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Original articles

Hearing and functioning: An analysis of the context of a hearing rehabilitation service based on the International Classification of Functioning

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ABSTRACT

Purpose: to verify the association between types and degrees of hearing loss and demographic factors and categories of the International Classification of Functioning, Disability, and Health, related to "Body Structures and Functions" and "Activities and Participation."

Methods: a cross-sectional, analytical, observational study with a nonprobabilistic sample, developed with secondary data, according to the International Classification of Functioning, Disability, and Health, obtained from the medical records of patients assessed for hearing rehabilitation at a specialized rehabilitation center. Descriptive and bivariate analyses were performed. Association analyses used Pearson's chi-square test, with the significance level set at 5%.

Results: the study analyzed 122 medical records, which revealed a predominance of women, a sensorineural hearing loss of a moderately severe degree and progressive history. The type of hearing loss was associated with three categories of Body Structures and Functions and three categories of Activities and Participation. The degrees of hearing loss were associated with 10 categories of Body Structures and Functions and six categories of Activities and Participation.

Conclusion: types and degrees of hearing loss are associated with Body Structures and Functions and Activities and Participation, further impairing communication.

Keywords: Hearing; Hearing Loss; Public Health; International Classification of Functioning, Disability and Health; Correction of Hearing Impairment

INTRODUCTION

Age-related hearing loss – presbycusis – affects one in three people aged 65 years, one in two in those aged 75, and up to 81% in those aged over 80 years[1,2]. It characteristically involves cochlear sensory cell loss, stria vascularis impairment, and auditory neuron degeneration[3], possibly compromising auditory functioning.

People with a complaint or confirmation of any type or degree of unilateral or bilateral hearing loss can be treated at hearing rehabilitation services in the Public Health System[4]. They assess and diagnose hearing loss; select, provide, and fit hearing aids (HA) to ensure the best use of the residual hearing of people with hearing loss; and offer speech-language-hearing therapy to monitor them and maintain the HA. Hearing rehabilitation minimizes barriers and allows the subject to participate in society on equal terms with other people[4].

The International Classification of Functioning, Disability and Health (ICF) classifies health and related aspects, focusing on describing the subject's functioning[5]. Its unified and standardized language makes it possible to compare descriptive data and health conditions between countries, services, and sectors and track their progress over time[5,6].

The ICF is divided into two parts: Functioning and Disability and Contextual and Personal Factors. The first part covers the domains of Body Functions and Structures and Activities and Participation, and the second part covers those of the Contextual and Personal Factors. Each component is specified by an alphanumeric code identified as 'b' for Body Functions, 's' for Body Structures, 'd' for Activities and Participation, and 'e' for Environmental Factors. It does not classify Personal Factors[5,6].

Health professionals can use the ICF in their professional practice to classify the effects of hearing loss on a person's life and the results of treatment and offer continued care by analyzing the categories related to the impairment levels in body functions and structures, activity and participation. These advantages are not obtained by classifying the type and degree of hearing loss, as they do not provide information about the subject's biopsychosocial individuality[7,8]. Thus, ICF use allows a multidimensional analysis of functioning and disability related to human communication. Furthermore, the classification can help organize and standardize information on the functional profile and quality of life of people with hearing loss in the health service[6,9].

This study aimed to verify the association between types and degrees of hearing loss and demographic factors and ICF categories related to "Body Structures and Functions" and "Activities and Participation", regarding patients of a hearing rehabilitation service at a specialized rehabilitation center.

METHODS

The study was approved by the Research Ethics Committee (CEP) of the Universidade Federal de Minas Gerais, MG, Brazil, under evaluation report number 3.903.587, CAAE 26407919.5.0000.5149. It was exempted from having an Informed Consent Form because it used secondary data. The research and data collection took place between April 2019 and December 2021.

This cross-sectional, analytical, observational study had a non-probabilistic sample and was developed at a hearing rehabilitation service of a specialized rehabilitation center. It is the part of the Public Health System responsible for assessing, diagnosing, and rehabilitating patients with disabilities[10].

Data on clinical audiometry, medical history, and assessment protocol for HA fitting candidates were collected from the medical records of patients with an indication for HA fitting at the service. These examinations were carried out by the professionals at the service, and the data are structured according to ICF components.

The sample included the records of patients who only had hearing loss, without any other associated disability, with complete audiometry, aged over 18 years, and whose medical history survey and assessment protocol for HA fitting candidates had been filled out at the time of evaluation in the service. The exclusion criteria were patients whose medical records had an incomplete audiological assessment, whose examinations did not confirm hearing loss, and/or whose medical history survey and assessment protocol for HA fitting candidates had not been filled out at the time of the evaluation.

Audiometry results provided records on air-conduction pure-tone thresholds at 0.5, 1, 2, 3, 4, 6, and 8 kHz bone-conduction ones at 0.5, 1, 2, 3, and 4 kHz. The types of hearing loss were classified according to Silman and Silverman criteria[11], and the degrees of hearing loss were based on the classification of the World Health Organization (WHO)[12].

The criteria proposed by the WHO to classify degrees of hearing loss[12] are based on the mean air-conduction

thresholds at 0.5, 1, 2, and 4 kHz, characterizing hearing loss from 20 dB mean thresholds. The recommendation is to assess the classification along with the ICF[12] to individually classify whether the person's auditory functioning is impaired.

The medical history survey and assessment protocol for HA fitting candidates provide demographic data (sex, age, and education level), clinical data (complaint and history of hearing loss, age at hearing loss detection, presence of deafness in the family, and previous HA use), and the functional assessment with ICF components, from which data Body Structures and Functions and Activities and Participation were collected (Table 1).

Table 1. Hearing-related categories of the International Classification of Functioning, Disability, and Health

Domains	Categories
Body Structures and Functions	s240 – Structure of external ear
	s250 – Structure of middle ear
	s260 – Structure of inner ear
	s110 – Structure of brain
	s710 – Structure of head and neck region
	b167 – Mental functions of language
	b2304 – Speech discrimination
	b2300 – Sound detection
	b2301 – Sound discrimination
	b2302 – Localization of sound source
	b2303 – Lateralization of sound
	b150 – Hearing perception
	b16700 – Reception of spoken language
	b16710 – Expression of spoken language
	b310 – Voice functions
	b280 – Sensation of pain
	b235 – Vestibular functions
Activities and Participation	d3503 – Conversing with one person
	d3504 – Conversing with many people
	d310 – Communication with – receiving – spoken messages
	d175 – Solving problems
	d220 – Undertaking multiple tasks
	d470 – Using transportation
	d475 – Driving
	d660 – Assisting others
	d760 – Family relationships
	d845 – Acquiring, keeping and terminating a job

The types and degrees of hearing loss were the response variables, and the demographic factors and ICF components (Body Structures and Functions and Activities and Participation) were the explanatory variables.

To meet the study objective, data were descriptively analyzed with frequency distribution of categorical variables and measures of central tendency and dispersion of continuous variables. The association analyses used Pearson's chi-square test, setting the level of statistical significance at p-value ≤ 0.05. Data were entered, processed, and analyzed in SPSS software, version 25.0.

RESULTS

The assessment sample had 122 medical records of service patients. Their mean age was 65.17 years, with a 14.90 standard deviation. Analysis of demographic and clinical data revealed that most participants were females (58.2%), older adults (68.9%), with a history of progressive (66.7%) moderately severe (36.4% in the right ear, and 32.2% in the left ear) sensorineural hearing loss (81.2% in the right ear and 86.2% in the left ear).

The analyses in both ears indicated a statistically significant association between the type of hearing loss and age – respectively p < 0.001 and p = 0.001 (Table 2).

Table 2. Association analysis between types and degrees of hearing loss per ear and demographic data of the International Classification of Functioning, Disability, and Health

Variables	Type of hearing loss – right ear			p-value	Type of hearing loss – left ear			p-value
	Conductive N (%)	Sensorineural N (%)	Mixed N (%)		Conductive N (%)	Sensorineural N (%)	Mixed N (%)	
Age								
Adult (up to 59 years old)	1 (50.0)	20 (21.1)	13 (65.0)	<0.001*	2 (100.0)	24 (24.0)	9 (64.3)	0.001*
Older adult (60 years or older)	1 (50.0)	75 (78.9)	7 (35.0)		0 (0.0)	76 (76.0)	5 (35.7)	
Total	2 (100.0)	85 (100.0)	20 (100.0)		2 (100.0)	100 (100.0)	14 (100.0)	

Variables	Degree of hearing loss – right ear					p-value	Degree of hearing loss – left ear					p-value
	Mild N (%)	M/M SevN (%)	Severe N (%)	Profound N (%)	Total N (%)		Mild N (%)	M/M SevN (%)	Severe N (%)	Profound N (%)	Total N (%)	
Sex												
Males	7 (41.2)	28 (39.4)	11 (52.4)	3 (50.0)	0 (0.0)	0.736	5 (38.5)	29 (41.4)	9 (42.9)	3 (42.9)	2 (66.7)	0.934
Females	10 (58.8)	43 (60.6)	10 (47.6)	3 (50.0)	1 (100.0)		8 (61.5)	41 (58.6)	12 (57.1)	4 (57.1)	1 (33.3)	
Total	17(100.0)	71(100.0)	21(100.0)	6(100.0)	1 (100.0)		13(100.0)	70(100.0)	21(100.0)	7 (100.0)	3 (100.0)	
Age												
Adult (up to 59 years old)	5 (29.4)	18 (25.4)	6 (28.6)	4 (66.7)	1 (100.0)	0.136	4 (30.8)	19 (27.1)	8 (38.1)	2 (28.6)	1 (33.3)	0.916
Older adult (60 years or older)	12 (70.6)	53 (74.6)	15 (71.4)	2 (33.3)	0 (0.0)		9 (69.2)	51 (72.9)	13 (61.9)	5 (71.4)	2 (66.7)	
Total	17 (100.0)	71(100.0)	21(100.0)	6(100.0)	1 (100.0)		13(100.0)	70(100.0)	21(100.0)	7 (100.0)	3 (100.0)	

Pearson's chi-square test
Captions: N = number of individuals; M/M Sev = Moderate/Moderately severe; * = p-value < 0.05

Concerning Body Structures and Functions, the hearing loss type was statistically significantly associated with Structure of middle ear – s250 (p = 0.001) in the right ear, Sensation of pain – b280 (p = 0.017) in the left ear, and Mental functions of language – b167 (p = 0.001) in both ears (Table 3).

Table 3. Association analysis between types of hearing loss per ear and the Body Structures and Functions category of the International Classification of Functioning, Disability, and Health

Variables	Type of hearing loss – right ear			p-value	Type of hearing loss – left ear			p-value
	Conductive N (%)	Sensorineural N (%)	Mixed N (%)		Conductive N (%)	Sensorineural N (%)	Mixed N (%)	
s250 – Structure of middle ear								
No impairment	1 (50.0)	38 (77.6)	1 (14.3)	0.001*	0 (0.0)	38 (73.1)	2 (33.3)	0.055
Mild impairment	0 (0.0)	4 (8.2)	0 (0.0)		1 (50.0)	4 (7.7)	0 (0.0)	
Moderate impairment	1 (50.0)	6 (12.2)	4 (57.1)		1 (50.0)	8 (15.4)	3 (50.0)	
Severe impairment	0 (0.0)	0 (0.0)	2 (28.6)		0 (0.0)	1 (1.9)	1 (16.7)	
Not specified	0 (0.0)	1 (2.0)	0 (0.0)		0 (0.0)	1 (1.9)	0 (0.0)	
Total	2 (100.0)	49(100.0)	7 (100.0)		2 (100.0)	52 (100.0)	6 (100.0)	
b167 – Mental functions								
No impairment	1 (50.0)	92 (98.0)	19 (95.0)	0.001*	1 (50.0)	96 (98.0)	13 (92.9)	0.001*
Mild impairment	1 (50.0)	1 (1.0)	1 (50.0)		1 (50.0)	1 (1.0)	1 (7.1)	
Moderate impairment	0 (0.0)	1 (1.0)	0 (0.0)		0 (0.0)	1 (1.0)	0 (0.0)	
Total	2 (100.0)	94(100.0)	20(100.0)		2 (100.0)	98 (100.0)	14(100.0)	
b280 – Sensation of pain								
No impairment	0 (0.0)	34 (68.0)	6 (50.0)	0.064	0 (0.0)	35 (67.3)	5 (50.0)	0.017*
Mild impairment	0 (0.0)	11 (22.0)	2 (16.7)		0 (0.0)	11 (21.2)	0 (0.0)	
Moderate impairment	0 (0.0)	3 (6.0)	3 (25.0)		0 (0.0)	5 (9.6)	3 (30.0)	
Severe impairment	0 (0.0)	0 (0.0)	1 (8.3)		0 (0.0)	0 (0.0)	1 (10.0)	
Not specified	0 (0.0)	2 (4.0)	0 (0.0)		0 (0.0)	1 (1.9)	1 (10.0)	
Total	0 (0.0)	50(100.0)	12(100.0)		0 (0.0)	52 (100.0)	10(100.0)	

Pearson's chi-square test
Caption: N = number of individuals; * = p-value < 0.05

Also, in the right ear, the degree of hearing loss was statistically significantly associated with Sound detection – b230 (p = 0.003), Localization of sound source – b2302 (p = 0.002); Lateralization of sound – b2303 (p = 0.001), Hearing perception – b150 (p = 0.001); Reception of spoken language – b16700 (p = 0.018), and Expression of spoken language – b16710 (p = 0.006). As for the left ear, it was statistically significantly associated with Mental functions of language – b167 (p = 0.002), Hearing perception – b150 (p = 0.001), and Vestibular functions – b235 (p = 0.007). It was also statistically significantly associated in both ears with Speech discrimination – b2304 (p = 0.001), and Sound discrimination – b2301 (p = 0.035) (Table 4).

Table 4. Association analysis between degrees of hearing loss per ear and the Body Structures and Functions category of the International Classification of Functioning, Disability, and Health

Variables	Degree of hearing loss – right ear					p-value	Degree of hearing loss – left ear					p-value
	Mild N (%)	M/M Sev N (%)	Severe N (%)	Profound N (%)	Total N (%)		Mild N (%)	M/M Sev N (%)	Severe N (%)	Profound N (%)	Total N (%)	
b2304 – Speech discrimination												
No impairment	1 (5.9)	10 (14.5)	2 (9.5)	0 (0.0)	0 (0.0)		1 (7.7)	5 (7.4)	5 (23.8)	0 (0.0)	0 (0.0)	
Mild impairment	16 (94.1)	19 (27.5)	1 (4.8)	0 (0.0)	1 (100.0)		12 (92.3)	21 (30.9)	4 (19.0)	2 (33.3)	0 (0.0)	
Moderate impairment	0 (0.0)	36 (52.2)	14 (66.7)	4 (66.7)	0 (0.0)	0.001*	0 (0.0)	36 (52.9)	10 (47.7)	2 (33.3)	3 (100.0)	0.001*
Severe impairment	0 (0.0)	4 (5.8)	4 (19.0)	2 (33.3)	0 (0.0)		0 (0.0)	6 (8.8)	2 (9.5)	2 (33.4)	0 (0.0)	
Total	17 (100.0)	69 (100.0)	21 (100.0)	6 (100.0)	1 (100.0)		13 (100.0)	68 (100.0)	21 (100.0)	6 (100.0)	3 (100.0)	
b230 – Sound detection												
No impairment	4 (25.0)	4 (7.7)	1 (5.9)	0 (0.00	0 (0.0)		2 (18.2)	3 (5.5)	3 (18.8)	0 (0.0)	0 (0.0)	
Mild impairment	11 (68.8)	27 (51.9)	4 (23.5)	2 (40.0)	0 (0.0)		8 (72.7)	32 (58.2)	4 (25.0)	2 (50.0)	0 (0.0)	
Moderate impairment	1 (6.2)	21 (40.4)	11 (64.7)	2 (40.0)	0 (0.0)	0.003*	1 (9.1)	19 (34.5)	8 (50.0)	2 (50.0)	3 (100.0)	0.136
Severe impairment	0 (0.0)	0 (0.0)	1 (5.9)	1 (20.0)	0 (0.0)		0 (0.0)	1 (1.8)	1 (6.2)	0 (0.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.00	4 (100.0)	3 (100.0)	
b2301 – Sound discrimination												
No impairment	1 (6.3)	2 (3.8)	1 (5.9)	0 (0.0)	0 (0.0)		0 (0.0)	2 (3.6)	1 (6.3)	0 (0.0)	0 (0.0)	
Mild impairment	14 (87.4)	14 (26.9)	1 (5.9)	0 (0.0)	0 (0.0)		10 (90.9)	16 (29.1)	4 (25.0)	2 (50.0)	0 (0.0)	
Moderate impairment	1 (6.3)	33 (63.5)	12 (70.6)	4 (80.0)	0 (0.0)	0.001*	1 (9.1)	33 (60.0)	9 (56.2)	1 (25.0)	3 (100.0)	0.035*
Severe impairment	0 (0.0)	3 (5.8)	3 (17.6)	1 (20.0)	0 (0.0)		0 (0.0)	4 (7.3)	2 (12.5)	1 (25.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.0)	4 (100.0)	3 (100.0)	
b2302 – Localization of sound source												
No impairment	3 (18.8)	4 (7.7)	1 (5.9)	0 (0.0)	0 (0.0)		1 (9.1)	3 (5.5)	2 (12.5)	0 (0.0)	0 (0.0)	
Mild impairment	12 (75.0)	27 (51.9)	3 (17.6)	2 (40.0)	0 (0.0)		9 (81.8)	31 (56.4)	4 (25.0)	2 (50.0)	0 (0.0)	
Moderate impairment	1 (6.2)	21 (40.4)	11 (64.7)	2 (40.0)	0 (0.0)	0.002*	1 (9.1)	19 (34.5)	9 (56.3)	2 (50.0)	3 (100.0)	0.212
Severe impairment	0 (0.0)	0 (0.0)	2 (11.8)	1 (20.0)	0 (0.0)		0 (0.0)	2 (3.6)	1 (6.3)	0 (0.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.0)	4 (100.0)	3 (100.0)	
b2303 – Lateralization of sound												
No impairment	3 (18.7)	3 (5.8)	1 (5.9)	1 (20.0)	0 (0.0)		1 (9.1)	4 (7.4)	1 (6.2)	0 (0.0)	0 (0.0)	
Mild impairment	13 (81.3)	28 (53.8)	3 (17.6)	1 (20.0)	0 (0.0)		10 (90.9)	30 (54.5)	5 (31.3)	2 (50.0)	0 (0.0)	
Moderate impairment	0 (0.0)	21 (40.4)	11 (64.7)	2 (40.0)	0 (0.0)	0.001*	0 (0.0)	19 (34.5)	9 (56.3)	2 (50.0)	3 (100.0)	0.157
Severe impairment	0 (0.0)	0 (0.0)	2 (11.8)	1 (20.0)	0 (0.0)		0 (0.0)	2 (3.6)	1 (6.2)	0 (0.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.0)	4 (100.0)	3 (100.0)	
b150 – Hearing perception												
No impairment	3 (18.8)	4 (7.7)	2 (11.8)	0 (0.0)	0 (0.0)		1 (9.1)	2 (3.6)	2 (12.5)	0 (0.0)	0 (0.0)	
Mild impairment	13 (81.2)	14 (26.9)	1 (5.9)	1 (20.0)	0 (0.0)		10 (90.9)	18 (32.7)	2 (12.5)	2 (50.0)	0 (0.0)	
Moderate impairment	0 (0.0)	31 (59.6)	11 (64.7)	3 (60.0)	0 (0.0)	0.001*	0 (0.0)	31 (56.4)	10 (62.5)	1 (25.0)	3 (100.0)	0.008*
Severe impairment	0 (0.0)	3 (5.8)	3 (17.6)	1 (20.0)	0 (0.0)		0 (0.0)	4 (7.3)	2 (12.5)	1 (25.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.0)	4 (100.0)	3 (100.0)	
b16700 – Reception of spoken language												
No impairment	5 (31.2)	13 (25.0)	3 (17.6)	1 (20.0)	0 (0.0)		3 (27.3)	10 (18.2)	4 (25.0)	0 (0.0)	1 (33.3)	
Mild impairment	10 (62.5)	26 (50.0)	4 (23.5)	1 (20.0)	0 (0.0)		7 (63.6)	30 (54.5)	5 (31.3)	2 (50.0)	0 (0.0)	
Moderate impairment	1 (6.3)	13 (25.0)	8 (47.1)	2 (40.0)	0 (0.0)	0.018*	1 (9.1)	13 (26.7)	6 (37.4)	2 (50.0)	2 (66.7)	0.558
Severe impairment	0 (0.0)	0 (0.0)	2 (11.8)	1 (20.0)	0 (0.0)		0 (0.0)	2 (3.6)	1 (6.3)	0 (0.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.0)	4 (100.0)	3 (100.0)	
b16710 – Expression of spoken language												
No impairment	6 (37.5)	31 (59.6)	9 (52.9)	2 (40.0)	0 (0.0)		4 (36.4)	30 (54.5)	7 (43.7)	2 (50.0)	1 (33.3)	
Mild impairment	9 (56.2)	10 (19.2)	0 (0.0)	1 (20.0)	0 (0.0)		6 (54.5)	14 (25.5)	2 (12.5)	1 (25.0)	0 (0.0)	
Moderate impairment	1 (6.3)	11 (21.2)	7 (41.2)	2 (40.0)	0 (0.0)	0.006*	1 (9.1)	11 (20.0)	6 (37.5)	1 (25.0)	2 (66.7)	0.199
Severe impairment	0 (0.0)	0 (0.0)	1 (5.9)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	1 (6.3)	0 (0.0)	0 (0.0)	
Total	16 (100.0)	52 (100.0)	17 (100.0)	5 (100.0)	0 (0.0)		11 (100.0)	55 (100.0)	16 (100.0)	4 (100.0)	3 (100.0)	
b235 – Vestibular functions												
No impairment	1 (11.2)	25 (52.1)	6 (54.5)	2 (100.0)	1 (100.0)		1 (12.5)	24 (53.3)	8 (72.7)	1 (20.0)	0 (0.0)	
Mild impairment	4 (44.4)	15 (31.3)	2 (18.2)	0 (0.0)	0 (0.0)		4 (50.0)	15 (33.4)	0 (0.0)	3 (60.0)	1 (100.0)	
Moderate impairment	4 (44.4)	5 (10.4)	2 (18.2)	0 (0.0)	0 (0.0)	0.484	3 (37.5)	5 (11.1)	1 (9.1)	0 (0.0)	0 (0.0)	0.007*
Severe impairment	0 (0.0)	1 (2.1)	1 (9.1)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	2 (18.2)	0 (0.0)	0 (0.0)	
Not specified	0 (0.0)	2 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	1 (2.2)	0 (0.0)	1 (20.0)	0 (0.0)	
Total	9 (100.0)	48 (100.0)	11 (100.0)	2 (100.0)	1 (100.0)		8 (100.0)	45 (100.0)	11 (100.0)	5 (100.0)	1 (100.0)	

Pearson's chi-square test
Captions: N = number of individuals; M/M Sev = Moderate/Moderately severe; * = p-value < 0.05

Regarding Activities and Participation, the hearing loss type was statistically significantly associated with Conversing with many people – d3504 (p = 0.040) and Solving problems – d175 (p = 0.002) in the right ear, Solving problems – d175 (p = 0.001) in the left ear, and Family relationships – d760 (p = 0.001) in both ears (Table 5).

Table 5. Association analysis between types of hearing loss per ear and the Activities and Participation category of the International Classification of Functioning, Disability, and Health

Variables	Type of hearing loss – right ear			p-value	Type of hearing loss – left ear			p-value
	Conductive N (%)	Sensorineural N (%)	Mixed N (%)		Conductive N (%)	Sensorineural N (%)	Mixed N (%)	
d3504 – Conversing with many people								
No impairment	1 (50.0)	4 (4.3)	1 (5.3)	0.040*	0 (0.0)	5 (5.2)	0 (0.0)	0.422
Mild impairment	1 (50.0)	22 (23.9)	2 (10.4)		2 (100.0)	20 (20.6)	3 (21.4)	
Moderate impairment	0 (0.0)	49 (53.3)	11 (57.9)		0 (0.0)	53 (54.6)	8 (57.2)	
Severe impairment	0 (0.0)	17 (18.5)	4 (21.1)		0 (0.0)	18 (18.6)	2 (21.4)	
Total impairment	0 (0.0)	0 (0.0)	1 (5.3)		0 (0.0)	1 (1.0)	0 (0.0)	
Total	2 (100.0)	92 (100.0)	19 (100.0)		2 (100.0)	97 (100.0)	14 (100.0)	
d175 – Solving problems								
No impairment	0 (0.0)	39 (41.5)	7 (35.0)	0.002*	1 (50.0)	39 (39.4)	6 (42.9)	0.001*
Mild impairment	0 (0.0)	26 (27.7)	7 (35.0)		0 (0.0)	26 (26.3)	6 (42.9)	
Moderate impairment	1 (50.0)	28 (29.7)	5 (25.0)		0 (0.0)	32 (32.3)	2 (14.2)	
Severe impairment	1 (50.0)	1 (1.1)	1 (5.0)		1 (50.0)	2 (2.0)	0 (0.0)	
Total	2 (100.0)	94 (100.0)	20 (100.0)		2 (100.0)	99 (100.0)	14 (100.0)	
d760 – Family relationships								
No impairment	0 (0.0)	65 (69.9)	13 (68.4)	0.001*	1 (50.0)	66 (67.3)	9 (69.2)	0.001*
Mild impairment	1 (50.0)	15 (16.1)	1 (5.3)		0 (0.0)	18 (18.4)	1 (7.7)	
Moderate impairment	0 (0.0)	13 (14.0)	5 (26.3)		0 (0.0)	14 (14.3)	3 (23.1)	
Severe impairment	1 (50.0)	0 (0.0)	0 (0.0)		1 (50.0)	0 (0.0)	0 (0.0)	
Total	2 (100.0)	93 (100.0)	19 (100.0)		2 (100.0)	98 (100.0)	13 (100.0)	

Pearson's chi-square test
Caption: N = number of individuals; * = p-value < 0.05

Moreover, in both ears, the degree of hearing loss was statistically significantly associated with the following ICF Activities and Participation categories: Conversing with one person – d3503 (p = 0.001), Conversing with many people – d3504 (p = 0.025), and Communication with – receiving – spoken messages – d310 (p = 0.003). In the left ear, it was statistically significantly associated with Driving – d475 (p = 0.011) and Acquiring, keeping, and terminating a job – d845 (p = 0.030). No association was found between the degree of hearing loss in the right ear and individual ICF Activities and Participation categories (Table 6).

Table 6. Association analysis between degrees of hearing loss per ear and the Activities and Participation category of the International Classification of Functioning, Disability, and Health

Variables	Degree of hearing loss – right ear					p-value	Degree of hearing loss – left ear					p-value
	Mild N (%)	M/M Sev N (%)	Severe N (%)	Profound N (%)	Total N (%)		Mild N (%)	M/M Sev N (%)	Severe N (%)	Profound N (%)	Total N (%)	
d3503 – Conversing with one person												
No impairment	12 (87.6)	14 (20.3)	2 (9.5)	0 (0.0)	0 (0.0)	0.001*	8 (66.7)	16 (23.5)	4 (19.0)	2 (28.5)	0 (0.0)	0.001*
Mild impairment	2 (14.3)	34 (49.3)	8 (38.1)	1 (16.7)	1 (100.0)		4 (33.3)	29 (42.6)	6 (28.6)	3 (42.9)	2 (66.7)	
Moderate impairment	0 (0.0)	19 (27.6)	10 (47.6)	5 (83.3)	0 (0.0)		0 (0.0)	23 (33.9)	10 (47.6)	1 (14.3)	0 (0.0)	
Severe impairment	0 (0.0)	1 (1.4)	1 (4.8)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	1 (4.8)	1 (14.3)	0 (0.0)	
Total impairment	0 (0.0)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)	
Total	14 (100.0)	69 (100.0)	21 (100.0)	6 (100.0)	1 (100.0)		12 (100.0)	68 (100.0)	21 (100.0)	7 (100.0)	3 (100.0)	
d3504 – Conversing with many people												
No impairment	1 (7.1)	3 (4.3)	1 (4.8)	0 (0.0)	0 (0.0)	0.025*	1 (8.3)	1 (1.4)	1 (4.8)	2 (28.6)	0 (0.0)	0.001*
Mild impairment	9 (64.3)	16 (22.9)	0 (0.0)	0 (0.0)	0 (0.0)		6 (50.0)	16 (23.2)	3 (14.3)	0 (0.0)	0 (0.0)	
Moderate impairment	4 (28.6)	39 (55.7)	12 (51.7)	4 (66.7)	1 (100.0)		5 (41.7)	40 (58.0)	10 (47.6)	3 (42.8)	2 (66.7)	
Severe impairment	0 (0.0)	11 (15.7)	8 (38.1)	2 (33.3)	0 (0.0)		0 (0.0)	12 (17.4)	7 (33.3)	2 (28.6)	0 (0.0)	
Total impairment	0 (0.0)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)	
Total	14 (100.0)	70 (100.0)	21 (100.0)	6 (100.0)	1 (100.0)		12 (100.0)	69 (100.0)	21 (100.0)	7 (100.0)	3 (100.0)	
d310 – Communication with – receiving – spoken messages												
No impairment	2 (14.3)	8 (11.3)	2 (9.5)	0 (0.0)	0 (0.0)	0.003*	0 (0.0)	7 (10.0)	2 (9.5)	0 (0.0)	0 (0.0)	0.001*
Mild impairment	8 (57.1)	22 (31.0)	5 (23.8)	0 (0.0)	0 (0.0)		7 (63.6)	19 (27.1)	6 (28.6)	0 (0.0)	0 (0.0)	
Moderate impairment	4 (28.6)	39 (54.9)	12 (57.2)	3 (50.0)	1 (100.0)		4 (36.4)	42 (60.0)	9 (42.9)	2 (33.3)	2 (66.7)	
Severe impairment	0 (0.0)	1 (1.4)	2 (9.5)	3 (50.0)	0 (0.0)		0 (0.0)	2 (2.9)	4 (19.0)	4 (66.7)	1 (33.3)	
Total impairment	0 (0.0)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Total	14 (100.0)	71 (100.0)	21 (100.0)	6 (100.0)	1 (100.00		11 (100.0)	70 (100.0)	21 (100.0)	6 (100.0)	3 (100.0)	
d845 – Acquiring, keeping and terminating a job												
No impairment	4 (100.0)	6 (42.9)	2 (50.0)	1 (50.0)	0 (0.0)	0.381	2 (100.0)	8 (53.3)	0 (0.0)	0 (0.0)	0 (0.0)	0.030*
Mild impairment	0 (0.0)	2 (14.3)	2 (50.0)	1 (50.0)	1 (100.0)		0 (0.0)	4 (26.7)	2 (100.0)	1 (50.0)	0 (0.0)	
Moderate impairment	0 (0.0)	5 (35.7)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	3 (20.0)	0 (0.0)	0 (0.0)	1 (100.0)	
Not specified	0 (0.0)	1 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	1 (50.0)	0 (0.0)	
Total	4 (100.0)	14 (100.0)	4 (100.0)	2 (100.0)	1 (100.0)		2 (100.0)	15 (100.0)	2 (100.0)	2 (100.0)	1 (100.0)	

Pearson's chi-square test
Caption: N = number of individuals; * = p-value < 0.05

DISCUSSION

Sensorineural hearing loss and older adults predominated in both ears. This is possibly due to age-related hearing loss (presbycusis) and the communicative difficulties that accompany it, making them seek hearing rehabilitation services more often[13]. Studies also report that older people with untreated hearing loss have a poorer quality of life[14] and are at greater risk of developing dementia[15] – which may influence the need for referrals to hearing rehabilitation services.

Hearing loss was associated with Structure of middle ear (s250) in the right ear, with higher values attributed to "no disability". These findings are coherent since most patients at the service have sensorineural hearing loss – which involves the inner ear structure. The same inference can be made for the association with Sensation of pain (b280) in the left ear, with higher values attributed to "no disability", given that pain is a more common symptom in conductive and mixed hearing losses. Regarding the association with Mental functions of language (b167) in both ears, individuals clearly have preserved language function, despite their hearing loss, which is expected in presbycusis for being a postlingual hearing loss[16].

The degree of hearing loss was associated in the right ear with difficulty detecting sounds (b230), localizing the sound source, and lateralizing the sound (b2302 and b2303, respectively). This may be due to asymmetric hearing losses in the sample, as such cases lack the processing of temporal differences between the ears[17]. The association found between the left ear and Vestibular functions (b235) is unanimous in the literature, since older people may have more vestibular complaints as their labyrinth functioning is reduced with age[16,18]. The sample's difficulties in language reception and expression (d310) may result from their deprivation

of speech sounds, which occurs even in mild hearing losses[15,19]. All degrees of hearing loss compromise both auditory feedback and speech comprehension.

The statistical significance found between the type of hearing loss in the right ear and Conversing with many people (d3504) is in line with the literature. Hearing loss compromises the reception of speech signals and their differentiation from noise, impacting speech comprehension[20]. It was also associated in both ears with Solving problems (d175) and Family relationships (d760), with a greater proportion of "no impairment". The literature reports that hearing loss can interfere with family relationships[20], unlike the result of this study. This may be due to the support network provided to the hearing impaired in the sample. Concerning d175, individuals are noticeably able to maintain their autonomy despite their disability.

In both ears, the degree of hearing loss was associated with Conversing with one person (d3503), Conversing with many people (d3504), and Communication with – receiving – spoken messages (d310). This was already expected, as studies indicate that the greater the degree of hearing loss, the greater its impact on communication[21]. Moreover, the degree of hearing loss was associated with Driving (d475) in the left ear, which can be explained by the driver's position when driving – the left ear is further away from the passenger's speech. Due to the difficulty in hearing and understanding what was said, the driver may direct attention to the passenger, increasing the risk of accidents. Also, 82.9% of patients in the sample have disabling hearing loss – i.e., their hearing threshold in the best ear is greater than or equal to 41 dB[22]. This situation restricts activities of daily living, such as driving, and affects the subject's autonomy and independence. Hence, this study points out the relevance of hearing rehabilitation services to improve the quality of life of individuals with hearing loss.

This study has advances and limitations that must be considered to better understand the results. The limitations include the use of secondary data, the study design, and the impossibility of generalizing the data to other services. Regarding the secondary data, the study found that information in the medical records was missing, inadequately filled out, or not uniform. The study design was a negative aspect in that it only used data collected at the time of evaluation; hence, it could not address the progress of the participant's disability and functioning after HA rehabilitation. Also, data cannot be generalized due to the specificity of the design and sample recruitment.

The main advances are the transposition of clinical practice data into scientific information, which helps understand and improve the flow of care processes. The study is an important advance, given the possibility of discussing the functioning and disability data of patients with hearing impairment treated at a specialized rehabilitation center, whose care process is guided by the ICF. Public policy practices related to hearing diagnosis and rehabilitation are strengthened through the ICF, building evidence on its implementation in the context of public health.

CONCLUSION

The association between ICF categories and types and degrees of hearing loss of individuals undergoing auditory rehabilitation in a specialized rehabilitation center revealed that sensorineural hearing loss predominated and most of the sample were older adults, which is explained by the increase in life expectancy.

The type and degree of hearing loss were associated in both ears with the reception and comprehension of spoken messages, in conversing with either one or more than one person. This difficulty can impact communication and cognition, although it may be minimized with HA. Thus, this study reinforces the importance of auditory rehabilitation in the Public Health System to promote individual and collective well-being.

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DSPJ, SMAL: Supervision; Conceptualization; Formal analysis; Writing - review & editing.