aumento posterior, especialmente en los exámenes vestibulares.

**DESCRIPTORES:** Covid-19; Audición; Sistema Vestibular; SUS; Pandemia.

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## INTRODUCTION

Covid-19, an infectious disease resulting from the high transmission capacity of the SARS-CoV-2 virus, was unleashed in 2019 in the city of Wuhan, China. <sup>(1)</sup> Although the symptomatic characteristics are mostly respiratory, many individuals developed symptoms related to hearing and balance disorders such as dizziness, tinnitus, ear fullness and hearing loss <sup>(2)</sup> which can manifest themselves in different ways depending on the spread of the virus in the auditory and vestibular systems. <sup>(3)</sup>

Studies indicate seriousness in relation to the auditory pathways, in which the tropism in the central nervous system, resulting from the neuroinvasion mechanism of the virus, can cause direct changes in the auditory and vestibular pathways. As in other viral pathologies, SARS-CoV-2 can directly affect organs of the inner ear such as the organ of Corti and inner hair cells, and can cause hearing loss, with the sensorineural type being the most frequent, the degree of which can vary from mild to severe, with unilateral or bilateral involvement. <sup>(3)</sup> There is evidence that the virus may have tropism for the hair cells that form the sensory structure of the semicircular canals, utricle and sacule, affecting body balance. <sup>(4)</sup> However, this evidence is still incipient and requires further scientific approaches.

In addition, most of the medica-

tions administered during the treatment of Covid-19, especially at the beginning of the pandemic, when there were disagreements about which substances and doses presented good therapeutic responses, had ototoxic potential. Examples include the administration of chloroquine, hydroxychloroquine and azithromycin, whose efficacy has been questioned. This fact may also have contributed to the greater occurrence of hearing and vestibular problems in affected individuals. <sup>(2)</sup>

Furthermore, audiovestibular impairments impact not only physical health but also emotional changes such as anxiety, depression, changes in routine and mood that resulted from the need for social isolation, as well as difficulties in concentration, learning and financial investments that were also noticed in the population affected by the virus and with changes in the hearing and balance systems. <sup>(5)</sup>

For this reason, all individuals with a history of hearing and vestibular disorders should be referred for an appropriate evaluation in order to prevent damage, establish a topodiagnosis, and direct the necessary therapeutic practices for the rehabilitation of those who present hearing loss and/or vestibular dysfunctions during the course of the disease.

In view of the above, the present research aimed to study the outpatient production of hearing and vestibular exams in the pre, during, and

post-pandemic periods in order to investigate the recent relationships between Covid-19 and audiovestibular impairments.

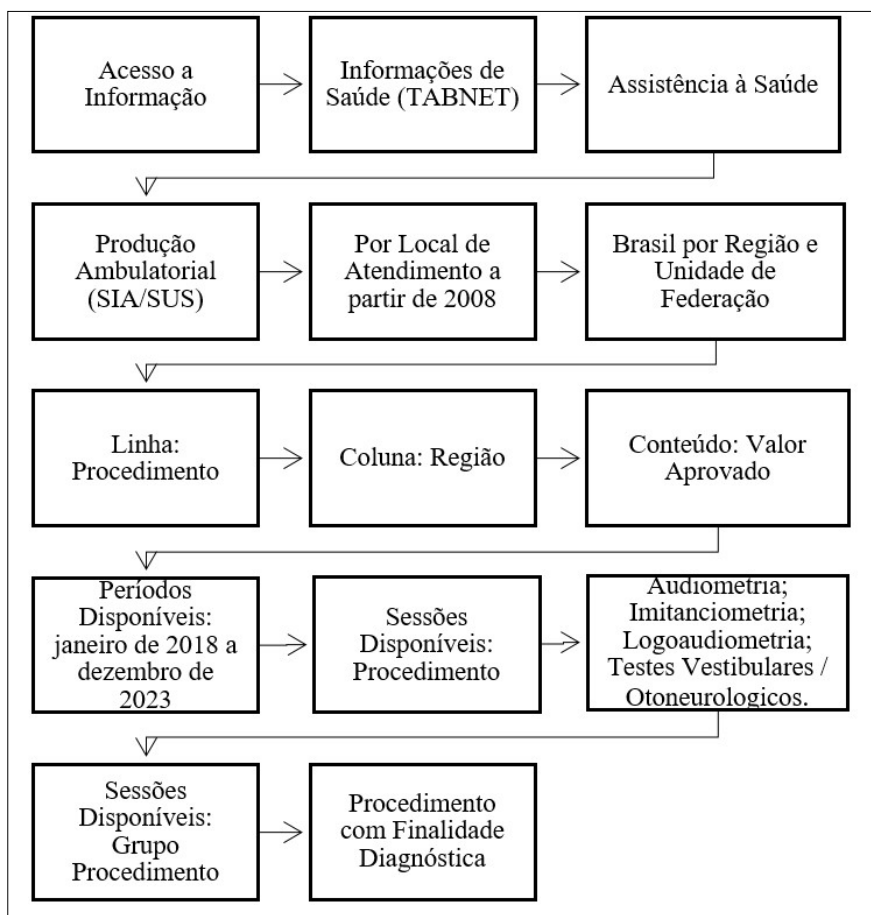
## METHODS

This is an ecological study, carried out based on the analysis of data recorded by the Department of Information Technology of the Unified Health System (DATASUS) and tabulated by the Outpatient Information System of the Unified Health System (SIA/SUS) in Brazil and in the five federative regions in the period from 2018 to 2023, grouped into three periods: pre (2018-2019), during (2020-2021) and post-pandemic (2022-2023).

The data collected are gold standard exams for detecting auditory and vestibular disorders performed in outpatient clinics in specialized SUS units in different regions of Brazil, such as pure tone audiometry (code 0211070041), immittance testing (code 0211070203), logoaudiometry (code 0211070211) and vestibular/otoneurological exams (code 0211070351).

Data collection was performed on the official DATASUS website and followed the steps described in the flowchart below (Figure 1).

**Figure 1. Flowchart of the steps for accessing data provided by SIA/SUS.**



Caption: SIA/SUS = Outpatient Information System/Unified Health System.

Source: Own (2023).

**Table 1. Distribution of the absolute frequency and growth rate of outpatient production of hearing and vestibular exams performed in the pre, during and post Covid-19 pandemic periods.**

Exam	Period			Growth rate (%)
	Pre	During	Post	
Hearing	139.391.565	100.439.736	133.967.722	-3,9
Vestibular	615.859	426.748	638.080	+3,6

Source: Ministry of Health-SUS Outpatient Information System (SIA/SUS).

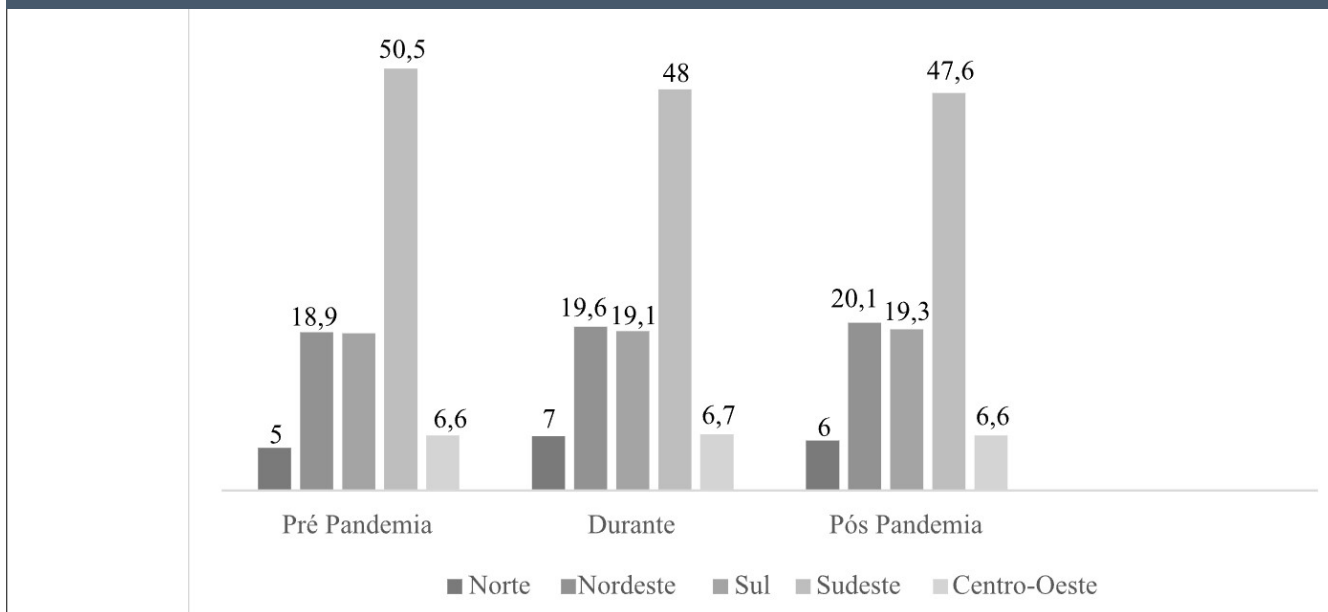
This methodology did not require approval from the Research Ethics Committee (CEP) since its object of study is organized and available in the public domain of the Department of Information Technology of the Ministry of Health. The data collected were recorded and presented using descriptive statistics through percentages, presentation rates, absolute and relative frequencies.

## RESULTS

From the search for hearing and vestibular exams in Brazil, it was found that hearing exams represent a significant portion of outpatient production in the period analyzed, however the growth rate decreased throughout the pandemic, while the production of vestibular exams showed an inverse dynamic with a slight increase in the growth rate in the same period (Table 1).

Regarding outpatient production of exams, the data reveal discrepancies in the provision of these services, with the North region having the lowest production of hearing exams in all periods, but with a slight increase in production during and after the pandemic. The Southeast region, on the other hand, had the highest flow of these exams, despite showing continuous declines in the periods analyzed, being the only region to demonstrate declines in the periods related to the pandemic (Figure 2).

**Figure 2. Distribution of the relative frequency of hearing exams in the five federative units in the pre, during and post Covid-19 pandemic periods.**



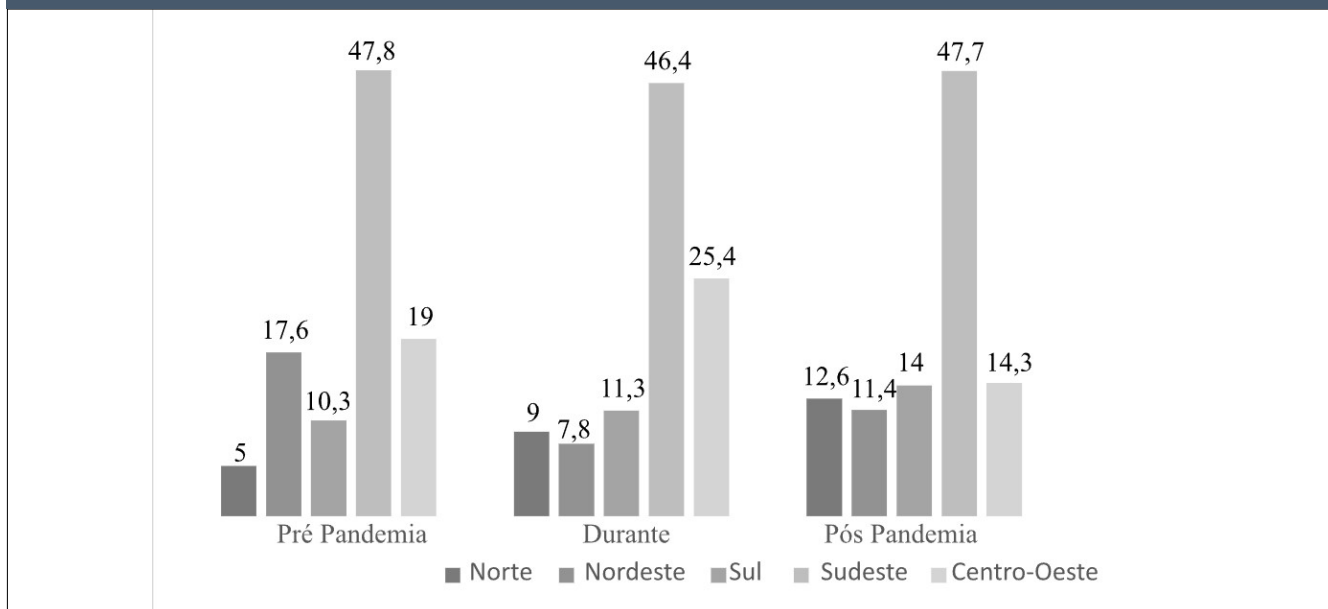
Source: Ministry of Health – SUS Outpatient Information System (SIA/SUS).

Regarding entrance exams, the North region also showed the lowest production rate, although there was an

increase during and after the pandemic, when compared to hearing exams. The Southeast region continued to lead the quantity of production of these exams during the pandemic. In addition, the

Northeast region showed a considerable drop during the pandemic and the Central-West region followed the opposite dynamic of exam production (Figure 3).

**Figure 3. Distribution of the relative frequency of vestibular function exams in the five federative units in the pre, during and post Covid-19 pandemic periods.**



Source: Ministry of Health – SUS Outpatient Information System (SIA/SUS).

Regarding the growth rates of audio-vestibular exams, Table 2 shows that the region with the greatest decline in the supply of hearing exams during and after the pandemic was the Southeast region, exceeding national rates. In contrast, the North region showed the smallest decline during the pandemic, as well as the greatest growth in the post-pandemic period.

According to data in Table 2, entrance exams showed slight growth in the North region, being the only federative unit to show growth in the pre- and post-pandemic period. The Northeast region was the one that showed the greatest drop in the production of these exams, more than double the national growth rate during the pandemic and maintained the decline in the post-pandemic period.

## DISCUSSION

In the present study, a higher number of hearing tests were performed in the public health system than in vestibular tests throughout the period analyzed. It is suggested that this discrepancy is related to the fact that hearing services are offered more frequently than vestibular services, since they are more easily available in the public health system and have a relatively lower cost. Since hearing and vestibular disorders can occur together, the present study hypothesizes that vestibular function assessment is often requested as a differential diagnosis or in the presence of diseases that affect the vestibular system, which could justify the low production in the public sector.

Regarding the growth rates of audio-vestibular exam production, there was a decrease in hearing exams and a slight increase in vestibular exams. This reversal in the dynamics can be explained by the social isolation of the population, recommended by the

**Table 2. Distribution of growth rates for outpatient exam production at the national level and in the federative units during and after the Covid-19 pandemic.**

Federative unit	Auditive (%)		Vestibular (%)	
	During	Post	During	Post
Brazil	- 27,9	- 3,9	- 30,7	3,6
North	- 8	12,8	90,4	141,4
Northeast	- 25,4	2,4	- 71,3	-32,8
South	- 26,9	+1	- 28,3	41,6
Southeast	- 31,5	- 9	- 37	3,2
Midwest	- 26,5	- 3,9	- 13	-22,3

Fonte: Sistema de Informações Ambulatoriais do SUS (SIA/SUS).

National Health Council during the pandemic<sup>(12)</sup>, which made it impossible to perform exams, especially hearing exams, in the units or a decrease in the supply of outpatient procedures related to hearing health. However, the increase in the growth rate of vestibular exams during this period may be related to the emergency nature of their symptoms at the time of labyrinthine crises or tinnitus, in which the patient presents discomfort requiring immediate care.

In the detailed analysis by federative unit, it was observed that the North region presented the lowest outpatient production of hearing and vestibular exams, which can be justified by the fact that it was the region that presented the lowest number of infections by the virus in the period analyzed.<sup>(13)</sup> Furthermore, it is the second least populated region according to the demographic census, in which it represents 8.6% of the population<sup>(14)</sup>, as it is also the region with the lowest number of hearing health services in the country<sup>(15)</sup>, in addition to having the lowest human development index and the majority of the population does not have a sanitation station or sewage collection network, which can contribute to the onset of comorbidities.<sup>(16)</sup> As in the North region, the Northeast has the worst self-assessment rates regarding access to health and public services, with a gradual decrease in the supply of activities related to population care.<sup>(17)</sup>

On the other hand, the region that presented the highest production rates

of hearing and vestibular exams was the Southeast, which was expected, since this region has the largest part of the population.<sup>(14)</sup> Furthermore, it was the region with the highest percentage of virus infections in Brazilian territory.<sup>(13)</sup> Additionally, the Southeast is home to the largest number of organizations dedicated to hearing services<sup>(15)</sup> and its population faces fewer difficulties in accessing healthcare compared to other regions, as well as benefiting from a greater distribution of professionals who perform the necessary procedures or referrals.<sup>(18)</sup>

The discrepancies identified in this study illustrate regional inequalities, since, even with increases in hearing tests in the North and Central-West regions, these remain low when compared to the Southeast, South and Northeast regions, which are home to the majority of the population and hearing health units in Brazil.<sup>(17)</sup> However, with regard to vestibular tests, the percentage of production in the post-pandemic period became equal, with the exception of the Southeast region, which produced almost three times as much compared to the other regions.

It is important to emphasize that although the study has provided important data that help to understand the relationship between auditory-vestibular impairments and Covid-19, even if indirectly, it has limitations, such as the short period analyzed, since the pandemic began in 2020. Another bias is the fact that

the DATASUS data do not accurately illustrate the number of tests performed, and may contain repeated, underreported and even unrecorded data. Furthermore, there is no way to differentiate whether the number of tests carried out in different periods were carried out only by individuals infected with Covid-19.

However, the data made available in the SIA/SUS provide a record of the health dynamics of our country and should be valued as an important tool for analyzing the health behaviors of the population, especially in cases of pandemics, given that the number of people

affected is considerable.

In addition, since Covid-19 is a new disease whose pathological mechanisms are still poorly understood, more studies that directly address this issue need to be developed in order to assist health professionals in developing strategic health planning within the scope of intervention and prevention of diseases.

## CONCLUSION

According to the data obtained, it was possible to infer that the outpatient production of audiovestibular exams fol-

lowed the social dynamics established by the pandemic, in which hearing exams demonstrated greater productivity throughout the period analyzed, but with a drop in the growth rate in the same period and opposite behavior to vestibular exams, indicating that the emergency nature of vestibular crises may have interfered in this quantity, which suggests the influence of infection by the SARS-Cov 2 virus on the auditory and, especially, vestibular pathways, in line with the findings in the literature.

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