

Activity limitations in the elderly: a study of new hearing aid users using the APHAB questionnaire

Limitação de atividades em idosos: estudo em novos usuários de próteses auditivas por meio do questionário APHAB

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ABSTRACT

Purpose: To evaluate hearing limitations among elderly individuals with moderate to severe sensorineural hearing loss according to the variables educational level and degree of hearing loss, using the *Abbreviated Profile of Hearing Aid Benefit* self-assessment questionnaire. **Methods:** The questionnaire was applied to 30 elderly subjects before and after three months of use of amplification. The sample was composed of 60% females and 40% males, with mean age of 71.6 years. Educational level was divided into three categories: illiterate, elementary school, and high school education. Data were analyzed statistically. Scores were compared by subscale and an overall assessment was conducted by subtracting these scores. Moreover, it was calculated the association between benefit and educational level and degree of hearing loss. **Results:** The comparative study between scores obtained in the questionnaire with and without hearing aid revealed difference in the subscales Ease of Communication, Reverberation and Background Noise, with values $p < 0.001$. In the Aversion to Sounds subscale, it was observed a decline with amplification. Performance improved with the hearing aid in the overall evaluation for all three subscales. There was no association between benefits obtained with the hearing aid, educational level, and degree of hearing loss. **Conclusion:** Benefits were reported in the subscales: Ease of Communication, Reverberation, and Background Noise. No association was found between benefits, educational level and degree of hearing loss. The benefit obtained in the Background Noise subscale is smaller than that observed in Reverberation and Ease of Communication.

Keywords: Hearing loss; Elderly health; Hearing aids; Presbycusis; Questionnaires

INTRODUCTION

In light of population aging in Brazil, managing hearing loss among the elderly has become increasingly relevant.

The population of individuals aged 60 years and older was approximately 17 million in 1998, representing around 2% of the total population in Brazil. In 2006, this number rose to around 19 million, demonstrating Brazil's accelerated population aging process. Life expectancy increased between 1999 and 2003 among all age groups, for both men and women. However, female life expectancy surpasses that of males, which partially explains the greater number of elderly women in relation to men⁽¹⁾.

As an important form of social interaction, particularly among the elderly, the communication process can be considered a way of exchanging professional and personal experiences. Among sensory deprivation conditions, presbycusis, or bilateral sensorineural hearing loss among the elderly as a result of aging is relevant in that it has the most devastating effect on communication. It is considered one of the most debilitating conditions, limiting the activity of sufferers or preventing them from fully participating in society⁽²⁾.

Hearing impairment contributes significantly to the onset and persistence of depression, given that it either partially or completely prevents individuals from carrying out social activities and limits interaction due to the isolation it can cause⁽³⁾.

Recent studies show that as the elderly population has grown, so too has the prevalence of presbycusis, interfering in quality of life among the aged⁽⁴⁾.

The main purpose of hearing aid adjustment is to ensure its effectiveness in minimizing hearing difficulties experienced and lessen the psychosocial consequences of hearing impairment⁽⁵⁾.

Self-assessment questionnaires are the most widely used instruments for evaluating these limitations and restrictions among the hearing impaired.

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The *Profile of Hearing Aid Performance* (PHAP) self-assessment survey aims to quantify the assistance provided by hearing aids in different situations of daily living and evaluate the patient's opinion regarding the use of amplification. Several situations involving communication are addressed, as well as reactions to intense background noise⁽⁶⁾. This questionnaire was expanded to create the PHAB (*Profile of Hearing Aid Benefit*), which contains the same instructions, items and responses as the PHAP, with an additional element of two response times: with and without a hearing aid. This inventory provides data for measuring the benefits of amplification, comparing responses from both situations⁽⁷⁾.

The *Abbreviate Profile of Hearing Aid Benefit* (APHAB), an abbreviated version of the PHAP and PHAB questionnaires, consists of 24 items divided into four subscales that assess communication, including situations in favorable environments (EC scale) and experiences in the presence of noise (BN scale), reverberating rooms (RV scale) and loud sounds (AV scale). A software program was also created to analyze results obtained in the different subscales⁽⁸⁾. This survey also provides information that facilitates successful adaptation, helping patients assess the advantages and disadvantages of amplification. Individuals become more aware of their performance in certain situations, which aids adjustment of the device and evaluates adaptation to the hearing aid, quantifying the benefits of amplification⁽⁹⁾.

A study by speech therapists regarding knowledge and applicability of self-assessment inventories found that although the 45 participating therapists were familiar with the instruments, they did not use them in their clinics on a daily basis. Among teaching clinicians, 100% applied these questionnaires. The APHAB was the most widely used instrument for evaluating the benefits of amplification and was part of the protocol in several studies conducted by teaching professionals⁽¹⁰⁾.

Self-evaluation surveys investigate individual perception of functional and psychosocial damage caused by hearing loss in the elderly and are essential to better understand presbycusis and its diagnosis, particularly in regard to hearing re-education⁽⁴⁾.

Subjective analysis of the benefits of amplification through self-assessment inventories is valuable and may help to select and validate adaptation results⁽¹¹⁾.

Using these subjective instruments is important since the fact they are standardized allows results and questions concerning adaptation to hearing aids to be compared on a broader scale, providing better indicators for changes needed in the adaptation process⁽¹⁰⁾.

Considering the previously mentioned data and the hypothesis that hearing aids improve elderly performance in activities of daily living, the present study sought to evaluate hearing limitations among aged users of these devices in activities of daily living, using the APHAB self-assessment questionnaire. Results of subjective evaluation before and after adaptation to the hearing aid were compared to determine whether an association exists between benefits of the device and the variables educational level and degree of hearing loss.

METHODS

This investigation was approved by the Research Ethics Committees of the *Universidade Estadual de Ciências da Saúde de Alagoas* – UNCISAL and the *Universidade Federal de São Paulo*, under protocol numbers 742/07 and 2013/08, respectively. All subjects signed a free and informed consent to voluntarily participate in the study.

The present study was conducted within the highly complex services of the Alagoas State Hearing Healthcare network in the areas of hearing impairment diagnosis and selection and adaptation of hearing aids by the Outpatient Information System (SIA) of the National Health Service (SUS) (APAC database system).

Inclusion criteria were: age above 60 years; moderate to severe sensorineural hearing loss in accordance with the criteria of Davis and Silverman⁽¹²⁾; new users of bilateral hearing aids; devices installed in healthcare units cited above from March to August 2008; no evident neurological, psychological and/or cognitive disorders.

An initial analysis of medical charts was performed for patients enrolled in the aforementioned services who were candidates for hearing aid adaptation, in order to identify those that met inclusion criteria. A total of 43 subjects were selected and invited to participate in the study on the date established for hearing aid adjustment. Subsequently, the Mini-Mental State Examination (MMSE)⁽¹³⁾ and the Geriatric Depression Scale (GDS)⁽¹⁴⁾ were applied to rule out the presence of cognitive and/or depressive disorders. Aged individuals excluded from the research were referred to a geriatric specialist in the public or private sector, depending on patient preference and financial status.

Of the patients chosen, 13 were excluded: five had previously used a hearing aid, four exhibited signs of depression and four displayed cognitive deficit, detected by the GDS and MMSE questionnaires, respectively.

Thus, 30 individuals participated in this investigation, 18 women and 12 men aged between 60 and 87 years.

The APHAB (*Abbreviated Profile of Hearing Aid Benefit*) was applied, developed by Cox and Alexander⁽⁸⁾, adapted into Portuguese by Almeida, Gordo, Iório and Scharlach and published in 1998⁽¹⁵⁾.

All protocols used in this study were conducted in a private room by a researcher, who assisted the subjects when necessary.

For the APHAB, participants selected the best option among seven possible responses after reading each item. When needed, the researcher helped individuals by giving examples of daily life situations. The questionnaire was first applied during a session where hearing aids were supplied, prior to their adjustment.

Educational material was employed to instruct participants on using the hearing aid and provide strategies for facilitating communication. Questions were answered regarding care and maintenance of the device, as well as handling batteries. Subjects were also advised on strategies for care, hearing, communication and face reading to improve their communication.

The APHAB was applied a second time when subjects returned to the healthcare unit for follow-up after three months of hearing aid use, the required period for acclimatization to the device. Individuals who did not voluntarily attend were contacted by the main researcher to schedule a home visit for survey application.

Analysis of the APHAB occurred as proposed by the author, considering responses for the 24 items divided into four subscales: ease of communication in favorable environments (EC), communication in reverberating environments, reverberation (RV), communication in locations with high background noise levels (BN) and aversiveness to sound (AV). Patients were instructed to select one of seven possible answers corresponding to the frequency of difficulty experienced in certain daily communication situations. Each alternative presented was associated to percentage values defined for each subscale: always (99%), almost always (87%), generally (75%), half-the-time (50%), occasionally (25%), seldom (12%) or never (1%).

In order to be considered beneficial, a result of at least 22% is required between scores with and without a hearing aid in only one of the subscales: ease of communication, reverberation or background noise. When the goal is overall assessment, scores achieved with a hearing aid should be 10% better than those obtained without the device in subscales EC, RV and BN. The authors reported that standardization of results for aversiveness (AV) was not possible and further research is needed concerning this subscale⁽¹⁶⁾.

Statistical methods

Data were summarized as absolute (N) and relative frequency (%) in the case of categorical variables and by the descriptive statistics mean, standard deviation, median and minimum and maximum value for numerical variables.

In order to compare patient scores before and after adaptation to the hearing aid, the Wilcoxon test was used for the four APHAB subscales (ease of communication, reverberation, background noise and aversiveness) both separately and as a whole, adding the first three domains (ease of communication, reverberation and background noise).

Benefits obtained from using the hearing aid were determined by subtracting scores achieved before and after fitting the device.

We also investigated the association between education level and benefit, and degree of hearing loss and benefit. In the first instance, the Kruskal-Wallis test was applied to determine whether there was a significant difference in benefit between illiterate, elementary school (complete or incomplete) and high school educated patients (complete or incomplete). The Mann-Whitney test was used to assess the relationship between degree of hearing loss and benefit among patients with moderate and moderately severe hearing loss. The Friedman test was used to compare benefits among the three subscales (EC, RV and BN) and the Wilcoxon test was applied to establish where differences between them occurred.

All statistical tests employed (Wilcoxon, Kruskal-Wallis, Friedman and Mann-Whitney) are non-parametric and results were considered significant when $p < 0.05$.

For data analysis and graph construction we used Minitab 15.1 statistical software.

RESULTS

The present study includes data obtained in assessments of activity limitations among 30 individuals, whose sociodemographic data and information regarding hearing loss are shown in Table 1.

Table 1. Frequency distributions for sample characterization

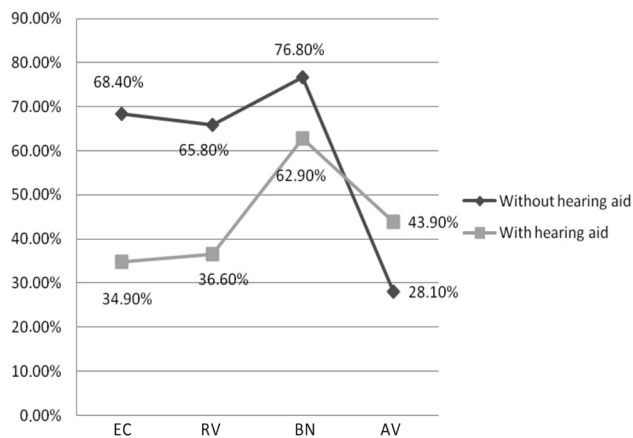
Demographic data	n	%
Gender		
Female	18	60
Male	12	40
Educational level		
Illiterate	11	36.7
Elementary incomplete	8	26.7
Elementary complete	1	3.3
High School incomplete	6	20
High School complete	4	13.3
Degree of hearing loss		
Moderate	19	63.3
Moderately severe	11	36.7
Age (years)		
Mean		71.6
SD		7.8
Minimum – maximum		60 – 87

Note: SD = standard deviation

Following application of the APHAB, scores obtained with and without hearing aids were analyzed per subscale.

Results of this analysis for subscales ease of communication, reverberation, background noise and aversiveness are displayed in Table 2 and Figure 1, respectively.

Next, we determined the overall score for hearing difficulties and benefits of using the device, as per Table 3.



Note: EC = ease of communication; RV = reverberation; BN = background noise; AV = aversiveness

Figure 1. Hearing difficulties with and without hearing AIDS according to subclasses of the APHAB questionnaire.

Table 2. Hearing difficulties with and without hearing aids and benefits in accordance with subscales ease of communication, reverberation, background noise and aversion from the APHAB questionnaire

	n	EC (%)			RV (%)			BN (%)			AV (%)		
		WOD	WD	B	WOD	WD	B	WOD	WD	B	WOD	WD	B
Mean	30	68.4	34.9	33.5	65.8	36.6	29.2	76.8	62.9	14	28.1	43.9	-15.8
SD	30	22.1	19.1	26.7	17.5	13.7	17.2	16.9	18.1	18.1	18.6	18.3	19.8
Minimum	30	31.2	16.3	-45.3	33.2	16.3	-12.3	41.5	22.8	-39.3	1	8.7	-59.7
Median	30	68.7	28.1	33	68.4	35.4	29	83.9	65.4	13.3	31.3	47.8	-12.4
Maximum	30	97	87	76.5	95	62.3	70	97	87	55.3	62.5	68.7	35.5
p-value		<0.0001*			<0.0001*			<0.0001*			<0.0001*		

* Significant values (p<0.05) – Wilcoxon Test

Note: SD = standard deviation; EC = ease of communication; RV = reverberation; BN = background noise; AV = aversiveness; WOD = without the device; WD = with the device; B = benefit

Table 3. Overall score and benefit obtained in the APHAB questionnaire (EC+RV+BN)

General	n	Mean	SD	Minimum	Median	Maximum	p-value
Without hearing aid (%)	30	70.3	17.5	35.4	69.9	95.7	<0.001*
With hearing aid (%)	30	44.8	15.5	20.6	43.9	78.1	
Benefit (%)	30	25.5	18.5	-25.4	26.4	67.3	

* Significant values (p<0.05) – Wilcoxon test

Note: SD = standard deviation; EC = ease of communication; RV = reverberation; BN = background noise

Table 4. Assessment of benefit obtained in the APHAB questionnaire according to the variables: education level and degree of hearing loss

	Educational level			Degree of hearing loss	
	Illiterate	Elementary	High School	Moderate	Moderately severe
	%	%	%	%	%
n	11	9	10	19	11
Mean	23.4	28.1	25.5	23.9	28.4
SD	17.2	18.3	21.7	13.7	25.4
Minimum	-17.3	6.3	-25.4	-17.3	-25.4
Median	25.3	28.2	29.1	24.1	30.7
Maximum	47.5	67.3	56.3	42.8	67.3
p-value		0.897			0.533

Kruskal-Wallis test (p<0.05)

Note: SD = standard deviation

Table 5. Benefit according to the subscales: ease of communication, reverberation and background noise before and after using a hearing aid

Subscales	Mean	p-value
Ease of communication	33.5	<0.001*
Reverberation	29.2	
Background noise	14	

Mean values in %

* Significant value (p<0.05) – Wilcoxon test

For overall assessment, we considered the means of subscales ease of communication, reverberations and background noise.

The Kruskal-Wallis test was then applied to determine the association between educational level and the evaluation obtained by the APHAB. To that end, education level was grouped into three categories: illiterate, elementary school (complete or incomplete) and high school education (complete or incomplete). Correlation between benefits of the device and degree

of hearing loss was established using the Mann-Whitney test. Results are shown in Table 4.

The Friedman test was applied to compare benefits between the EC, RV and BN scales, as per Table 5.

DISCUSSION

The present study includes data obtained in the evaluation of 30 elderly subjects. Of these, 70% complained of hearing loss and were concerned about their communication problems and the number of situations in which they perceived difficulty, with background noise reported as one of the elements increasing these problems. No association was recorded between age and sex with respect to hearing complaints exhibited by participants.

The prevalence of females corroborates the literature⁽¹⁷⁻¹⁹⁾. In Brazil, the number of elderly women is higher than that of men: in 2003, this proportion was 55.9% and 44.1%, respectively. An investigation of 40 aged individuals (34 women and

6 men), demonstrated that 83.6% of male subjects showed hearing loss against 58.8% of female subjects. Thus, 41.2% of females and 16.4% of males displayed normal hearing and although most of the elderly exhibited this problem, few were aware of it⁽¹⁹⁾.

Data from the abovementioned studies show that hearing loss complaints were higher among women, while others show greater hearing impairment in male subjects^(2,4,19).

In line with other investigations^(17,20,21), this study used hearing loss classification proposed by Davis, Silverman⁽¹²⁾, although different classification criteria for degree of hearing loss are employed by other authors^(3,4,11,18,19,22,23). Research employing the same classification method as the present investigation observed a prevalence of moderate hearing loss in the elderly populations analyzed^(17,21). A hearing assessment of 40 elderly of both sexes aimed at comparing two classifications for degree of hearing loss, namely that of Davis and Silverman⁽¹²⁾ and another recommended by the *Bureau International d'Audio Phonologie* – BIAP. The investigation found that the technique proposed by the BIAP provides the best representation of hearing loss in elderly populations, since it allows individuals deemed as normal who exhibit diminished high-frequency hearing to be classified as suffering from mild hearing loss⁽²¹⁾.

According to Cox and Alexander⁽⁸⁾, results for the AV scale (aversiveness) are not well understood and may be related to adjustments of the maximum output of the device. However, further research is needed to provide more information on this subscale⁽²⁴⁾.

A study of 256 new hearing aid users, using the ABHAB and IOI-HA self-assessment questionnaires, observed that most difficulties experienced with the device occurred in the presence of noise (BN=54.39%) and reverberating environments (RV=53.82%), followed by performance in situations of easy communication (EC=43.62%). With sound amplification, these fell to 27.46% for BN, 24.64% for RV and 19.15% for EC. In relation to intolerance of loud or undesirable sounds (AV), it was found that even with amplification, there were no reports of greater discomfort in the presence of loud noise. [With regard to the benefits of hearing aids in different daily listening situations in a group exhibiting mild hearing loss (hearing thresholds of 30-55 dB (NA)) and another displaying more significant hearing loss (hearing thresholds of 60-70 dB (NA)), the authors reported a significant improvement ($p(2)=0.019$) among those with slight and moderate hearing loss. In other words, these subjects were more capable of understanding speech (ease of communication) when using the device. Overall assessment of the subscales (EC, RV and BN) showed real benefits⁽³⁾.

Another study⁽²⁵⁾ examined benefits and satisfaction with hearing aids by applying the APHAB and IOI-HA inventories before the device was installed and after four weeks of use. The author recorded a decline in hearing difficulties for the subscales ease of communication, reverberation and background noise, while greater difficulties were experienced in the aversiveness subscale. Furthermore, although problems with sound decreased in environments compatible with the first three subscales, individuals experienced greater aversiveness with the device than without it.

Results obtained for aversiveness corroborate those found in other studies^(20,24-28), although some research shows no significant differences with or without a hearing aid for this subscale^(3,11).

Statistical analysis in the present investigation revealed that most subjects demonstrated significant benefits when using a hearing aid, that is, they experienced fewer communication difficulties. This is in line with other studies using the same assessment instrument^(3,11,20,22,25,27,29).

When evaluating amplification using the APHAB, the author of the questionnaire states that in order to conclude that a hearing aid provides real benefits, scores obtained with the device must be 10% higher than those achieved without it, in the EC, RV and BN subscales⁽¹⁶⁾. Results in this study demonstrate statistically significant benefits after three months of amplification, corroborating literature findings and confirming the benefits of wearing a hearing aid^(3,11,15, 20,25-29).

It is important to note that individual benefit analysis revealed that two aged subjects achieved a negative score. In other words, these participants experienced a decline in their condition rather than improvement, in overall analysis, when using a hearing aid. This may be due to inadequate use of the device or ineffective monitoring and advice. Aging is a life phase in which individuals display physical, sensory, intellectual and emotional changes⁽²⁹⁾. These variables can influence adaptation to the device and responses in self-assessment questionnaires.

An analysis of benefits in accordance with education level found no association between this variable and amplification, as shown by the Kruskal-Wallis test. As such, no significant benefit gain was recorded in relation to educational level when a hearing aid was used, confirming the lack of association. Certain non-auditory factors are known to influence hearing aid adaptation results, including education, lifestyle, social support and race/ethnicity⁽²⁵⁾. Response variations among illiterate elderly indicate their answers may be subject to interference by the examiner at some point during application⁽³⁰⁾. The present study found that educational level had no influence on adaptation to the hearing aid.

When examining the advantage of hearing aid use according to degree of hearing loss, no correlation was recorded between these variables. The classification technique proposed by Davis and Silverman⁽¹²⁾ was selected to analyze degree of hearing loss in the population studied. Some authors emphasize the importance of using a classification based on broad frequency ranges to determine degree of hearing loss in the aged^(4,17). Studies investigating the correlation between complaints of communication difficulty among the elderly and degree of hearing loss recorded an association at high frequencies, but not at medium or low frequencies. This demonstrates the need to correlate degree of hearing loss with audiometric configuration when compiling audiological reports. These findings confirm that high frequency data is more strongly related to communication performance than medium and low frequency information. This may explain the common complaint among elderly presbycusis sufferers that they can hear speech, but cannot understand it⁽¹⁸⁾. Another investigation assessed the benefit of hearing aids according to

degree of hearing loss, considering mild hearing loss within auditory thresholds of 30-55 dBNA (lower) and more substantial hearing loss (hearing thresholds of 60-70 dBNA). The group with low to moderate hearing loss exhibited significant improvement, that is, greater ease in understanding speech in environments of easy communication⁽²⁵⁾.

The benefit of using hearing aids was also evaluated by comparing results obtained in the EC, BN and RV subscales (Table 5). A statistically significant result was recorded for background noise in comparison with the other subscales (EC and RV), identifying greater communication difficulties in noisy situations in relation to favorable or reverberating en-

vironments. No research was found in the literature regarding benefits between subscales.

CONCLUSION

Reduced activity limitation was recorded for the subscales: ease of communication, reverberation and background noise when hearing aids were used. Benefits gained in the background noise scale were lower than those obtained for ease of communication and reverberation. There was no association between benefits achieved with the device and the variables education and degree of hearing loss.

RESUMO

Objetivo: Avaliar limitações auditivas de idosos com perda auditiva sensorineural de grau moderado a severo segundo variáveis escolaridade e grau da perda auditiva, por meio do questionário de auto-avaliação *Abbreviate Profile of Hearing Aid Benefit* (APHAB). **Métodos:** Foi aplicado o questionário em 30 idosos antes e após três meses de uso da amplificação. A amostra foi composta por 60% mulheres e 40% homens, com média de idade de 71,6 anos. O grau de escolaridade foi distribuído em três categorias: não-alfabetizado, ensino fundamental e ensino médio. Os dados foram analisados estatisticamente. Os escores foram comparados por sub-escala, e a avaliação geral pela subtração desses escores. Além disso, foi calculada a associação entre benefício e grau de escolaridade e grau de perda auditiva. **Resultados:** O estudo comparativo entre os escores obtidos na aplicação do questionário sem e com prótese auditiva revelou diferença nas sub-escalas Facilidade de Comunicação, Reverberação e Ruído Ambiental, com valores de $p < 0,001$. Na sub-escala Aversão aos Sons ocorreu piora com a amplificação. Houve melhora no desempenho com prótese auditiva na avaliação geral nas três sub-escalas. Não houve associação entre o benefício obtido com a prótese auditiva, grau de escolaridade e grau de perda auditiva. **Conclusão:** Há benefício nas sub-escalas: Facilidade de Comunicação, Reverberação e Ruído Ambiental. Não há associação entre benefício, escolaridade e grau da perda auditiva. O benefício obtido na sub-escala Ruído Ambiental é menor que nas sub-escalas Facilidade de Comunicação e Reverberação.

Descritores: Perda auditiva; Saúde do idoso; Auxiliares de audição; Presbiacusia; Questionários

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