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Review articles

Criteria to classify degrees of hearing loss and the social protection of people with this disability

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ABSTRACT

Purpose: to identify criteria used nationally and internationally to classify degrees of hearing loss, compare them with what is established in the Brazilian law, and discuss possible consequences of such a law on the social protection of people with hearing loss.

Methods: a narrative review was conducted to identify the criteria used in this classification, by searching the platforms VHL and PubMed in April 2020. It included primary human research explicitly mentioning the criteria used to classify the degree of hearing loss, published between 2015 and 2019 in English, Spanish, and Portuguese.

Literature Review: there is a preference for the four-frequency mean at 0.5, 1, 2, and 4 kHz. The Brazilian law does not follow these criteria, which may pose a barrier to people with hearing loss, hindering their access to social protection programs.

Final Considerations: there is no consensus on the best criteria, although the most encompassing ones in hearing assessment predominate – which are not the ones legally used in Brazil. It is necessary to debate the Brazilian legal criteria to ensure existing social rights to part of people with hearing loss in Brazil.

Keywords: Legislation; Diagnosis; Hearing Tests; Deafness; Persons with Hearing Impairments; Public Policy

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INTRODUCTION

Hearing loss (HL) is the third most predominant disability in Brazil, with an approximately 1.1% prevalence in the general population, according to the last (2010) demographic census by the Brazilian Institute of Geography and Statistics (IBGE)[1]. According to the 2019 National Health Survey (PNS), there were about 2.3 million Brazilians with HL[2].

One of the concerns with HL is late diagnosis. If not diagnosed early, it may cause important child developmental delays. In cases of postlingual HL, it also impairs these patients' social life. However, despite the social and economic impacts on people with this disability, early HL diagnosis is still a health policy issue. An initial obstacle to reaching a diagnosis is the population's access to health services[3].

Regarding classification, HL is characterized according to the type, audiometric configuration, laterality, and degree. It is called bilateral when it affects both ears, and unilateral when it affects only one. Unilateral HLs are not less significant than bilateral ones. They bring a series of limitations to the individual because in these cases the brain receives auditory information from only one ear, impairing auditory skills such as sound localization, speech comprehension in noisy environments, and hearing difficulties in specific situations. Hence, activities like crossing a street, participating in classroom discussions, and so forth demand great effort[4,5].

Many recommendations are found for the degree of HL because there is no consensus on the criteria for its classification. The Federal Speech-Language-Hearing Council (CFFa), the agency that regulates the practice of these professionals in Brazil, has promulgated resolutions on HL classification considering technical-scientific advancements. The agency recommends calculating degrees of HL based on the arithmetic mean of hearing thresholds at 0.5, 1, 2, and 4 kHz (four-frequency mean) or at 0.5, 1, and 2 kHz (three-frequency mean)[6].

Means above 41 dB characterize moderate, severe, or profound HL or total deafness. Nomenclature depends on the references used, with possible variations between them. However, all of them indicate hearing difficulties on an increasing scale, ranging from amplified speech comprehension to total sound perception incapacity[6].

Decree no. 5.296/2004[7] stands out in the Brazilian law as it addresses the basic criteria to provide accessibility to people with disabilities (PWD). The calculation of the degree of HL in this decree is not the same as recommended by CFFa. Also, it does not consider unilateral HLs. On the other hand, both documents state that HL above 41 dB causes considerable speech comprehension difficulties. Another issue is that the Ministry of Health has not promulgated any protocols in this regard.

Brazilian Decree no. 7.612/2011 instituted the National Plan for the Rights of PWD ("Living without Limits" Plan)[8], which describes a series of commitments made by the federal government regarding the rights of PWD. Moreover, Law no. 13.146/2015 was promulgated as a legal framework to put these rights into practice, as it recognizes the relevance of public policies implemented by the State aiming at the social inclusion of PWD[9].

Nevertheless, despite these advancements, doubts remain regarding the convergence of HL diagnosis criteria used by the Brazilian government, other institutions in the country, and internationally used parameters. Both laterality and the calculation of the degree are relevant to HL diagnosis because recognizing individuals with HL has important practical, legal, economic, and social consequences for them and their families[10].

Social policies – whose main objective is to protect all vulnerable people – are essential in the context of the high prevalence of people with HL, with significant socioeconomic consequences[11]. If some people with important HL are not recognized as PWD, they are denied access to social programs and specific opportunities aimed at this public. It must be pointed out that the concept of disability in the International Classification of Functioning (ICF) – which is at the core of this discussion – is broad, going beyond functional measurements. It recognizes the determinants of living conditions of PWD, thus stimulating the conception of inclusive public policies[12].

Hence, despite the progressive implementation of more inclusive public policies in Brazil, there may be significant restrictions involving the public for whom they were intended – i.e., the beneficiaries of these policies. For instance, there are the criteria to classify people with HL referred to in Decree no. 5.296/2004[7].

Therefore, this article aimed at identifying national and international criteria used to classify degrees of HL, compare them with the ones established in the Brazilian law, and discuss possible consequences of the parameters used in Brazil for the social protection of people with HL.

METHODS

A narrative review of the scientific literature was conducted, whose central topic was the classification of degrees of HL. In general, narrative reviews are conducted to synthesize the scientific literature neither systematically nor exhaustively, though it is recommended that they i) justify their importance; ii) establish their objectives or concrete questions they aim to answer; iii) describe the literature search strategy; iv) support statements with references; v) present appropriate evidence; and vi) adequately present relevant results[13].

Since it is a secondary method, which does not involve the identification of humans, it was not necessary to register the study in the National Commission for Research Ethics (CONEP) or have it evaluated by the Research Ethics Committee, according to stipulations in Resolution no. 510/2016 of the National Health Council.

The research question was as follows: "What criteria are used nationally and internationally to classify the degrees of HL?".

The scientific literature was searched on two platforms – Virtual Health Library (VHL) and PubMed –, which give access to important sources of information in the field of health – the Latin American and Caribbean Health Sciences Literature (LILACS) and Medical Literature Analysis and Retrieval System Online (MEDLINE). Other sources, such as the Brazilian law and technical documents, were also searched. The search took place in April 2020, considering documents published between 2015 and 2019.

The inclusion criteria were as follows: A) research published in English, Spanish, and Portuguese; B) studies in humans; C) primary/original studies; D) studies published between 2015 and 2019; and E) explicitly mentioned criteria used to classify the degrees of HL. The exclusion criteria were A) research published in other languages; B) animal studies; C) secondary studies, such as systematic, narrative, and integrative reviews, meta-analyses, and clinical practice guidelines; D) duplicates; and E) studies that did not explicitly mention the criteria used to classify the degrees of HL.

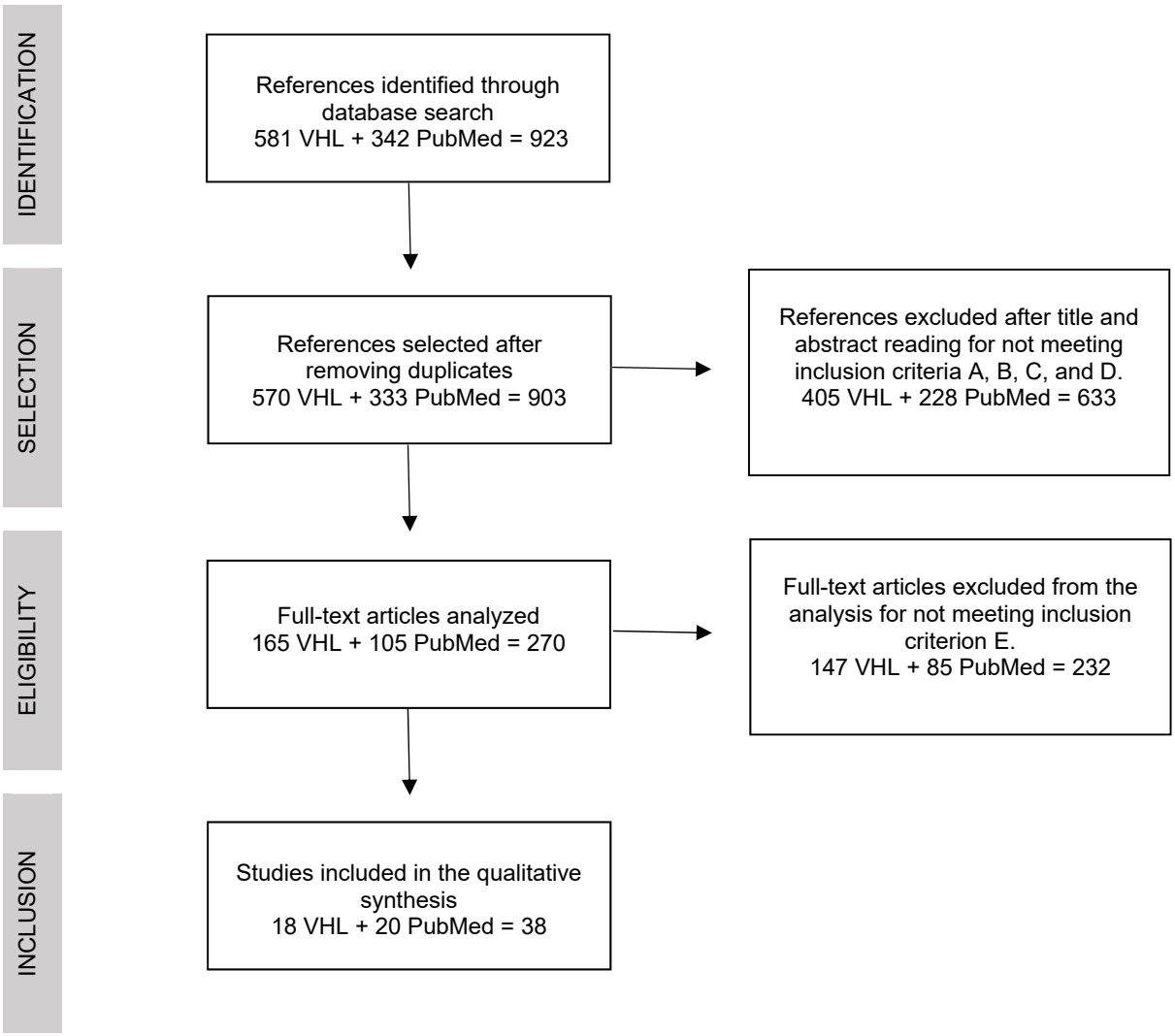
Studies were selected based on different search strategies for each database, though always with the Boolean operator AND. The following terms from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) were used: "*critérios*", "*diagnóstico*", "*deficiência auditiva*", "hearing loss", "criteria", and "diagnosis". VHL was screened with the following search expression: (tw:(critérios)) and (tw:(diagnóstico)) and (tw:(deficiência auditiva)). The option "title, abstract, and topic" was selected in all lines. The strategy used in PubMed was: ((hearing loss [MeSH Terms]) and criteria [Title/Abstract]) and diagnosis [Title/Abstract].

Two independent authors concluded all phases of the narrative review, with no divergence between them. The initial criterion in study selection was the removal of duplicates, followed by the removal of references after the title and abstract reading; lastly, eligible studies were read in full text for inclusion. Data were structured in an instrument with the following information: search platform, authors, year of publication, country, criteria used to calculate the degrees of HL, objective, study type or method used, and HL laterality. The research made qualitative and descriptive analyses, discussing the points mentioned in the study objectives.

LITERATURE REVIEW

Altogether, 923 references were identified in the database search (581 in VHL and 342 in PubMed). Of these, 20 duplicates were removed (11 from VHL and 9 from PubMed). Thus, 903 studies were selected, of which 633 were excluded after the title and abstract reading for not meeting inclusion criteria A, B, C, and D. Hence, 270 studies were eligible for more careful analysis, of which 232 did not meet inclusion criterion E. Lastly, 38 references were included in the qualitative synthesis (Figure 1).

The synopsis of the 38 references included in the review is presented below (Figure 2).



Source: Developed by the authors.

Figure 1. Flowchart with selected studies

CRITERIA/STUDY	YEAR	COUNTRY	OBJECTIVE	STUDY TYPE OR METHOD*	LATERALITY
1. Mean 0.5, 1, 2, and 4 kHz					
1. Chu et al.[14]	2019	Taiwan	To demonstrate a new approach to screening schoolchildren's hearing status.	Prospective cohort study.	Unilateral and bilateral.
2. Gisselsson-Solen M.[15]	2018	Sweden	To investigate the circumstances in which Swedish children received grommets and examine how physicians follow surgery guidelines.	Descriptive study. Secondary database analysis.	NA.
3. Soli et al.[16]	2018	USA	To validate the use of the Extended Speech Intelligibility Index (ESII) to predict non-stationary real-world speech intelligibility in noisy settings.	Predicted and measured speech intelligibility analyses.	Bilateral.
4. Heffernan et al.[17]	2018	USA	To describe the characteristics of hearing losses documented in patients treated with clarithromycin alone for nontuberculous mycobacterial lymphadenitis.	Descriptive study. Secondary database analysis.	Unilateral and bilateral.
5. Looi, Bluett, Boisvert.[18]	2017	Australia	To investigate the referral rates of postlingual deaf adult candidates to a cochlear implant.	Retrospective cohort study.	Unilateral and bilateral.
6. Kreicher et al.[19]	2017	USA	To assess the type and degree of hearing loss in child patients with primary ciliary dyskinesia and relate these measures with the patients' demography and otologic factors.	Cross-sectional study. Secondary database analysis.	Unilateral and bilateral.
7. Weir et al.[20]	2017	USA	To assess the prevalence, type, and degree of hearing loss in children with paralysis and analyze the audiological and otologic results.	Cross-sectional study. Secondary database analysis.	Unilateral and bilateral.
8. Muus et al.[21]	2017	USA	To assess the prevalence, type, and severity of hearing loss in children with growth hormone deficiency.	Retrospective cohort study.	Unilateral and bilateral.
9. Sacco et al.[22]	2016	France	To assess the quantitative hearing benefit provided by using TEO First®, a hearing aid.	Clinical trial without a control group.	Bilateral.
10. Leigh, Dettman, Dowell.[23]	2016	Australia	To establish updated evidence-based guidelines to recommend a cochlear implant to small children.	Prospective cohort study.	NA.
11. Bennett, Meyer, Eikelboom.[24]	2016	Australia	To assess whether clinical follow-up is associated with better hearing aid outcomes.	Prospective cohort study.	NA.
12. Brennan-Jones, Eikelboom, Swanepoel.[25]	2016	Australia	To examine the diagnostic accuracy of automated audiometry in adults with hearing loss.	Accuracy study.	Unilateral and bilateral.
13. Mistry et al.[26]	2016	England	To identify the key factors in identifying patients with nonorganic hearing loss during cochlear implant assessment and present a local screening protocol for this type of loss.	Cross-sectional study. Secondary database analysis.	Unilateral and bilateral.
14. Weir et al.[27]	2016	USA	To assess the prevalence, type, and severity of hearing loss in patients with velocardiofacial syndrome and compare them with patients' demography and other otologic factors.	Cross-sectional study. Secondary database analysis.	Unilateral and bilateral.
15. Seccia et al.[28]	2016	Italy	To assess the clinical characteristics of audiological impairment and its relationship with the nasal, vestibular, and rheumatological profile of patients with eosinophilic granulomatosis with polyangiitis.	Prospective cross-sectional study.	Unilateral and bilateral.
16. El-Badry et al.[29]	2016	Egypt	To increase the sensitivity of radiological examination to diagnose large vestibular aqueduct syndrome.	Case-control study.	NA.
17. Kim et al.[30]	2016	USA	To assess the effect of ventilation tubes on long-term hearing results in children with a cleft palate.	Case series.	NA.
18. Moulin, Pauzie, Richard.[31]	2015	France	To validate and assess a French version of the speech, spatial, and hearing quality scale.	Validation of a research instrument.	Unilateral and bilateral.
19. Foulon et al.[32]	2015	Belgium	To determine hearing configuration in children with hearing loss born with cytomegalovirus infection.	Cross-sectional study.	Unilateral and bilateral.
20. Ribeiro et al.[33]	2015	Portugal	To assess the auditory function in individuals who finish the treatment of multi-resistant and extensively resistant tuberculosis at a reference center between 2009 and 2012.	Cross-sectional study.	NA.
21. Sanecka et al.[34]	2015	Poland	To determine whether electrocardiogram screening reduces the risk of sudden cardiac death in patients with hearing loss early diagnosing the Jervell and Lange-Nielsen syndrome.	Cross-sectional study.	Unilateral and bilateral.
22. Lovett, Vickers, Summerfield.[35]	2015	England	To determine criteria for child candidates for a bilateral cochlear implant.	Cross-sectional study.	NA.

CRITERIA/STUDY	YEAR	COUNTRY	OBJECTIVE	STUDY TYPE OR METHOD*	LATERALITY
2. Mean 0.5, 1, 2, and 3 kHz					
1. Puccinelli, Carlson.[36]	2019	USA	To highlight that sensorineural hearing loss improvement with steroid therapy does not exclude the diagnosis of vestibular schwannoma or the need for magnetic resonance imaging.	Cross-sectional study.	NA.
2. Dwyer-Hemmings et al.[37]	2019	England	To evaluate stapes surgery in patients with otosclerosis and profound hearing loss.	Cross-sectional study.	NA.
3. Weir et al.[38]	2016	USA	To assess the prevalence, type, and severity of hearing loss in patients with Ehlers-Danlos syndrome and compare these characteristics with the patients' demography and other otologic factors.	Cross-sectional study. Secondary database analysis.	Unilateral and bilateral.
4. Weir et al.[39]	2016	USA	To assess the prevalence, type, and severity of hearing loss in patients with Duane retraction syndrome and relate these measures with the patients' demography and other otologic and audiological factors.	Cross-sectional study. Secondary database analysis.	Unilateral and bilateral.
3. Mean 0.5, 1, and 2 kHz					
1. McRackan et al.[40]	2018	USA	To compare word recognition scores by adults submitted to cochlear implant assessments measured with earphones and hearing aids.	Cross-sectional study.	NA.
2. Mohan et al.[41]	2018	USA	To assess specific inner ear and general diseases in patients who reported hearing loss and whether they are sufficiently correlated.	Cross-sectional study.	NA.
3. Havenga et al.[42]	2015	South Africa	To compare tele-intervention with conventional intervention in 10 children with hearing loss and their families.	Crossover study.	Unilateral and bilateral.
4. Individual thresholds at 0.25, 0.5, 1, 2, 4, and 8 kHz					
1. Marnitz et al.[43]	2018	Germany	To assess the correlation of objective and patient-reported hearing loss with cervical cancer after cisplatin treatment.	Cross-sectional study.	Unilateral and bilateral.
2. Ungar et al.[44]	2017	Israel	To examine the numerical value in the classification scale (NRS) in the initial assessment of patients with suspicion of sudden unilateral sensorineural hearing loss until a formal audiogram is available.	Non-controlled prospective clinical study.	Unilateral.
3. Liberman.[45]	2015	Brazil	To identify whether genetic factors influence hearing loss in child patients treated for cancer with platinum chemotherapy.	Cross-sectional study.	NA.
5. Mean 0.25, 0.5, 1, 2, and 4 kHz					
1. Leigh et al.[46]	2016	Australia	To furnish evidence-based speech perception guidelines for the ear to be implanted.	Cross-sectional study.	Unilateral and bilateral.
2. Komori et al.[47]	2016	Japan	To evaluate whether idiopathic spontaneous perilymphatic fistula is a causing factor of sudden sensorineural hearing loss.	Cross-sectional study.	NA.
6. Mean 0.25, 0.5, 1, 2, 4, and 8 kHz					
1. Amarillo et al.[48]	2019	Spain	To describe the experience in the treatment of sudden idiopathic sensorineural hearing loss with intratympanic steroids.	Cross-sectional study.	Unilateral and bilateral.
2. Louw, Swanepoel, Eikelboom.[49]	2018	South Africa	To assess the performance of self-reported hearing loss both alone and in combination with pure-tone threshold audiometry in primary healthcare clinics in South Africa.	Cross-sectional study.	NA.
8. Mean 0.5, 1, and 2 kHz and mean 3, 4, and 6 kHz					
1. Jeong et al.[50]	2016	South Korea	To assess the association between rheumatoid arthritis and hearing loss in the adult Korean population.	Cross-sectional study. Secondary database analysis.	NA.
9. Individual thresholds at 0.125, 0.25, 0.5, 1, 2, 4, 6, and 8 kHz					
1. Bruno et al.[51]	2015	Italy	To verify whether an early replacement treatment can prevent sensorineural hearing loss in patients with congenital hypothyroidism with no risk factors for neuro-otologic changes.	Cross-sectional study.	Unilateral and bilateral.

Source: Developed by the authors.
Caption: NA = Not available.
Note*: Study types and methods reported in this chart were explicitly informed by the authors; when not clearly informed in the article, they were inferred from the methodological procedures they described.

Figure 2. Distribution of the references included in the review per criteria used to calculate the degrees of hearing loss, year of publication, country, objective, study type or method, and hearing loss laterality

The synopsis shows an unstandardized use of criteria to calculate degrees of HL. Different criteria were used in publications from different countries, and sometimes from the same country (Figure 2). However, these results may not reflect the norms stipulated in each country.

Altogether, nine criteria used to calculate the degrees of HL were identified. The three most cited ones are described below[14-42]. This excludes the studies presented in references 43 to 51, whose criteria are not mentioned in technical documents in Brazil.

Most studies (n = 22) used the four-frequency mean (at 0.5, 1, 2, and 4 kHz). They were published between 2015 e 2019 and conducted in 11 countries (Taiwan, Sweden, United States of America [USA], Australia, France, England, Italy, Egypt, Belgium, Portugal, and Poland) – among which, the USA stood out, with seven publications. The clinical indication to apply this criterion included diagnosis in adults and children, school screening, occupational audiology, cochlear implant indication and follow-up, otosclerosis, and otitis[14-35]. This criterion was comprehensively used, and most studies considered HL unilaterality.

The second and third most reported criteria were the four-frequency mean (at 0.5, 1, 2, and 3 kHz) (n = 4)[36-39] and the three-frequency mean (at 0.5, 1, and 2 kHz) (n = 3)[40-42]. The studies that employed these criteria were published between 2015 and 2019, in only three countries (USA, England, and South Africa). They were used to diagnose HL in general and in diseases such as acoustic schwannoma, Ehlers-Danlos syndrome, and Duane syndrome. Once again, the USA concentrated most pieces of research (n = 5).

In Brazil, CFFa recognizes in its audiological assessment instruction guide the existence of extensive literature to classify the degrees of HL. Based on robust studies, it suggests using the four-frequency mean (at 0.5, 1, 2, and 4 kHz) or the three-frequency mean (at 0.5, 1, and 2 kHz). According to the Council, professionals are free to choose either of these, but the decision must be properly referenced[6]. Other authors also admit the contradictions on which is the best classification – giving priority to speech intelligibility, they state that the mean obtained at 0.5 to 4 kHz is the most adequate criterion[52].

In 2011, Dobie[53] conducted a study validating the American Medical Association (AMA) method to estimate HL. This method argues that it is adequate to use the four-frequency mean at 0.5, 1, 2, and 3 kHz. Nevertheless, contrary to the use of AMA guidelines, some researchers have suggested that reliability and validation processes must be analyzed by different evaluators, not just one researcher in the field[54].

The Hearing Committee of the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) has recognized that the lack of standardization to classify hearing levels hinders research. Hence, they approved a standard for hearing results based on the four-frequency mean at 0.5, 1, 2, and 3 kHz. In 2013, the American Academy of Audiology (AAA) clearly stated its concern about this standardization, pointing out the need for enough evidence on the effectiveness of the approach. It also stated that using the 3-kHz frequency is not ideal for ototoxic- or noise-induced HL, for example, in which cases changes are found even at 4 kHz[55].

In Brazil, parallel to the CFFa recommendations, Decree no. 5.296/2004 (which regulates Laws no. 10.048/2000 and 10.098/2000) establishes that people with HL are those who meet the criteria described in article 4:

> People with disabilities are those who fit the following categories: ... II – hearing loss – bilateral, partial or total loss of forty-one or more decibels (dB), measured in audiograms at 500 Hz, 1000 Hz, 2000 Hz, and 3000 Hz[7].

Noticeably, the description in this decree does not consider unilateral losses and is ambiguous about the use of frequencies to calculate the degrees of HL. The text does not make it clear whether the value in dB is obtained from the four-frequency mean or each frequency alone. Neither of the alternatives follows the CFFa recommendations – which do not include the 3-kHz frequency to calculate the four-frequency mean or agree to establish degrees of HL based on single frequencies[6].

An imprecision is perceived when the HL measure criteria described in the Brazilian law are compared with the ones most used by national and international researchers. The literature presents little evidence for indicating the use of the 3-kHz frequency to calculate the four-frequency mean. Only four out of the 38 articles included in this analysis used this criterion – two of them conducted by the same authors. Moreover, clinical indications were limited, and none of them were conducted in Brazil, as shown above[36-39]. Not including 4 kHz in the calculation of the four-frequency mean affects the most accurate representation of speech intelligibility[52] – which points to the need to rediscuss

and reassess the legal criteria used in the country to recognize HL.

Brazilian legal structure makes it one of the most inclusive countries in Latin America. However, technical issues still need reckoning in order to decide on the best criteria to classify degrees of HL. These issues have consequences for another yet more complex problem – the social protection of people with HL.

The coexistence of questionable biomedical criteria – like the one used in Decree no. 5.296/2004[7] –, late diagnoses, and PWD's obstacles to living with dignity may result in considerable damage to these individuals and their families[56]. Consequences of HL involve not only communicational skills; emotional and socioeconomic aspects are likewise relevant and significantly affected, as educational, professional training, and job market opportunities pose a challenge to them[10].

In practical terms, to gain access to the rights acquired over time – e.g., companies' duty to hire PWD (Law no. 8.213/1991)[57], ensured Continued Payment Benefit (BPC, Law no. 8.742/1993)[58], and quota in civil service examinations (Decree no. 3.298/1999)[59] –, PWD often need to resort to the judiciary. Even then, decisions in this branch regarding the criteria that classify people with HL (specified in Decree no. 5.296/2004) are not unanimous. Jurisprudence in the Supreme Labor Court (TST) favors the recognition of unilateral HL as a disability[60], whereas in the Supreme Court of Justice (STJ), it follows the recommendation of the said Decree, not considering unilateral HL[61].

The "Living without Limits" Plan is an important legal framework[8] toward the inclusion of PWD. However, the initial obstacle imposed on these people – i.e., HL diagnosis – may keep their vulnerability from being recognized, leading to some extent to social exclusion instead of inclusion. The lack of guidelines of the Ministry of Health on criteria for this diagnosis further increases divergences on the topic and keeps HL, with all its complexity, invisible and not fully understood.

This article identified yet other criteria used to calculate the degrees of HL. However, despite being mentioned by the study authors, no recommendation was found in the literature supporting their use. These other criteria, which diverge from the three most prevalent ones, were employed to specific ends – e.g., assessing the ototoxicity of certain drugs and verifying the relationship between some diseases and HL.

Regarding the limitations of this study, only two platforms were used to search the scientific literature (VHL and PubMed), and no sources of government information were included – which may have limited the identification of technical documents from other countries addressing the classification of the degrees of HL. On the other hand, this limitation may have been minimized by the number of studies from the same country, as it is supposed that relevant national norms were considered when choosing the criteria used in the studies.

FINAL CONSIDERATIONS

This narrative review of the literature aimed to identify the criteria used nationally and internationally to classify the degrees of HL, revealing a lack of consensus between various countries. Nonetheless, there is a preference for the four-frequency mean at 0.5, 1, 2, and 4 kHz.

The Brazilian legal criteria to this end do not follow the evidence. As a consequence, some people with HL are not recognized as PWD and miss the benefits of social protection public policies. Hence, they are further socioeconomically vulnerable.

Brazil needs a more comprehensive debate on these criteria to make existing social rights accessible to people with HL. It is suggested that, through the National Commission for the Incorporation of Technologies (CONITEC) in the Unified Health System (SUS) and the General Coordination of Health for PWD, the Ministry of Health develop guidelines to classify the degrees of HL, reviewing the legal norms that are currently an obstacle to the social protection of part of the people with this disability.

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