

# Hearing aid use among the elderly: SABE study - health, well-being and aging survey

## Uso de aparelho de amplificação sonora individual por idosos: estudo SABE - saúde, bem-estar e envelhecimento

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### ABSTRACT

**Purpose:** Describe hearing aid use by the elderly population in the city of São Paulo and identify associated factors. **Methods:** A cross-sectional, descriptive, quantitative study integrated with the SABE (health, well-being and aging) project developed in 2006. A total of 1.115 individuals aged 65 or over were interviewed. Sample selection occurred in two stages, with replacement and probabilities proportional to the population to complement those aged 75 or over. Structured questionnaires and validated instruments were used. The data were weighted, the Rao-Scott test was used for univariate analysis and backward stepwise logistic regression was used for multivariate analysis, performed on Stata 10® software. **Results:** Three hundred and seventy-seven subjects (30.4%) were classified as hearing impaired and 10.1% of these reported using hearing aids. To acquire the devices, 78.8% used their own resources and 16.9% acquired them through the Brazilian public health system (SUS). Among non-users of hearing aids, 16.6% reported prior indication; however, 8.6% were unable to adapt to the device and 8.0% could not afford to acquire one. Hearing aid use was associated with lower prevalence of probable dementia. **Conclusion:** The low number of hearing aid users indicates the difficulties elderly people face in acquiring them and/or that the health services face in effectively helping them to adapt. These findings may influence the quality of life of elderly with hearing impairment, given the association with probable dementia revealed by this study.

**Keywords:** Aging; Dementia; Hearing aids; Hearing loss; Morbidity surveys

### RESUMO

**Objetivo:** Descrever o uso do aparelho de amplificação sonora individual (AASI) pela população idosa do município de São Paulo e fatores associados. **Métodos:** Estudo transversal, descritivo e quantitativo, integrante do Estudo SABE (Saúde, Bem-estar e Envelhecimento), desenvolvido no ano de 2006. Foram entrevistados 1115 sujeitos com 65 anos ou mais. A amostra foi obtida de setores censitários em dois estágios, com reposição e probabilidade proporcional à população, complementando-se para acima de 75 anos. Utilizou-se questionário estruturado e instrumentos validados. Os dados foram ponderados e a análise foi realizada no software Stata 10®, através do teste de Rao-Scott para análise univariada e regressão logística tipo *stepwise backward* para análise multivariada. **Resultados:** Trezentos e setenta e sete sujeitos (30,4%) apresentaram deficiência auditiva autorreferida e destes, 10,1% declararam utilizar o AASI. Dentre as formas de aquisição do dispositivo, 78,8% utilizaram recursos particulares e 16,9% adquiriram via Sistema Único de Saúde (SUS). Dentre os não protetizados, 16,6% relataram indicação prévia. Entretanto, 8,6% não se acostumaram e 8,0% não adquiriram, por problemas financeiros. O uso do AASI associou-se à menor prevalência de provável demência. **Conclusão:** O baixo número de usuários de AASI indica dificuldades dos idosos em adquiri-lo e/ou dos serviços de saúde em adaptá-los de forma efetiva. Esse achado pode influenciar a qualidade de vida do idoso deficiente auditivo, visto a associação com a provável demência, revelada pelo presente estudo.

**Descritores:** Envelhecimento; Demência; Auxiliares de audição; Perda auditiva; Inquéritos de morbidade

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**Conflict of interests:** No

**Author's contributions:** MSC contributed to the review of the literature, treatment and data analysis, manuscript preparation and revision of the final version of the manuscript. MCPL contributed to the study conception and planning, analysis and data interpretation, preparation of the draft and approval of the final version of the manuscript. JLF collaborated in data processing, statistical analysis and revision of the final version of the manuscript. YAOD contributed to the study design, database organization, analysis and data interpretation and critical review of the final version of the manuscript. MLL collaborated in the study design and revision of the final version of the manuscript. ATARC contributed to database construction and data analysis, participated in the drafting and discussion of the results and revision of the final version of the manuscript.

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**Received:** 8/14/2012; **Accepted:** 7/15/2013

## INTRODUCTION

Aging in the general population requires specific projects and research for the elderly population, since this age group presents distinct physical and mental health characteristics. Among the most common alterations verified in the elderly, sensory loss like visual and hearing impairment should be highlighted, since this can influence behavior and social interaction.

Presbycusis is the general term used to refer to age-related hearing loss. It is characterized by a reduction in hearing sensitivity and speech understanding in noisy environments, slow central processing of acoustic information and deficient location of sound sources<sup>(1)</sup>. The popular belief is that presbycusis only affects the elderly; however, it is worth highlighting that it can be detected in younger adults, as early as 40 years of age<sup>(2)</sup>, and the most important association is with the aging process, not exclusively with chronological age.

Due to the close relation between hearing loss and aging, it is assumed that the continuous increase in the elderly Brazilian population will accompany an increase in people with hearing loss, particularly if public health actions directed at young adults and the elderly do not invest in adequate measures to promote hearing health and prevent this deficiency.

One impact of the growing number of hearing impaired adults and elderly is reflected in the specialized health services for hearing health, particularly those of medium and high complexity, which are responsible for assisting patients adapt to hearing aids, in accordance with Decree n°. 2073/04, which establishes Brazilian National Policy on Hearing Health Care (*Política Nacional de Atenção à Saúde Auditiva - PNSA*). This document indicates the guidelines for hearing health care, emphasizing interdisciplinary care, continued education for professionals and preventive measures at all levels. Furthermore, it establishes guidelines for the organization of services in health institutions at all levels of technical complexity: primary, secondary and tertiary care<sup>(3)</sup>.

Despite the high degree of organization advocated by the PNSA, observation shows that the existence of available services is no guarantee that people use them. Access to health services can be related to supply; however, while access is a important feature of the effective use of services, this also depends on individual and contextual factors<sup>(4)</sup>.

The presence of services that include actions that focus on hearing health can be a protective factor against hearing loss, due to the character of primary prevention and health promotion that certain health services may provide, such as Primary and Family Health Care Centers. Despite the formation of minimum teams for family health strategy, these teams cannot count on the participation of trained professionals in hearing health, such as audiologists and otorhinolaryngologists. These professionals may be members of Family Health and Support Center (*Núcleo de Apoio à Saúde da Família*) teams and assist

in collective actions to improve the hearing health of the population, in partnership with the professionals on the strategy team, especially following the implementation of Ordinance 154 of January 24<sup>th</sup>, 2008<sup>(5)</sup>.

Besides the availability of services and regulation by law, geographical proximity can be another facilitator for access to hearing rehabilitation. In a qualitative study conducted in a medium complexity service for hearing health, located in Itajaí, SC, Brazil, involving 19 elderly hearing aid users, the authors concluded that hearing impaired elderly individuals attributed the possibility of access to hearing aids to the establishment of a Hearing Health Care Center close to their neighborhood, since these services tends to organize the supply and availability of care<sup>(6)</sup>.

Despite advances, effective use of hearing aids by the elderly is problem that audiologists find hard to resolve, a fact also highlighted in international studies. A survey conducted in Finland verified that only 15 to 30% of elderly individuals with hearing impairment possessed hearing aids and among these, only 55% used the device all the time. The main reasons for non-use of hearing aids were no perceived improvement, broken devices and difficulty in handling the device due to the small size of hearing aids, particularly when considering the frequent presence of alterations in fine motor skills among the elderly<sup>(7)</sup>. These data are troubling, considering the potential benefits that hearing aid use can offer, such as improving communication and contributing to the preservation of functional capacity and cognitive skills<sup>(8)</sup>.

Brazil still lacks of studies correlating hearing loss prevalence with the presence of health services, or that describe the access that the hearing impaired population have to these services. Information concerning the use of services by the elderly with hearing loss can assist in improving the elaboration of public policies aimed at hearing health and potentiate the actions of existing services.

To attend this and other demands for information on health, particularly that focused on the elderly, in 2000, the SABE Study (*Saúde, Bem-estar e Envelhecimento* - health, well-being and aging) was initiated. Initially, the study was proposed and coordinated by the Pan American Health Organization as a multicenter study with the participation of Argentina, Barbados, Brazil, Chile, Cuba, Mexico and Uruguay. It was characterized by its simultaneous, comprehensive and rigorously comparable research and was the first of its kind in the region. Its purpose was to obtain information, with results that could support both the development of further studies and the organization of public policy for the elderly. The original survey can be accessed on the SABE website: <http://www.fsp.usp.br/sabe>.

Thus, based on data from the SABE study, the aim of this work was to verify the occurrence of hearing aid use by elderly individuals with self-reported hearing loss in the city of São Paulo, describe the reasons for non-use of the device and analyze possible factors associated with hearing aid use.

## METHODS

The study population consisted of elderly residents in the municipality of São Paulo, in 2006, who were included in the SABE study conducted in Brazil.

The sample was composed of two segments. The first, resulting from random selection, was based on the permanent record of 72 census tracts, available at the Department of Epidemiology of the School of Public Health of the Universidade de São Paulo (USP). This segment of the sample was obtained from the records of the National Sample Survey (*Pesquisa Nacional por Amostra de Domicílios*, 1995), consisting of 263 census tracts, randomly selected by cluster sampling, under the criterion of probability proportional to the number of households. The segment corresponding to the probability sample comprised 1568 respondents.

The second segment, consisting of 575 residents from the districts in which the previous interviews had been conducted, corresponded to the individuals required to complete the prescribed number of interviews among people over 75 years-old, considering the mortality rate in this age group of the population. The minimum number of randomly selected households in the second segment was approximated to 90. Completion of the sample of people aged 75 years-old or over was achieved by locating homes close to the selected sectors or, at least, within the boundaries of the districts to which the selected sectors belonged, according to the SABE study. The data were simultaneously collected through home interviews using an instrument consisting of 11 thematic blocks. Each questionnaire was weighted, calculated according to the corresponding census tract ( $\text{weight}=1/f$ ).

For the questionnaires applied to individuals in non-randomly selected households (75 years-old or over), calculation of the weight was performed according to the ratio of the elderly population in this age group resident in São Paulo in 1998, and the total number of elderly people in this age group in the final sample.

For this profile, the sample consisted of 1,115 elderly individuals aged 65 years-old or over, resident in São Paulo, interviewed during the SABE Study survey in 2006 and who had also been interviewed in the first phase in 2000. Subjects who met the following criteria, alone or in combination: declared their hearing as regular, poor or very poor to the question *"In general, how would you describe your hearing (with or without a hearing aid)"*; reported being users of a hearing aid and/or who had been prescribed a hearing aid, were considered elderly individuals with self-reported hearing loss.

Data concerning the use of hearing aids and rehabilitation were determined by the questions contained in block C, "Health Status", specifically: *Do you use some type of hearing aid? Why don't you use a hearing aid? How did you purchase the device? Did you receive any special training to use the device? Did you receive follow-up to develop your operation of the device?*

Considering the factors potentially associated with the use of hearing aids among the elderly in São Paulo, variables that could influence patient adaptation were studied:

- Sociodemographic data: age, sex, ethnicity, family structure, literacy, education level (years of schooling), income (in minimum wages), perception of sufficient income and occupational position.
- Data concerning morbidity, mobility and health care: perceived health, mobility, presence of depressive symptoms, considered to be a case of probable dementia, reports of dizziness/vertigo, patient aware of what they are entitled to in the public health system, possession of a private health plan that covers rehabilitation services and adaptation to orthoses, prostheses or support devices.
- Performance of basic and instrumental activities of daily living.

Cases of probable dementia were defined as individuals who presented abnormal results on both the Mini-Mental State Examination (MMSE) and Pfeffer Functional Activities Questionnaire (PFAQ). Initially developed by Folstein et al.<sup>(9)</sup>, the MMSE is a screening tool for cognitive impairment used internationally for the purpose of providing information concerning different dimensions of cognitive functions, including orientation, memory, calculation and language. In this study, a modified version was applied with a cutoff at 12/13, such that cognitive impairment was indicated by a score of 12 or less.

The MMSE results were used as a filter for application of the PFAQ<sup>(10)</sup>, which is designed to evaluate an individual's functional autonomy in relation to the activities of daily living. The aim of this association with the PFAQ result was to verify whether cognitive impairment contributed to limitations in functional capacity. The cutoff point was that proposed by its authors, equal to or greater than six, indicating that the individual needed help to perform daily activities denominated instrumental. Individuals who scored 12 or less on the MMSE and six or more on the PFAQ were permitted a substitute informant for the interview. Those who scored 13 points or more on the MMSE and five or less on the PFAQ were permitted an informant to assist with the rest of the questionnaire.

Data analysis was conducted using the "survey" module of the Stata 10.0® program, which permits the incorporation of features related to the complex design of the sample, namely, disproportionate stratification, drawing in clusters and weighting. The weighting variable, created to examine the data, was defined by the inverse of the sampling fraction and adjusted so that the sample did not present distortions regarding age and sex. Summarization of the data was performed from exploratory analysis, using percentages to describe categorical variables and means and standard deviations to describe continuous variables.

For univariate analysis, the Rao-Scott test was applied, since it determines the significance of the association in double entry tables, adjusting for sample design. Multivariate analysis was

performed using “backward stepwise” (step by step backward) logistic regression. All variables associated with the dependent variable at a significance level of 20% ( $p < 0.20$ ) were selected and integrated into the logistic regression model. The second option was integrated multivariate analysis of the variables that the literature highlighted as strongly associated with the outcome studied and/or that could be confounding factors for other variables, even when the strength of association was not verified by the univariate model, such as sex and age. The retrograde procedure was used in the elaboration of the multiple model and the variable remained in the final model of  $p < 0.05$ . The strength of association between the independent variables and the dependent variable was expressed in estimated values of crude and adjusted prevalence ratios with confidence intervals of 95% (95%CI).

The research project for the SABE study was reviewed and approved by the Research Ethics Committee of the Faculty of Public Health of the Universidade de São Paulo, under protocol n°. 1345, report COEP/83/06, having obtained authorization for data analysis. All the subjects evaluated signed a term of free, informed consent.

## RESULTS

A total of 1,115 elderly individuals were interviewed, with a mean age of 68.1 years-old ( $SD \pm 0.4$ ). The prevalence of self-reported hearing loss was 30.4% (95%CI 27.2-33.8), represented by 377 elderly individuals.

The prevalence of hearing aid users in the total population ( $n=1115$ ) was 3% (95%CI 1.9-4.7). However, considering only the self-reported hearing loss patients ( $n=377$ ), the prevalence of users was 10.1% (95%CI 6.5-15.2). Research concerning the process of obtaining the hearing aid and subsequent follow-up of elderly users is presented in Table 1.

The responses obtained by the interviewers during the application of the instrument indicating the options “do not know/no answer”, understood as “non-responses”, were not included in the final tables and were considered to be sample loss. The decision not to consider these responses for processing was due to their possible influence on the exact values of the total prevalences obtained or distributions described, in accordance with the methodology chosen for statistical analysis.

The need for an assistant informant (*proxy*) for data collection was higher among elderly non-users of hearing aids compared with those who used a hearing aid (13.8% versus 1.7%,  $p < 0.001$ ). Univariate analysis of factors associated with hearing aid use is presented in Tables 2, 3 and 4.

All the associations established in the univariate analysis with a  $p$  value of  $< 0.20$  were included in the logistic regression. According to this criterion, the following independent variables: occupational position, probable dementia, possessing a private health plan, difficulties in basic activities of daily living (dressing, using the toilet), difficulties in all instrumental activities

**Table 1.** Distribution of the number and percentage of hearing aid use by elderly with self-reported hearing loss

Variable	n	%
Does the patient use a hearing aid		
Yes	45	10.1
No	332	89.9
Why does the patient not use a hearing aid		
Not necessary	132	43.9
Never prescribed one	130	39.5
One was prescribed, but the patient could not adapt	33	8.6
One was prescribed, but the patient could not afford it	28	8.0
Total	323	100
How did the patient acquire a hearing aid		
They purchased it	23	56.1
Someone else purchased it	11	22.7
SUS (public health service)	6	16.9
Associate discount / health plan	1	1.8
Other	3	2.5
Total	44	100
The patient received training in hearing aid use		
Yes	34	87.0
No	10	13.0
Total	44	100
The patient received follow-up regarding hearing aid use		
Yes	33	81.4
No	10	18.6
Total	43	100

of daily living, and specifically, using the telephone and taking medication, were included in the multivariate analysis. The outcome of the analysis was the use or non-use of a hearing aid. The final logistic regression model was adjusted for sex and age, because of the possibility that these variables present as confounding factors in the model studied. The variables that remained in the model, with  $p < 0.05$  after multivariate analysis, are described in Table 5.

## DISCUSSION

A low rate of hearing aid use (10.1%) was verified among the elderly with self-reported hearing loss in the city of São Paulo. This percentage is lower than that reported in a study conducted in Finland, which was 15 to 30%<sup>(7)</sup>. Besides much lower values, the reasons for non-use were also distinct. In this study, one of the main reasons given for not using the device was that the elderly individual did not consider it necessary, or its use had never been prescribed.

According to data revealed in Japan<sup>(11)</sup>, following evaluation of the population from 40 to 84 years-old, 11.0% of individuals with hearing loss were hearing aid users, a very similar value to that verified in this study, despite the difference between the age groups evaluated. In the above study, the authors highlighted that use of the device tended to decrease with advancing age,

**Table 2.** Distribution of the number and percentage of hearing aid use by the elderly with self-reported hearing loss according to sociodemographic factors

Variable	Hearing aid use				p-value
	Yes		No		
	n	%	n	%	
Age group					
65-69	11	52.9	110	53.0	0.24
70-74	6	26.5	73	15.9	
75-79	11	12.7	81	15.4	
80-84	13	4.6	40	12.7	
85 or over	4	3.3	26	3.0	
Sex					
Female	24	59.6	181	53.1	0.43
Male	21	40.4	151	46.9	
Color/ethnicity					
White	27	67.9	231	68.3	0.97
Other	18	32.1	100	31.7	
Family structure					
Lives alone	8	9.5	51	14.9	0.39
Lives with others	36	90.5	279	85.1	
Literate					
Yes	39	81.6	259	80.6	0.91
No	6	18.4	73	19.4	
Education (years of schooling)					
None	9	20.6	100	25.1	0.46
1 to 6	25	55.5	194	59.8	
7 to 11	11	23.9	38	15.9	
Income (minimum wages)					
Less than 1	2	1.8	09	4.5	0.23
Equal to or greater than 1	28	98.2	220	95.5	
Perception of income					
Sufficient	28	44.4	155	46.9	0.89
Insufficient	17	55.6	164	53.1	
Occupational position					
Worker/employee/rural	29	80.6	186	59.9	0.001*
Self-employed	2	2.4	12	3.5	
Boss	5	4.9	84	30.4	
Other	6	12.1	23	6.2	

\*Significant values ( $p \leq 0.05$ ) – Rao-Scott test

indicating that it was influenced by other variables, such as sex and educational level.

Although hearing loss is very common in the elderly, the available treatment options may not be well accepted, especially when the deficiency is not severe<sup>(12)</sup>. In the United States, only 25% of adults with hearing loss use hearing aids and the reasons given were similar to those described in this study, e.g. poor perception of the need for the device<sup>(13)</sup>. One explanation for this fact is that the demand for hearing aids usually occurs between 10 and 13 years after the initial detection of hearing loss, when it is already at an advanced stage, or has become profound hearing loss<sup>(14)</sup>.

In Brazil, the delay in seeking care professional for hearing loss indicated that specialized care for hearing health is the last resort sought by the elderly<sup>(15)</sup>. Even following the decision to seek professional assistance, the elderly face barriers regarding

access to specialists and treatment adherence, since they are unable to find a “cure” for hearing loss and their expectations are frustrated.

Given the results of the study, two possible explanations are raised in these cases: the search for a professional for hearing loss treatment remains low, possibly due to the difficulty in finding services available in the community, or due to the difficulty these services face in achieving the expectations of the elderly; the slow onset and gradual hearing loss characteristic of presbycusis seems to favor the advancement of hearing loss, unless measures are taken early. Moreover, the stigma of using a hearing aid could generate refusal to accept the condition, which justifies the response “I did not think it was necessary”.

In a study that explored the discourse of five elderly hearing aid users to identify repertoires that justified the decision to use the device, the Brazilian authors reported the following

**Table 3.** Distribution of the number and percentage of hearing aid use by the elderly with self-reported hearing loss according to morbidities, mobility and health care

Variable	Hearing aid use				p-value
	Yes		No		
	n	%	n	%	
Self-rated health					
Good or very good	22	49.6	119	39.2	0.29
Regular, poor or very poor	23	50.4	210	60.8	
Mobility					
Capable of walking	45	100	317	97.2	0.23
Wheelchair user/bedridden	-	-	14	2.8	
Depressive symptoms					
Yes	5	10.8	56	20.2	0.33
No	38	89.2	213	79.8	
Probable dementia					
Yes	2	1.8	70	14.7	0.002*
No	42	98.2	241	85.3	
Dizziness/vertigo					
Yes	5	18.1	75	26.5	0.34
No	38	81.9	211	73.5	
Patient aware of right to public health care					
Yes	43	93.9	314	96.9	0.41
No	2	6.1	11	3.1	
Private health plan					
Yes	30	60.6	145	43.8	0.05
No	15	39.4	186	56.2	
Private plan covers rehabilitation services					
Yes	17	74.9	91	80.8	0.61
No	5	25.1	22	19.2	
Private plan covers prostheses, orthoses and assistive devices					
Yes	3	14.0	13	12.8	0.90
No	20	86.0	89	87.2	

\*Significant values ( $p \leq 0.05$ ) – Rao-Scott tes

justifications: the hassle of repetition, the pursuit of prevention and self-care, the use of a beneficial technological resource, the benefits of the prosthesis, overcoming limitations, and the virtue of resignation, wherein, since they had hearing loss and had accepted it, they might not be affected by other “evils”<sup>(16)</sup>.

Another feature that explained the decision regarding hearing aid use deals with the concept of satisfaction. Despite the technological advances of modern acoustic systems, user satisfaction remains a challenge for audiologists and the high rates of abandonment of hearing aid use remain a problem for health services<sup>(17)</sup>. Thus, monitoring satisfaction is important in the evaluation of clinical procedures and to ensure the quality of health services. Studies indicate that hearing aid users attended by the Brazilian public health system (SUS) and evaluated by the Satisfaction with Amplification in Daily Life (SADL) questionnaire (validated Portuguese version) were satisfied with the adaptation; the “personal image” scale was the most favored<sup>(18)</sup>. In another approach using the same instrument, the researchers concluded that the degree of satisfaction of adults who were supplied devices by the SUS was related to the type of hearing aid; the intraaural device was rated the best. The

degree of satisfaction was not related to age, sex, degree of hearing loss or electrophysiological profile<sup>(19)</sup>.

In this study, the way in which hearing aid users acquired the device was highlighted, with the majority using private resources. Specifically regarding the acquisition and use of hearing aids, observation verified that adherence to the SUS by the elderly in order to treat their hearing loss remains low, which is important given the high cost of these devices.

The National Policy on Hearing Health Care (PNSA) aims to guide the actions of hearing health and to define the roles of services in order to extend access and organize attendance<sup>(3)</sup>. Considering that the data collection for this study occurred only two years after the establishment of the PNSA (2006), it is probable that the provision of hearing aids by the SUS has intensified following the effective implementation and/or greater dissemination of the policy.

This last statement is supported by the literature<sup>(6,20)</sup>. A collection conducted in Pernambuco, 2003, showed that 63% of municipalities did not have any professionals in the area of hearing loss diagnosis, neither otolaryngologists nor audiologists, registered with the Outpatient Information System of the

**Table 4.** Distribution of the number and percentage of hearing aid use by the elderly with self-reported hearing loss according to performance in basic and instrumental activities of daily living

Variable	n	Hearing aid use (%)	n	Non-use of hearing aid (%)	p-value
Difficulty performing BADL*					
One or more difficulties	32	81.1	207	70.9	0.22
No difficulties	13	18.9	122	29.1	
<b>BADL</b>					
Walking					
With difficulty	4	5.6	56	11.1	0.29
Without difficulty	41	94.4	275	88.9	
Dressing					
With difficulty	9	12.0	60	23.8	0.15
Without difficulty	36	88.0	271	76.2	
Bathing					
With difficulty	8	7.8	60	11.6	0.40
Without difficulty	37	92.2	271	88.4	
Eating by yourself					
With difficulty	3	3.3	25	4.9	0.66
Without difficulty	42	96.7	304	95.1	
Getting out of bed					
With difficulty	8	10.7	74	17.2	0.31
Without difficulty	37	89.3	256	82.8	
Using the toilet					
With difficulty	4	3.0	49	9.3	0.07
Without difficulty	41	97.0	282	90.7	
Difficulty performing IADL*					
One or more difficulties	05	8.5	52	21.8	0.13
No difficulties	40	91.5	273	78.2	
<b>IADL</b>					
Preparing a hot meal					
With difficulty	18	37.2	155	39.7	0.75
Without difficulty	26	62.8	176	60.3	
Managing money					
With difficulty	11	19.2	113	25.2	0.47
Without difficulty	33	80.8	216	74.8	
Using public transport					
With difficulty	22	45.2	168	38.6	0.42
Without difficulty	23	54.8	162	61.4	
Buying food					
With difficulty	18	27.7	148	41.1	0.22
Without difficulty	27	72.3	183	58.9	
Using the telephone					
With difficulty	09	14.2	110	25.8	0.17
Without difficulty	36	85.8	219	74.2	
Light housework					
With difficulty	23	50.6	169	45.3	0.57
Without difficulty	22	49.4	161	54.7	
Heavy housework					
With difficulty	37	77.6	244	68.2	0.32
Without difficulty	08	22.4	87	31.8	
Taking medication					
With difficulty	07	8.1	107	24.9	0.01*
Without difficulty	38	91.9	224	75.1	

\*Significant values ( $p \leq 0.05$ ) - Rao-Scott Test**Note:** BADL = basic activities of daily living; IADL = instrumental activities of daily living

**Table 5.** Logistic Regression of hearing aid use by the elderly with self-reported hearing loss

Variable	Hearing aid use				adjusted OR (95%CI)	p-value
	Yes		No			
	n	%	n	%		
Probable dementia						
Yes	2	1.8	70	14.7	11.3 (3.8-33.7)	<0.001*
No	42	98.2	241	85.3	1.0	
Using the toilet						
With difficulty	4	3.0	49	9.3	5.7 (1.8-18.2)	0.003*
Without difficulty	41	97.0	282	90.7	1.0	

\* Significant values ( $p \leq 0.05$ ) and adjusted for sex and age (Odds Ratio, OR), Logistic Regression

Ministry of Health<sup>(20)</sup>. Therefore, it is highly likely that these municipalities did not offer the public any action promoting hearing health, even in primary care centers.

Later, in 2006, a qualitative study on the perception of the elderly concerning the use of hearing aids provided by the SUS, in the State of Santa Catarina, revealed that the establishment of the Hearing Health Care Service in the region had made access to a hearing aid possible<sup>(6)</sup>. However, the study confirmed that elderly individuals continued in their belief that private health services provided hearing aids of better quality than those provided by the SUS, despite the wide range of devices offered by the public health system.

In this study, the majority of elderly hearing aid users (87%) reported having received training to use the device and follow-up involving more detailed guidance concerning its use (81.4%). It is worth emphasizing that the process of adapting to hearing aid use is especially difficult for the elderly, because they usually require more time to assimilate all the stages of selection and adaptation to amplification and, consequently, it is necessary that the information is presented gradually and continuously<sup>(21)</sup>. However, even with these potential difficulties, the study verified that the elderly who declared they were hearing aid users reported receiving training and follow-up, a factor that probably had a positive influence on the use of the device.

Additional analysis conducted by this study focused on the factors associated with hearing aid use among the elderly in the city of São Paulo and, among these, contact with health services. The vast majority of elderly hearing aid users (93.9%) reported knowing that they were entitled to the SUS, though this percentage was also high among non-users (96.6%). However, the generic form of approach to this issue, i.e. not asking directly whether the elderly individuals knew of their specific right to audiological care by the SUS, should be considered a limitation of the analysis of this result.

Multivariate analysis verified that only the presence of probable dementia and difficulty in performing the activity of daily living of using the toilet were associated with hearing aid use. Given these findings, the following hypotheses were developed: use of a hearing aid could be a protective factor that prevents the occurrence of dementia, since the amplification provided by a hearing aid favors the preservation of certain cognitive

abilities; elderly individuals with confirmed dementia could present greater difficulties in hearing tests, particularly behavioral exams (audiometry and logaudiometry), and in their compliance with the protocols of hearing aid adaptation, factors that impair the process of auditory diagnosis and adaptation in this population, especially when objective methodologies are not available. However, given the cross-sectional design of this study, it was not possible to affirm which of these factors occurred first. Thus, an exact description of causality in the situations discussed is not viable, and should be considered another limitation of the study.

The hypothesis that hearing aid use could be a protective factor in the maintenance of cognitive performance in the elderly is supported by national and international literature. Studies have shown that auditory rehabilitation with hearing aids led to improvement in global cognitive measures<sup>(22)</sup> and that their occurrence was perceived by close relatives. The skill most favored by hearing aid use was auditory attention, which contributes to reducing social isolation and communication difficulties, and thus to improving the quality of life<sup>(23)</sup>.

The other hypothesis raised was that elderly people with hearing loss would show greater difficulty in their performance on the MMSE and would receive worse evaluations by their caregivers in the PFAQ, since the execution of all the items of the MMSE depends on understanding oral commands and many of the activities evaluated in the PFAQ depend on hearing. This bias could produce a significant number of false cases of "probable dementia", since without the compensation provided by the prosthesis, hearing impairment could influence the cognitive and functional assessment of these elderly individuals.

The relation between cognitive impairment and hearing loss has been indicated in studies related to aging<sup>(24)</sup>. One study<sup>(25)</sup> reported a 6.6-fold greater risk that patients showing cognitive decline presented hearing loss, compared with the control group. Regarding this issue, American authors studied motor reaction time following an auditory stimulus and verified changes in the modulation of the auditory cortex in subjects with cognitive decline, resulting from neurological disorders in areas of the association cortex<sup>(26)</sup>. Besides the biological explanation, environmental factors could also contribute to the presence of cognitive decline among the hearing impaired.

Hearing loss can lead to social isolation, depression and reduced functional capacity<sup>(27)</sup>, factors that may produce a false diagnosis of dementia. Thus, audiologists need to recognize the importance of cognitive functions in hearing abilities, since in everyday life, hearing is highly influenced by cognition. On the other hand, sensory impairments (auditory and motor) can mask or amplify cognitive decline<sup>(28)</sup>. Although this relationship is rarely emphasized in the training of audiologists and otorhinolaryngologists, the differential diagnosis between cognitive decline and hearing loss must be carefully observed so that the correct diagnosis and intervention are achieved, especially in the elderly population, which presents a higher prevalence of both these comorbidities<sup>(29)</sup>.

Hearing aid use can be related to people's performance in various activities of daily living, especially in instrumental activities that involve the use of communication in their performance. However, in this study, hearing aid use was only associated with the activity of using the toilet, a basic activity of daily living that does not involve direct communicative demands. One explanation for this association is that as non-use of hearing aids is related to a higher prevalence of probable dementia, elderly non-users of hearing aids show greater cognitive compromise and would require assistance for the more basic daily needs. Another factor is related to the *proxy* effect. Since many elderly non-users of hearing aids required a substitute informant to answer the questionnaire and the activity of assisting someone use the toilet is often one of the most difficult for the caregiver to perform, this fact could have been superimposed on the response, demonstrating a more pronounced report by the caregiver regarding a daily difficulty faced by both the elderly individual and the caregiver.

One important fact observed was the number of auxiliary informants required by elderly individuals with self-reported hearing loss who were non-users of hearing aids to respond to the SABE questionnaire. This may have generated some inaccurate responses (*proxy* effect) and contributed to the number of "non responses" on certain tables, and should be considered another limitation of the study. Another plausible explanation for these missing data can be found in the communication difficulties that hearing loss can provoke. Numerous questions may have been marked as "do not know/no answer" due to lack of understanding of the question by the elderly individual, as a result of the difficulty in detecting sound or in processing acoustic information. Another hypothesis is it may have been difficult for the interviewer to understand the response, since loss of auditory feedback in the elderly can result in speech problems and voice disorders<sup>(30)</sup>, situations that could have led to a decrease in the number of responses considered on certain questions. Despite these difficulties in studying the factors associated with hearing loss and the use of hearing aids, particularly those discussed, detailing them is of paramount importance in understanding this population and for informing public health actions.

## CONCLUSION

The percentage of elderly individuals with self-reported hearing loss who used hearing aids in the city of São Paulo was considered low, while SUS coverage regarding the adaptation and follow-up of these users was considered insufficient. One of the problems that non-use of hearing aids can cause, or aggravate, is the onset or accentuation of cognitive decline and the consequent decrease in functional capacity in this population, since non-use of hearing aids was associated with higher prevalence of probable dementia, as revealed by the data obtained in this study

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