CoDAS
ISSN 2317-1782 (Online version)

Original Article
Artigo Original

Temporal analysis of hearing aids provision by the Brazilian Unified Health System

Análise temporal da concessão de aparelhos de amplificação sonora individual pelo Sistema Único de Saúde

Rodrigo Oliveira da Fonsêca[1]
Monique Ramos Paschoal Dutra[2]
Maria Ângela Fernandes Ferreira[3]

Keywords

Hearing
Hearing Loss
Hearing Aids
Unified Health System
Public Health Policy

ABSTRACT

Purpose: To analyze the outpatient production of aspects of hearing aids (HA) provision by the Brazilian Unified Health System (SUS) between 2005 and 2018. **Methods:** This is an ecological time-series study, based on data from the Outpatient Information System of the SUS and the Brazilian Institute of Geography and Statistics. The HA provision rates were analyzed with Joinpoint software. Descriptive analyses were carried out for technological categories, funding, HA replacement and audiological monitoring. **Results:** The South (9.96/10,000 inhabitants) and North (3.20/10,000 inhabitants) regions recorded the highest and lowest average rates, respectively. There were significant upward trends in HA provision in Brazil, in the North, Southeast and Midwest regions, with subsequent significant downward trends in the Southeast and Midwest. In the country, HA concession by technological categories was A (39.26%), B (36.93%) and C (23.81%), increasing funding. The Midwest (24.78%) and Northeast (14.22%) regions had the highest and lowest proportion of HA replacement, respectively. The audiological monitoring predominated in the Southeast (45.88%), with the lowest occurrence in the North (4.18%). **Conclusion:** Between 2005 and 2018, trends fluctuated and discrepancies between geographic regions were observed in HA provision by the SUS, in addition to mismatches in the provision of technological categories and funding, a considerable proportion of replacements and insufficient audiological monitoring for HA users.

Descritores

Audição
Perda Auditiva
Auxiliares de Audição
Sistema Único de Saúde
Políticas Públicas de Saúde

RESUMO

Objetivo: Analisar a produção ambulatorial de aspectos da concessão de aparelhos de amplificação sonora individual (AASI) pelo Sistema Único de Saúde (SUS) entre 2005 e 2018. **Método:** Trata-se de um estudo ecológico, de série temporal, baseado em dados do Sistema de Informações Ambulatoriais do SUS e do Instituto Brasileiro de Geografia e Estatística. As taxas de concessão de AASI foram analisadas com o *software Joinpoint*. Realizaram-se análises descritivas para categorias tecnológicas, financiamento e reposição de AASI e acompanhamento audiológico. **Resultados:** As regiões Sul (9,96/10.000 habitantes) e Norte (3,20/10.000 habitantes) registraram a maior e menor média das taxas, respectivamente. Houve tendências de aumento significativas da concessão de AASI no Brasil e nas regiões Norte, Sudeste e Centro-Oeste, com posteriores tendências de redução significativas nas regiões Sudeste e Centro-Oeste. No país, a concessão das categorias tecnológicas foi de A (39,26%), B (36,93%) e C (23,81%), elevando o financiamento. As regiões Centro-Oeste (24,78%) e Nordeste (14,22%) apresentaram a maior e menor proporção da reposição de AASI, respectivamente. O acompanhamento audiológico predominou na região Sudeste (45,88%), com menor ocorrência na região Norte (4,18%). **Conclusão:** Entre 2005 e 2018, há oscilações de tendências e discrepâncias entre as regiões geográficas quanto à concessão de AASI pelo SUS, além de descompassos no fornecimento das categorias tecnológicas e financiamento, considerável proporção de reposições e insuficiente quantitativo de acompanhamento audiológico para usuários de AASI.

Correspondence address:
Maria Ângela Fernandes Ferreira
Departamento de Odontologia, Universidade Federal do Rio Grande do Norte – UFRN
Avenida Senador Salgado Filho, 1787, Lagoa Nova, Natal (RN), Brasil, CEP: 59056-000.
E-mail: mangelaf50@gmail.com

Received: June 23, 2020.
Accepted: October 02, 2020.

Study conducted in the Programa Associado de Pós-graduação em Fonoaudiologia, Universidade Federal do Rio Grande do Norte – UFRN, Natal (RN), Brasil.

[1] Programa Associado de Pós-graduação em Fonoaudiologia – Universidade Federal do Rio Grande do Norte – UFRN - Natal (RN), Brasil.

[2] Programa de Pós-graduação em Saúde Coletiva – Universidade Federal do Rio Grande do Norte – UFRN - Natal (RN), Brasil.

[3] Departamento de Odontologia – Universidade Federal do Rio Grande do Norte – UFRN - Natal (RN), Brasil.

Financial support: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

Conflict of interests: Nothing to declare.

INTRODUCTION

The World Health Organization (WHO) estimated around 466 million people worldwide exhibited incapacitating hearing loss that in 2018, expected to reach 900 million by 2050[1]. In Brazil, the 2010 demographic census conducted by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) registered approximately 9.7 million people with self-reported hearing loss[2].

Given the magnitude of this sensory privation, hearing aids (HA) have become an essential resource for amplifying environmental sounds and minimizing damage, thereby improving the quality of life of people with hearing loss[1,3,4]. In several countries, HA provision depends on reimbursement systems, discounts and partial subsidies, while in Brazil, it is managed by the Brazilian Unified Health System (Sistema Único de Saúde - SUS)[5], created to guarantee free universal healthcare to the Brazilian population[6].

In order to ensure access to aural rehabilitation provided by the SUS, specific laws had to be approved[4]. One of the main measures occurred when the Ministry of Health (Ministério da Saúde - MS), via Ordinance SAS/MS no. 432 of 2000, regulated the diagnosis, HA fitting and outpatient follow-up of people with hearing loss[7].

Given the need to improve post-HA provision, the MS instituted the National Hearing Healthcare Policy (Política Nacional de Atenção à Saúde Auditiva - PNASA), via Ordinance GM/MS no 2.073 of 2004, thereby enabling a regional hierarchical network between the different healthcare levels, comprehensive care involving promotion, prevention, treatment and rehabilitation, with multiprofessional and interdisciplinary assistance in order to broaden coverage for people with hearing loss[8].

The PNASA was revoked by Decree no. 7.612 of 2011, which implemented the National Plan for the Rights of People with Disability - Living without Limits Plan, aimed at promoting programs and measures, and the full and equitable exercise of the rights of people with disability[9]. In 2012, Ordinance GM/MS no. 793 instituted the Care Network for People with Disability, with a view to expanding access and qualify care for people with hearing, physical, and intellectual impairment, ostomy and multiple disabilities[10].

Despite the progress made, it is important to underscore that in a country as the size of Brazil, HA provision by the SUS depends on the distribution of hearing health services, the relation between demand and the devices provided and the number of replacements[11,12]. Moreover, difficulties in providing HA from technological categories A, B and C affect hearing quality, since low-cost technological category A has more limited resources than its more costly categories B and C, which are more flexible and technologically advanced[5].

Over the years, the wastage of financial resources destined for HA provision by the SUS has stood out, given that many patients stopped using the device after being fitted, for various reasons, including technical problems[12]. Thus, audiological follow-up is a key strategy in meeting patient needs, monitoring possible hearing alterations and instructing them on the optimal use of the HA[13].

In addition, scientific studies are crucial to ensure that HA improves the quality of life of their users[14]. However, few studies have addressed outpatient HA provision in Brazil, a country with distinct populations cared for in its geographic regions[11]. Data collection and analysis is carried out by the SUS via its Outpatient Information System (Sistema de Informações Ambulatoriais do SUS – SIA/SUS), which stores data from outpatient public health procedures, thereby helping in decision making[5].

In this respect, the aim of the present study was to analyze outpatient HA provision by the SUS between 2005 and 2018.

METHODS

This is an ecological time-series study, based on the provision, technological categories, funding and replacement of HA and audiological follow-up. The data, collected in June 2019, are of public domain and derive from the SIA/SUS, integrated to the Information Department of the SUS and the IBGE.

In the SIA/SUS, access was sequenced from the items "Health Information (TABNET)", "Health Care" and "Outpatient Production (SIA/SUS)". The study area was the geographic regions of Brazil between January 2005 and December 2018, and included the necessary procedures (Chart 1).

To obtain the HA provision rate, the number of devices dispensed by the SUS in the geographic regions was determined, using IBGE population estimates for each year as denominator[15], in line with WHO recommendations[16].

The rates were calculated to study the trends using the Joinpoint Regression Program, version 4.7.0.0, which allows fitting data to a series with the fewest possible number of joinpoints (zero, that is, a straight line with no inflection points), and testing whether including more joinpoints was statistically significant, thereby determining if the estimated trends were also statistically significant[17].

Analysis with Joinpoint shows the moment at which the changes in trends occur and calculates the annual percentage change in each segment. The method used detected joinpoints with at most two points of change, selecting the best fit with the annual percentage change (APC), based on the trend of the segments, and estimating whether the values are statistically significant at a 95% confidence interval. Analysis initiates with a minimum number of joinpoints and compares if ≥ 1 is significant. The significant tests used are based on the Monte Carlo permutation method and the annual percentage change in the rate, using the logarithm of the rate[17].

Descriptive analyses were conducted for the technological category data, HA funding and replacement, and audiological follow-up of the users. In regard to HA replacement, a proportion was calculated involving the number of replacements approved by the SUS in the geographic regions, between 2005 and 2018, with the number of devices provided during the same period used as denominator.

In the present study, the individuals were not identified, dispensing the need for approval by the Research Ethics Committee, in accordance with National Health Council Resolution no. 510/2016[18].

Chart 1. Procedures selected for study analysis

Code and description – From 2007 onwards	Code and description – From 2008 onwards
3901105 – Follow-up of patients aged 3 years or younger with uni/bilateral HA	0301070032 – Follow-up of patient fitted with uni/bilateral HA
3901106 – Follow-up of patients between 3 and 15 years of age with uni/bilateral HA	
3901107 – Follow-up of patients aged 15 years or older with uni/bilateral HA	
3902101 – External behind-the-ear type A HA	0701030127 – External behind-the-ear type A HA
3902102 – External behind-the-ear type B HA	0701030135 – External behind-the-ear type B HA
3902103 – External behind-the-ear type C HA	0701030143 – External behind-the-ear type C HA
3902104 – External in-the-ear type A HA	0701030038 – External in-the-ear type A HA
3902105 – External in-the-ear type B HA	0701030046 – External in-the-ear type B HA
3902106 – External in-the-ear type C HA	0701030054 – External in-the-ear type C HA
3902107 – External in-the-canal type A HA	0701030062 – External in-the-canal type A HA
3902108 – External in-the-canal type B HA	0701030070 – External in-the-canal type B HA
3902109 – External in-the-canal type C HA	0701030089 – External in-the-canal type C HA
3902110 – External micro canal type A HA	0701030097 – External micro canal type A HA
3902111 – External micro canal type B HA	0701030100 – External micro canal type B HA
3902112 – External micro canal type C HA	0701030119 – External micro canal type C HA
3902113 – External conventional bone conduction type A HA	0701030011 – External conventional bone conduction type A HA
3902114 – Behind-the-ear external bone conduction type A HA	0701030020 – External behind-the-ear bone conduction type A HA
3902201 – External behind-the-ear type A replacement HA	0701030275 – External behind-the-ear type A replacement HA
3902202 – External behind-the-ear type B replacement HA	0701030283 – External behind-the-ear type B replacement HA
3902203 – External behind-the-ear type C replacement HA	0701030291 – External behind-the-ear type C replacement HA
3902204 – External in-the-ear type A replacement HA	0701030186 – External in-the-ear type A replacement HA
3902205 – External behind-the-ear type B replacement HA	0701030194 – External in-the-ear type B replacement HA
3902206 – External behind-the-ear type C replacement HA	0701030208 – External in-the-ear type C replacement HA
3902207 – External in-the-canal type A replacement HA	0701030216 – External in-the-canal type A replacement HA
3902208 – External in-the-canal type B replacement HA	0701030224 – External in-the-canal type B replacement HA
3902209 – External in-the-canal type C replacement HA	0701030232 – External in-the-canal type C replacement HA
3902210 – External micro canal type A replacement HA	0701030240 – External micro canal type A replacement HA
3902211 – External micro canal type B replacement HA	0701030259 – External micro canal type B replacement HA
3902212 – External micro canal type C replacement HA	0701030267 – External micro canal type C replacement HA
3902213 – External conventional bone conduction type A replacement HA	0701030160 – External conventional type A bone conduction replacement HA
3902214 – External behind-the-ear bone conduction type A replacement HA	0701030178 – External behind-the-ear type A bone conduction HA

HA = hearing aid

RESULTS

A total of 2,106,448 HA were provided in Brazil between 2005 and 2018, whose average provision rate was 7.66/10,000 inhabitants. The South (9.96/10,000 inhabitants) recorded the highest average provision rate and the North the lowest (3.20/10,000 inhabitants) (Table 1).

Analysis with Joinpoint detected a trend towards a significant increase between 2005 and 2011 in Brazil (APC1 = 7.8; 95% CI 4.0 to 11.8). The increasing trends were significant in the North (APC1 = 29.1; 95% CI 15.7 to 44.1), between 2005 and 2011; Southeast (APC1 = 8.5; 95% CI 4.7 to 12.3), between 2005 and 2011; and the Midwest (APC1 = 32.0; 95% CI 22.8 to 41.8), between 2005 and 2009. Later, there was a trend toward a significant decline in the Southeast (APC2 = -4.2; 95% CI -6.8 to -11.5), between 2011 and 2018, and the Midwest (APC2 = -3.6; 95% CI -5.6 to -1.6), between 2009 and 2018 (Table 1).

Between 2005 and 2018, the HA provision rates were unstable in the geographic regions. The rates in the Southeast and South were above those for Brazil and as of 2008, the Midwest rates were also higher. By contrast, the North and Northeast rates were lower than those for Brazil in all the years studied (Figure 1).

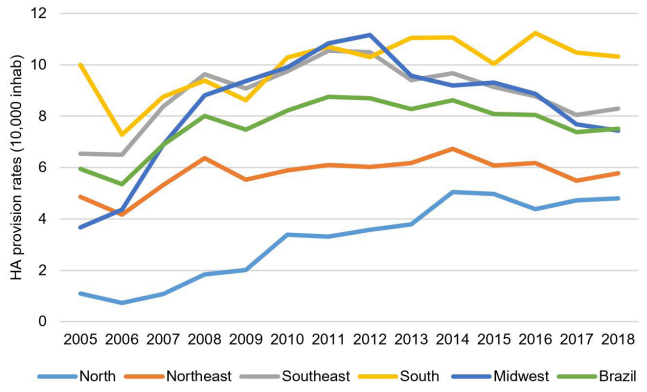
Between 2005 and 2018, 826,902 HA from technological category A (39.26%) were provided, 777,925 from category B (36.93%) and 501,621 from category C (23.81%). The amount of funding approved for HA provision was BRL 1,706,221,375.00. Category C received the most funding in all the geographic regions, except the Southeast, where the value approved was highest for category B (Figure 2).

A total of 402,006 HA were replaced, that is, 19.08% of those provided between 2005 and 2018. During this period, the Midwest replaced the highest proportion of HA (24.78%), followed by the North (23.54%), Southeast (21.07%), South

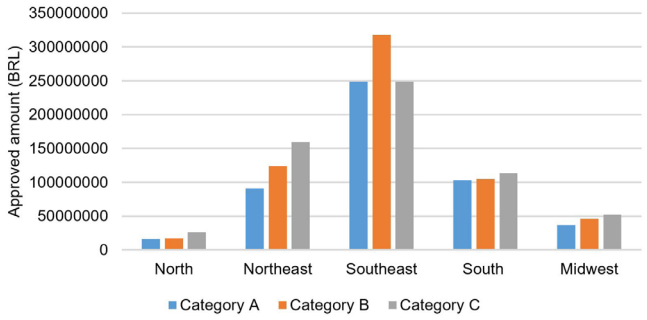
Table 1. Average rates of HA provision (10,000 inhabitants) in the geographic regions of Brazil, APC, Joinpoint years and 95%CI

Region	Average rate	APC1	95%CI	APC2	95%CI
North	3.20	29.1* (2005-2011)	15.7 to 44.1	5.1 (2011- 2018)	-3.7 to 14.6
Northeast	5.76	11.1 (2005-2008)	-2.3 to 26.4	0.0 (2008-2018)	-2.0 to 2.0
Southeast	8.87	8.5* (2005-2011)	4.7 to 12.3	-4.2* (2011-2018)	-6.8 to -11.5
South	9.96	3.3 (2005-2013)	-0.1 to 6.9	-0.8 (2013-2018)	-7.4 to 6.3
Midwest	8.36	32.0* (2005-2009)	22.8 to 41.8	-3.6* (2009-2018)	-5.6 to -1.6
Brazil	7.66	7.8* (2005-2011)	4.0 to 11.8	-2.6 (2011- 2018)	-5.3 to 0.3

*Statistically significant
HA = hearing aid; APC = annual percentage change; 95%CI = 95% confidence interval



HA = hearing aid
Figure 1. HA provision rates (10,000 inhab) in the Brazilian geographic regions



HA = hearing aid
Figure 2. HA provision according to technological categories and approved amount in the Brazilian geographic regions

(16.02%) and Northeast (14.22%). The total amount approved for this procedure was BRL 301,674,900.00 for all the regions.

Outpatient audiological follow-up, with a total of 1,727,793, was lower than that of HA provision in Brazil between 2005 and 2018. The Southeast (45.88%) exhibited the highest percentage, followed by the South (27.45%), Northeast (14.80%), Midwest (7.69%) and North (4.18%).

DISCUSSION

The results of the present study showed disparities in HA provision by the SUS between 2005 and 2018. The supply of these devices experienced temporal and regional oscillations, resulting in non-compliance with SUS principles and compromises the effectiveness of hearing health care.

In the period analyzed, HA provision by the SUS increased, as a function of the rise in hearing impairments in Brazil[19], associated with the significant aging of the population[4]. In addition, the creation of the PNASA broadened hearing health care compared to that provided up to 2004[19], expanding hearing-related services and measures[20] and allowing more users to have access to HA supplied by the SUS[21].

Although the hearing rehabilitation process in Brazil stands out in Latin America[22], many people with hearing loss have yet to be fitted with HA, reflecting the inequity between the geographic regions and unequal access to healthcare services and products[19,22,23]. The duality of success and failure in the SUS aggravates regional inequalities and hinders universal access to health services and products[6,24]. Lack of access to HA is an important obstacle, given that the provision of this resource should be unrestricted[1].

The HA provision rate shows that universal access and the distribution of services are factors that illustrate regional inequalities. In 2010, hearing health coverage was lowest in the North and Midwest[5]. One study concluded that the North provided half the coverage needed, while the Southeast and South exceeded estimates. Between 2004 and 2011, the North and Midwest saw the largest growth in the number of mid and high complexity diagnostic procedures in hearing health[20].

The results of this study showed that the APC1 in the North and Midwest regions obtained the highest increasing trends in HA provision. The findings reflect the fact that until 2012, these regions had the largest number of accredited hearing health services. This scenario demonstrates that investments were made to increase the number of SUS-accredited hearing health services in areas with the least coverage[23], and that improved access can influence HA provision procedures[25].

In a study on HA provision by the SUS from 1993 to 2012, a significant rise was observed from 2004 onwards[26]. Another investigation found that between 2008 and 2012, Brazil increased basic hearing assessment procedures, with a 73.6% rise in HA provision. Despite these advances, there was a decline in certain audiological procedures, except in the North and South[23].

In the present study, the Southeast and Midwest exhibited significant decreasing trends in HA provision rates, as illustrated by the APC2. Despite this decline, it is important to underscore

the gradual expansion of other interventions, such as cochlear implant surgeries[26], unawareness of the population regarding HA availability in the SUS and the massive market presence of private companies supplying HA to individuals with higher purchasing power[27].

In addition, the decreasing trend of HA provision is in line with the estimates of a predominance of hearing impairments in the lower socioeconomic classes, whose primary healthcare source is the SUS, and the growth in the older population in Brazil, the group most in need of healthcare services[3,4]. While these factors stimulate change in public health services, the lack of these services suppresses demand and needs[25], so much so that a large number of people with hearing impairment have not received the HA they require[22].

It is worth noting the differences between the populations treated and the hearing health services, given that Brazil is demographically heterogeneous[11,20], where historically, deep social, economic and regional differences have prevailed[6]. Researchers have reported that the use of teleaudiology may help overcome the gaps in HA provision in large countries[28], since hearing health services are generally concentrated in major urban centers, hindering access by users from peripheral and remote regions, thereby decreasing outpatient production[23,26].

However, in regard to hearing health, unequal efforts and resources are applied, primarily in terms of HA expenditures made by the SUS[19]. Between 2005 and 2018, technological category C incurred the highest costs, which is partially justified by the increasing order of costs of categories A, B and C[21].

On the other hand, the HA prescription percentage that the SUS[29] recommends for technological categories A (50%), B (35%) and C (15%), was not adhered to. Similarly, one study revealed that HA provision in Brazil between 2004 and 2010 was also underpredicted for category A and overpredicted for the other two[5]. At a hearing health facility in Paraná state, the percentage of category A (75%) predominated over B (17.93%) and C (7.06%)[13]. In São Paulo (SP), category A decreased following a municipal agreement that reestablished the provision percentage for A (30%), B (50%) and C (20%)[26].

In general, the use of HA should depend on the user's needs[4,14]. In Brazil, given the prevalence of light to moderate hearing loss, more flexible devices are needed, such as those from technological categories B and C[5]. The increase in these indications has been discussed internationally since category A is the most outdated, which limits amplification quality and leads to its being less prescribed in hearing health services. This information is important in revising the percentage established by the SUS and optimizing the financial resources invested[5,26].

Public services should adapt to heath needs, analyzing financial resource allocation to strengthen the cost-benefit relation[6,28]. As such, implementing hearing loss preventive measures is the most economical way to lower the high costs of hearing health caused primarily by HA provision[1,28].

Optimizing public expenditures is also essential in HA replacement, given that the geographic regions recorded high proportions. Expanding HA repairs by the SUS is an important strategy because many individuals cannot afford to pay for this service, and frequently stop using the device or request replacements from the hearing health facilities[12,21,30]. Researchers found that the savings obtained from decreasing public expenditures on replacements would benefit HA provision by the SUS, shortening the waiting times for the device[21].

In one hearing health service, it was concluded that 27.2% of the patients needed at least one HA replacement[30], a value below that reported in another study (31%)[12]. The main causes of HA replacement are technical problems, generally due to incorrect use[30], loss, theft, wear and changes in the user's audiological status[21]. To lengthen the lifespan of HA, it is important to periodically monitor the user, since it is not enough to merely provide the device[5,21,26,30].

SUS-accredited hearing health services are responsible for the audiological follow-up of patients[13]. However, the fragmented SUS and practices centered on providing HA limit this follow-up[26]. As observed in this study, researchers in Minas Gerais state found less audiological follow-up when compared to the HA provision procedure, in addition to the heterogenous regions of the state itself[25].

The difference between the results of outpatient HA provision and audiological follow-up may be due to the fact that the provisions were registered twice, since most of users are fitted bilaterally[5,25]. The records of audiological follow-up are independent of fitting, but with the new guidelines established by the SUS, it is expected that the former procedure will surpass the latter. The maximum levels imposed on the hearing health services is one of the obstacles, given that new patients are generally prioritized[5,26].

Accessibility, lack of human resources and specialized materials and difficulties in adherence and regulation also hamper audiological follow-up[14,19,25,26]. In this respect, the concentration of audiological follow-up in the Southeast is justifiable since the region performs the largest number of audiological procedures[20] and has the most audiologists in Brazil[22].

Outpatient production, especially audiological follow-up in the SUS, prompted establishment of the PNASA[5], due to the involvement of health information systems in Brazil, considered essential instruments to monitor and assess policies[24]. To that end, it is important to routinely monitor the data of these systems[28].

Nevertheless, SIA/SUS data are underutilized by health administrators and should be carefully analyzed because they are subject to digitation errors and undernotification, challenges inherent to the studies that use them[5,20,26]. Another disadvantage is the unviability of analyzing users and their peculiarities[26], because the aggregated data do not indicate the complexity of individual, collective, objective and subjective problems in hearing rehabilitation[19].

The present study has other limitations inherent to the SIA/SUS, such as the preclusion of collecting data related to sex, age group and fitting methods, given that the SIA/SUS

does not record if the fittings were unilateral or bilateral. The absence of data regarding the real prevalence of hearing loss and the different inter and intraregional care approaches used are also noteworthy restrictions.

In this respect, it is hoped that the present study stimulates dialogue on HA provision by the SUS and contributes to legislation in the area, in order to reduce regional inequalities, optimize public expenditures and improve hearing outcomes. Given the scarcity of studies addressing the issue, new research is recommended using different techniques such as geoprocessing and analyses conducted in states and/or municipalities.

CONCLUSION

The outpatient provision of HA by the SUS changed considerably between 2005 and 2018, with increasing and decreasing provision rates and marked discrepancies between geographical regions. In the period analyzed, there was inequitable distribution of technological categories, increasing costs, a significant number of replacements and insufficient audiological follow-up of HA users.

REFERENCES

1. WHO: World Health Organization. Addressing the rising prevalence of hearing loss. Geneva: WHO; 2018.
2. IBGE: Instituto Brasileiro de Geografia e Estatística. [Internet]. Censo demográfico. Rio de Janeiro: IBGE; 2010 [citado em 2019 Jul 12]. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/populacao/9662-censo-demografico-2010.html?edicao=9749&t=destaques
3. Ribeiro UASL, Souza VC, Lemos SMA. Qualidade de vida e determinantes sociais em usuários de aparelho de amplificação sonora individual. CoDAS. 2019;31(2):e20170287. http://dx.doi.org/10.1590/2317-1782/20182017287. PMid:30942286.
4. Mondelli MFCG, Silva LSL. Perfil dos pacientes atendidos em um sistema de alta complexidade. Arq Int Otorrinolaringol. 2011;15(1):29-34. http://dx.doi.org/10.1590/S1809-48722011000100004.
5. Bevilacqua MC, Morettin M, Melo TM, Amantini RCB, Martinez MANS. Contribuições para análise da política de saúde auditiva no Brasil. Rev Soc Bras Fonoaudiol. 2011;16(3):252-9. http://dx.doi.org/10.1590/S1516-80342011000300004.
6. Castro MC, Massuda A, Almeida G, Menezes-Filho NA, Andrade MV, Noronha KVMS, et al. Brazil's unified health system: the first 30 years and prospects for the future. Lancet. 2019;394(10195):345-56. http://dx.doi.org/10.1016/S0140-6736(19)31243-7. PMid:31303318.
7. Brasil. Ministério da Saúde. Portaria n º 432, de 14 de novembro de 2000. Institui a ampliação do universo de concessão de Aparelhos de Amplificação Sonora Individuais (AASI) aos pacientes em tratamento pelo Sistema Único de Saúde e dá outras providências. Diário Oficial da União; Brasília; 17 nov. 2000.
8. Brasil. Ministério da Saúde. Portaria GM/MS nº 2.073, de 28 de setembro de 2004. Institui a Política Nacional de Atenção à Saúde Auditiva. Diário Oficial da União; Brasília; 29 set. 2004.
9. Brasil. Presidência da República. Casa Civil. Subchefia para Assuntos Jurídicos. Decreto nº 7.612, de 17 de novembro de 2011. Institui o Plano Nacional dos Direitos da Pessoa com Deficiência - Plano Viver sem Limite. Diário Oficial da União; Brasília; 18 nov. 2011.
10. Brasil. Ministério da Saúde. Portaria nº 793, de 24 de abril de 2012. Institui a Rede de Cuidados à Pessoa com Deficiência no Âmbito do SUS. Diário Oficial da União; Brasília; 25 abr. 2012.
11. Bevilacqua MC, Melo TM, Morettin M, Lopes AC. A avaliação de serviços em Audiologia: concepções e perspectivas. Rev Soc Bras Fonoaudiol. 2009;14(3):421-6. http://dx.doi.org/10.1590/S1516-80342009000300021.
12. Bevilacqua MC, Melo TM, Morettin M, Reis ACMB, Martinez MANS. Falhas técnicas dos aparelhos de amplificação sonora individual dispensados pelo Sistema Único de Saúde. Rev CEFAC. 2014;16(1):55-64. http://dx.doi.org/10.1590/1982-0216201411312.
13. Mazzarotto IHEK, Gonçalves CGO, Bellia CGL, Moretti CAM, Iantas MR. Integralidade do cuidado na atenção à saúde auditiva do adulto no SUS: acesso à reabilitação. Audiol Commun Res. 2019;24:e2009. http://dx.doi.org/10.1590/2317-6431-2018-2009.
14. Cox RM, Johnson JA, Xu J. Impact of hearing aid technology on outcomes in daily life I: the patients' perspective. Ear Hear. 2016;37(4):e224-37. http://dx.doi.org/10.1097/AUD.0000000000000277. PMid:26881981.
15. IBGE: Instituto Brasileiro de Geografia e Estatística. [Internet]. População residente das Unidades da Federação e Grandes Regiões, enviada ao Tribunal de Contas da União - 2001-2019. Rio de Janeiro: IBGE; 2020 [citado em 2019 Jul 24]. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/populacao/9103-estimativas-de-populacao.html?=&t=resultados
16. WHO: World Health Organization. Ear and hearing care: indicators for monitoring provision of services. Geneva: WHO; 2019.
17. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation test for joinpoint regression with applications to cancer rates. Stat Med. 2000;19(3):335-51. http://dx.doi.org/10.1002/(SICI)1097-0258(20000215)19:3<335::AID-SIM336>3.0.CO;2-Z. PMid:10649300.
18. Brasil. Ministério da Saúde. Conselho Nacional de Saúde. Resolução nº 510, de 7 de abril de 2016. Trata sobre as diretrizes e normas regulamentadoras de pesquisa em ciências humanas e sociais. Diário Oficial da União; Brasília; 24 mai. 2016.
19. Vianna NG, Cavalcanti MLT, Acioli MD. Princípios de universalidade, integralidade e equidade em um serviço de atenção à saúde auditiva. Cien Saude Colet. 2014;19(7):2179-88. http://dx.doi.org/10.1590/1413-81232014197.09392013. PMid:25014297.
20. Silva LSG, Gonçalves CGO, Soares VMN. Política Nacional de Atenção à Saúde Auditiva: um estudo avaliativo a partir da cobertura de serviços e procedimentos diagnósticos. CoDAS. 2014;26(3):241-7. http://dx.doi.org/10.1590/2317-1782/201420140440. PMid:25118922.
21. Dumke C, Ribas Â, Gonçalves CGO, Martins J, Malucelli D. Investigação das falhas técnicas verificadas em próteses auditivas de usuários de um programa público de saúde auditiva. Rev CEFAC. 2014;16(4):1117-24. http://dx.doi.org/10.1590/1982-021620147612.
22. Bevilacqua MC, Novaes BC, Morata TC. Audiology in Brazil. Int J Audiol. 2008;47(2):45-50. http://dx.doi.org/10.1080/14992020701770843. PMid:18236235.
23. Andrade CL, Fernandes L, Ramos HE, Mendes CMC, Alves CAD. Programa Nacional de Atenção à Saúde Auditiva: avanços e entraves da saúde auditiva no Brasil. Rev Ciênc Méd Biol. 2013;12(4):404-10. http://dx.doi.org/10.9771/cmbio.v12i4.9181.
24. Paim JS. Sistema Único de Saúde (SUS) aos 30 anos. Cien Saude Colet. 2018;23(6):1723-8. http://dx.doi.org/10.1590/1413-81232018236.09172018. PMid:29972481.
25. Rezende CF, Carvalho SA, Maciel FJ, Oliveira Neto R, Pereira DV, Lemos SM. Hearing health network: a spatial analysis. Rev Bras Otorrinolaringol (Engl Ed). 2015;81(3):232-9. http://dx.doi.org/10.1016/j.bjorl.2014.01.003. PMid:25382426.
26. Vieira GI, Mendes BCA, Zupelari MM, Pereira IMTB. Saúde auditiva no Brasil: análise quantitativa do período de vigência da Política Nacional de Atenção à Saúde Auditiva. Distúrb Comun. 2015;27(4):725-40.
27. Paiva KM, Maciel PMA, Cintra LG. Compreendendo o idoso usuário de próteses auditivas. Cien Saude Colet. 2011;16(6):2927-34. http://dx.doi.org/10.1590/S1413-81232011000600030. PMid:21709989.
28. Wilson BS, Tucci DL, Merson MH, O'Donoghue GM. Global hearing health care: new findings and perspectives. Lancet. 2017;390(10111):2503-15. http://dx.doi.org/10.1016/S0140-6736(17)31073-5. PMid:28705460.

29. Brasil. Ministério da Saúde. Instrutivos de reabilitação auditiva, física, intelectual e visual (CER e serviços habilitados em uma única modalidade). Brasília: MS; 2013.

30. Ruschel NL, Bonatto AS, Teixeira AR. Reposição de próteses auditivas em programa de saúde auditiva. Audiol Commun Res. 2019;24:e2025. http://dx.doi.org/10.1590/2317-6431-2018-2025.

Authors' contributions

ROF was responsible for study design, data collection and analysis, writing and revising of the final article; MRPD was responsible for study design, data collection and analysis, writing and revising of the final article; MAFF was responsible for study design, advisor, data analysis, and writing and revising of the final article.