CoDAS
ISSN 2317-1782 (Online version)

Original Article
Artigo Original

Patricia Teixeira Menniti Pennini[1]
Katia de Almeida[1]

Speech, Spatial and Qualities of Hearing Scale in assessing the benefit in hearing aid users

Speech, Spatial and Qualities of hearing scale na avaliação do benefício em usuários de prótese auditiva

Keywords

Hearing Aids
Questionnaires
Adult
Hearing Loss
Outcomes

ABSTRACT

Purpose: To check the degree of reliability of the Speech, Spatial and Qualities of Hearing Scale (SSQ), in the assessment of the benefit in hearing aid users. **Methods:** Thirty hearing impaired adults, candidates for use (novice users) or users whose hearing aids (experienced users) were being replaced, participated in the study. All participants underwent complete audiological evaluation, selection and fitting of hearing aids, which included checking measurements with a probe microphone and assessment of the benefit from using hearing aids with the Speech, Spatial and Qualities of Hearing Scale (SSQ) questionnaire. A basic SSQ questionnaire was administered in the form of an interview. Later, four weeks after having started using new hearing aids, the versions B (for novice users) and C (for experienced users) of the SSQ questionnaire were administered. **Results:** Greater difficulty was identified in the Hearing for speech domain than in the other domains, namely Spatial hearing, and Qualities of hearing. Most participants found all questions easy to understand and reported they were compatible with the situations they dealt with in their daily life. Statistical analysis revealed a high Cronbach's alpha coefficient (>0.9), which is indicative of good internal consistency between the various items contained in the questionnaire. It proved to be a valuable tool for subjectively assessing communicative performance with and without the use of hearing aids. **Conclusion**: The SSQ proved to be an instrument that is easy to administer and highly reliable, allowing for the assessment of the benefit in individuals who are undergoing auditory rehabilitation, and which can be administered to individuals using different types of hearing aids.

Descritores

Auxiliares de Audição
Questionários
Adulto
Perda Auditiva
Avaliação de Resultados

RESUMO

Objetivo: foi verificar o grau de confiabilidade do *Speech, Spatial and Qualities of Hearing Scale* (SSQ), na avaliação do benefício em usuários de próteses auditivas. **Método**: Participaram do estudo 30 adultos deficientes auditivos, candidatos ao uso (novatos) ou usuários em fase de troca de suas próteses auditivas (experientes). Todos os participantes realizaram avaliação audiológica completa, seleção e adaptação das próteses auditivas que incluiu a verificação com medidas com microfone sonda e avaliação do benefício do uso das próteses auditivas utilizando o questionário *Speech, Spatial and Qualities of Hearing Scale* (SSQ). Inicialmente, foi aplicado o questionário SSQ Base, em forma de entrevista. Após quatro semanas de uso das próteses auditivas novas reaplicou-se o questionário SSQ, em sua versão B (para os novatos) e C (para os experientes). **Resultados:** Foi identificada maior dificuldade no domínio Audição para fala, do que nos outros domínios Audição espacial e Qualidades da audição. Todas as questões foram de fácil compreensão para a maioria dos participantes, que relataram serem compatíveis com as situações do seu cotidiano. A análise estatística revelou alto coeficiente Alpha de Cronbach (>0,9), demonstrando boa consistência interna entre os diversos itens do questionário. Demonstrou ser uma valiosa ferramenta para avaliar subjetivamente o desempenho comunicativo com e sem próteses auditivas. **Conclusão:** O SSQ mostrou ser um instrumento de fácil aplicação e com alta confiabilidade que permite avaliação do benefício em indivíduos que se encontram em processo de reabilitação auditiva e pode ser aplicado a indivíduos que utilizam diferentes tipos de próteses auditivas.

Correspondence address:
Patricia Teixeira Menniti Pennini
Alameda dos Arapanés, 1252, Moema, São Paulo (SP), Brasil, CEP: 04524-002.E-mail: patriciapennini@hotmail.com

Received: August 21, 2019

Accepted: April 14, 2020

Study conducted at Faculdade de Ciências Médicas, Santa Casa de São Paulo – Mestrado Profissional em Saúde da Comunicação Humana - São Paulo (SP), Brasil.

[1] Programa de Mestrado Profissional em Saúde da Comunicação Humana, Faculdade de Ciências Médicas da Santa Casa de São Paulo – FCMSCSP - São Paulo (SP), Brasil.

Financial support: nothing to declare.

Conflict of interests: nothing to declare.

INTRODUCTION

With the increasing aging of the population, one of the most relevant sensory changes in the elderly is hearing loss. More than 5% of the world population has some sort of disabling hearing loss. Approximately one third of people aged over 65 are affected. The negative effects and impacts of hearing loss bring limitations to the affected person, with the lack of speech comprehension in several acoustic environments, mainly in the presence of noise [1], being one of the most prevalent complaints.

Rehabilitation encompasses a set of measures that help people with disabilities to have and maintain ideal functionality when interacting with their environment. It is considered efficient when it reduces the individual's communication difficulties, that is, their hearing impairments; increases psychosocial well-being, reduces participation restrictions, and when the functional improvements achieved remain over time [2].

The role played by professionals in hearing rehabilitation aims to minimize the communication difficulties experienced by their hearing-impaired patients. The hearing aid, as well as the cochlear implant, are extremely important resources: they are widely used and have continuously improved over the years, minimizing the difficulties in communicating and maintaining a social life. The fitting and effective use of hearing aids are essential for the rehabilitation process of the hearing impaired to be established. It is important to assess the benefit from using a hearing aid and its positive effects on the individual's daily life as a measurement of the treatment outcome, i.e., how well-suited has been the process of hearing aids fitting.

Benefit is understood as the difference in the individual's performance between two conditions: without and with the electronic device; it can be assessed objectively or subjectively. Objective methods employ threshold or suprathreshold free-field measurements, speech intelligibility measurements, and measurements of restoration of the sensation of intensity, whereas subjective assessments, in turn, rely on self-assessment, i.e., they evaluate the user's opinion about the amplification, with no external reference for comparison [3].

It is of utmost importance to perform subjective measurements involving the individual's self-perception relating to their hearing difficulties in everyday life. Many questionnaires have been developed to better characterize the degree and disability resulting from hearing loss and to report the situations more specifically with which listeners have to cope. There are questionnaires that measure user satisfaction with amplification, while others quantify the benefit from using hearing aids and even those that assess more general aspects such as quality of life. However, there are a limited number of questionnaires that cover the domain of situations depending on binaural auditory abilities. Binaural hearing makes it possible to locate the sound, eliminate the head-shadow effect, thereby providing a better understanding of speech in noise and different environments, giving the hearer the impression of a three-dimensional sound.

The Speech, Spatial and Qualities of Hearing Scale – SSQ was developed with the aim of characterizing the relationship between disability and impairment to the hearing experience in a variety of complex listening situations in everyday life. It is an instrument for the individual's self-assessment in a variety of domains such as situations of directional hearing related to different distances and to movement, segregation of sounds and simultaneous voice flows, ease of listening, naturalness and clarity of everyday life sounds and different musical pieces and instruments [4,5]. The SSQ is a questionnaire comprised of 49 questions and divided into three dimensions: Hearing for speech, Spatial hearing, and Qualities of hearing. Different versions of this questionnaire have been developed, among which we highlight the SSQ-B and SSQ-C, whose objective is to assess the benefit from electronic devices in users thereof. Both contain the same questions as the base questionnaire but have different guidelines and answers for amplification users. The "benefit", or SSQ-B version, is intended for novice users, while the "comparative" or SSQ-C version is intended for experienced users after switching to new hearing aids. It can be used for the comparison of two different prostheses, i.e., the current hearing aid versus the hearing aid previously used [6].

In 2015, the SSQ questionnaire was translated into and adapted to Brazilian Portuguese [7] and has been used as an instrument for the subjective assessment of hearing difficulties across a variety of domains of listening situations. However, it has not yet been used for assessing the benefit in individuals using hearing aids.

Bearing this in mind, would it be feasible to administer the SSQ questionnaire in its Benefit and Comparative versions in order to assessment the benefit in hearing aid users?

This study thus aimed to investigate the degree of reliability of the Speech, Spatial and Qualities of Hearing Scale (SSQ) in assessing the benefit in hearing aid users.

METHODS

This study was entirely conducted at Faculdade de Ciências Médicas da Santa Casa de São Paulo – FCMSCSP, in São Paulo (SP), Brazil, and at a Private Clinic, São Paulo (SP), Brazil. The study was approved by the Research Ethics Committee (document number 1.613.072.). All participants gave their written and signed consent, agreeing to their participation in the study.

Thirty adult individuals with hearing impairment participated, 22 of whom were experienced hearing aid users and eight were novice users, aged between 44 and 94 years old, of both sexes (13 females and 17 males), and predominantly with higher level of education.

The selection of study individuals was based on the following eligibility criteria: adult individuals, who have hearing loss of any type or degree of severity, are candidates for using hearing aids or are already users but who are switching their hearing aids. The exclusion criteria were individuals who had: any health problems that prevented them from participating in all the assessments and procedures proposed for the study; any noticeable cognitive changes or other neurological changes, and if they were unable to effectively use hearing aids during the proposed period of time due to a number of complications.

Patients coming to the clinic for the initial fitting procedure or were switching their hearing aids were randomly selected.

Initially, general and relevant information about the individual's previous history were obtained regarding their hearing complaint, the probable etiology, the time they experienced hearing loss, and their general health status, which might interfere in the process. When necessary, molds or capsules were made for physically fitting hearing aids or in the case of intra-aural hearing aids.

The gain prescription was made according to the prescriptive methods validated as NAL NL1 - National Acoustic Laboratories Non-Linear [8] and DSL-v5 - Desired Sensation Level [9] for experienced users; and NAL-NL2 - National Acoustic Laboratories Non-Linear [10] for all novice hearing aid users. The programming and fine-tuning of hearing aids was carried out by using software from manufacturing companies on the NOAH platform.

The performance of the hearing aids was checked with the help of equipment with probe microphone in an acoustically treated room and the patient sitting a meter away from the speaker positioned at 0° azimuth by using the algorithm-driven Amplified speech mapping tool. This tool allows to assess the electroacoustic functioning of the selected hearing aids and verify whether the generated gain and output values were in accordance with the prescribed ones. An ISTS speech signal was used [11] at different input intensities: 55, 65, 75 dB SPL.

At that time, the Speech Intelligibility Index (Speech Intelligibility Index) – SII [12] values for the intensity of 65 dB SPL, termed SII 65, were registered. The hearing aid that provided the greatest SII value was used during a period of home experience, individuals with bilateral hearing loss were fitted with two hearing aids.

Both for the novice and the experienced user, home testing was allowed for four weeks, with returns for adjustments, receiving instructions and orientation on usage. The number of hours the individuals used the hearing aids daily was recorded by means of datalogging.

The Speech, Spatial and Qualities of Hearing Scale (SSQ) questionnaire, version 5.6[5], translated into and validated for Brazilian Portuguese [7] is intended for the individual's self-assessment in a variety of domains such as: situations of directional hearing related to different distances and to movement, segregation of sounds and simultaneous voice flows, ease of listening, naturalness and clarity of everyday life sounds and different musical pieces and instruments. The SSQ – Base questionnaire was initially administered to all individuals orally presenting to them each question in the form of an interview. The participants, based on their experience without hearing aids or according to their experience with old hearing aids, were then asked to score from 0 to 10 their communicative performance. All of them were informed that, on the response scale, 10 means that they are perfectly able to perform what was described in the question and 0 (zero), that they are unable to perform in the situation described. In addition, there is an option called "not applicable" for those cases where the question did not refer to their daily situation (Figure 1). The mean time for administering the questionnaire was 30 minutes.

Four weeks after using the hearing aids, the self-assessment questionnaires were once again administered; for novice users, though, the SSQ–B (Benefit) questionnaire was administered, whereas for the experienced ones, the SSQ–C (Comparative) questionnaire was used instead. What differentiates the Base, B and C versions are the instructions given and answer forms.

The SSQ–B questionnaire that was administered to novice hearing aid users is aimed at assessing the benefit when comparing the responses from individuals without and with hearing aids. The SSQ–C questionnaire, in turn, is intended for experienced users who are switching hearing aids. It contains the same questions with the same answer possibilities as does the SSQ–B. Each question was asked orally, and the participants had to rate on a score scale from -5 to +5 their communicative performance with their new hearing aids. They were informed that, on the response scale, +5 means that they are perfectly able to perform what was described in the question and -5, that they are unable to perform in the situation described. In addition, there is an option called "not applicable" for those cases where the question referred to a daily situation, they had not yet experienced (Figure 2).

The benefit was indicated by the difference between the difficulties observed before and after the intervention and showed the degree of improvement gained with the use of the hearing aid.

Initially, a descriptive analysis was performed for qualitative variables with frequencies, absolute value (N) and relative value (%), which are: sex, education, degree of loss. Summary

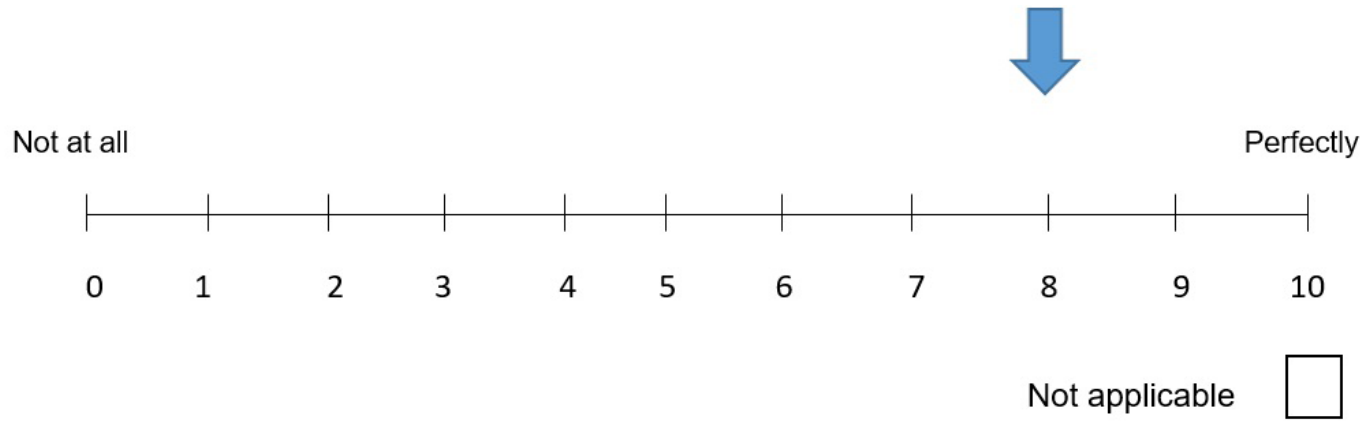

Figure 1. SSQ- BASE response scale

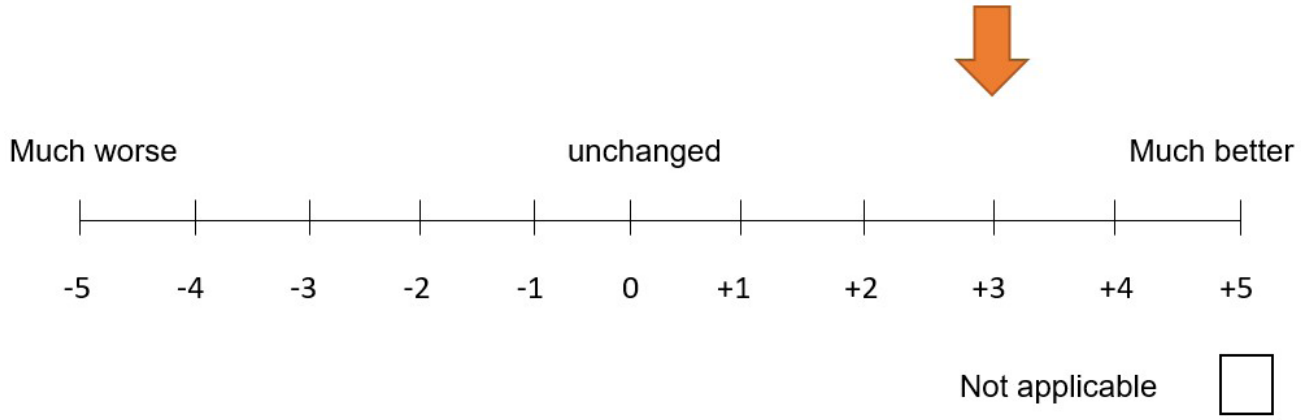

Figure 2. SSQ – B and C response scale

Table 1. Characterization of the sample of individuals who participated in the study

Characteristics	*Categories*	*n*	*%*
Age	44 - 63	10	33.3
	66 - 77	11	36.7
	78 - 94	9	30.0
Sex	Female	13	43.3
	Male	17	56.7
Level of education	Primary School (Brazilian system prior to 6 February 2006)	2	6.7
	Primary School (after 6 February, 2006)	1	3.3
	Secondary School (after 6 February, 2006)	5	16.7
	Higher Education	22	73.3
Users of bilateral hearing aids	Novices	8	26.7
	Experienced	22	73.3
Hearing loss (PTA in the best ear)	Mild	6	20.7
	Moderate	15	51.7
	Severe	6	20.7
	Deep	2	6.9
Hearing aid model	Retro	2	6.7
	Mini channel	4	13.3
	Intra channel	1	3.3
	REC	23	76.7
Daily use time (with hearing aid)	4 - 9 hours	12	40.0
	10 - 14 hours	10	33.3
	15 -18 hours	8	26.7

measures (mean, median, standard deviation, minimum and maximum) were calculated for quantitative variables: age, SSQ Base, B and C questionnaires. The reliability of the B and C questionnaires was estimated by using the internal consistency analysis, Cronbach's alpha. The Alpha coefficient (α) measures the correlation between responses in a questionnaire by analyzing the profile of the responses given by the respondents. The statistical analysis of the results was performed by using the SPSS program (13.0).

RESULTS

Thirty adult individuals with hearing impairment participated in this study, 22 of whom were experienced hearing aid users and eight were novice users, aged between 44 and 94 years old, of both sexes (13 females and 17 males), and predominantly with higher level of education. The mean time of hearing deprivation of the individuals in the sample was 9 years, the hearing thresholds in this sample were homogeneous, and there were found no statistically significant differences between the right (mean = 59.9 dB) and left ears (mean = 58 dB). After a four-week trial period, the number of hours of daily use was recorded by means of datalogging of the hearing aids, which varied from 4 to 18 hours a day (Table 1 and Figure 3).

Below are shown the participants' responses before and after using new hearing aids, in the Speech, Spatial and Qualities of Hearing Scale – SSQ Base, B and C questionnaires, represented as means, standard deviations, minimum and maximum scores for the items in Portuguese by domain and the overall values (Tables 2 and 3).

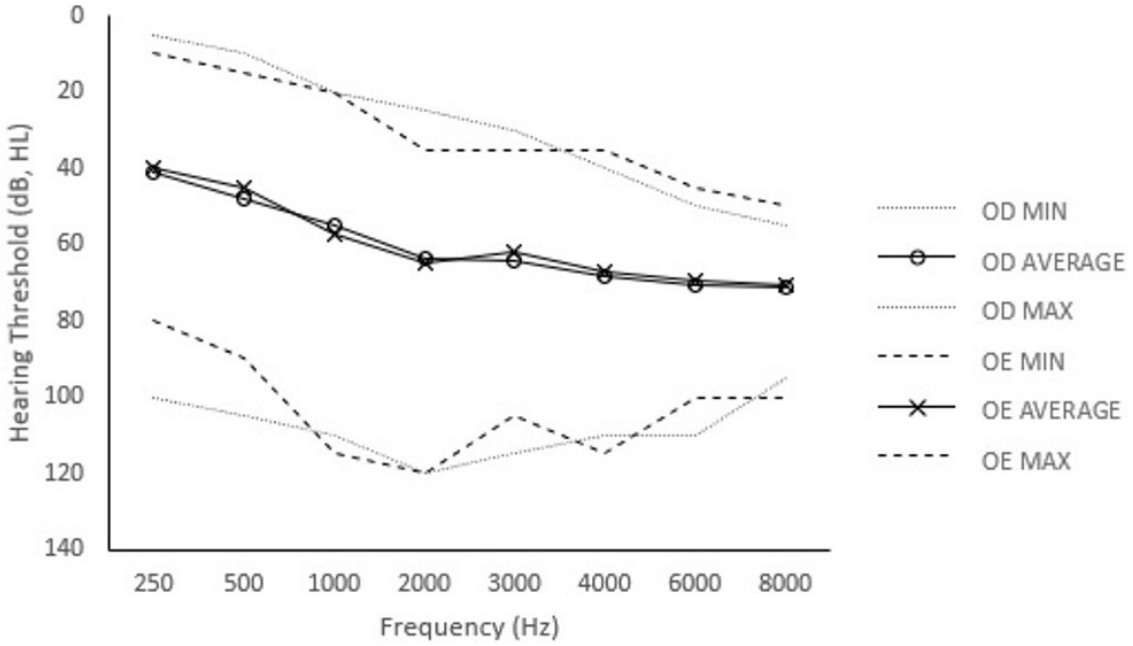

Figure 3. Distribution of the degree of Hering loss in the right and left ears (N=60)

Table 2. Mean, Median, standard deviation, minimum and maximum values for the responses to the SSQ-Base questionnaire in the domains Hearing for speech, Spatial hearing and Qualities of hearing.

SSQ – Base	Question	Mean	SD	Min	Max
HEARING FOR SPEECH	1. Talking with someone while the TV is on	5.77	1.69	3	10
	2. Talking with someone in a quiet room where there is a rug	8.63	1.45	5	10
	3. Talking with 5 people in a silent room while seeing them	5.90	2.24	2	10
	4. Talking with 5 people in a noisy room while seeing them	3.90	2.02	0	8
	5. Talking with someone in a continuously noisy room	6.37	1.54	4	10
	6. Talking with 5 people in a noisy room while not being able to see them	3.30	1.66	0	7
	7. Talking in an environment with an echo	4.60	2.37	0	10
	8. Ignoring the interfering voice having a same tone	5.30	2.16	2	10
	9. Ignoring the interfering voice having a different tone	5.53	2.06	2	10
	10. Talking with someone while watching TV	3.53	2.19	0	8
	11. Talking with someone in a room where there are other people talking	5	2.01	1	10
	12. Following changes in conversation while in a group	3.90	1.96	0	7
	13. Having a conversation on the phone	6.30	2.50	0	10
	14. Following a person talking and the phone	3.73	2.33	0	10
Total		**5.12**	**1.43**	**3.2**	**9.1**
SPATIAL HEARING	1. Locating the lawn mower	4.50	2.90	0	10
	2. Locating someone talking while sitting by a table	4.80	2.70	0	10
	3. Locating a speaker to the right or to the left	7.40	2.20	2	10
	4. Locating a closing door in an unknown house	5.40	3.30	0	10
	5. Locating the sound upstairs or downstairs	5.30	2.30	0	9
	6. Locating a dog barking	5.40	2.70	0	10
	7. Locating a vehicle's direction	5.50	2.80	0	10
	8. Guessing someone's distance from their steps or voice	4.20	2.20	0	8
	9. Guessing the distance from a vehicle	4.80	2.20	0	10
	10. Identifying the laterality of a vehicle's movement	4.80	2.90	0	10
	11. Guessing the laterality of someone's movement from their steps or voice	4.80	2.60	0	10
	12. Identifying a person's proximity or distance	5.40	2.30	0	10
	13. Identifying a vehicle's proximity or distance	5.90	2.50	0	10
	14.Non-externalized sounds (inside the head rather than outside)	6.70	2.00	2	10
	15. Closer than expected sounds	5.70	1.90	2	10
	16. Farther than expected sounds	4.90	2.30	0	10
	17. Sounds in an expected location	6.40	2.40	0	10
Total		**5.40**	**1.86**	**2.10**	**10**

Table 2. Continued...

SSQ – Base	Question	Mean	SD	Min	Max
QUALITY OF HEARING	1. Separation of two sounds	6.80	2.60	0	10
	2. Sounds seem mixed	6.80	1.90	3	10
	3. Listening to voice and music as separate sounds	5.60	2.40	0	10
	4. Identifying known people from their voices	7.50	1.90	4	10
	5. Distinguishing known music	7.20	2.40	0	10
	6. Distinguishing different sounds	7.00	2.30	2	10
	7. Identifying musical instruments in a song	5.70	2.50	0	10
	8. Naturalness of music	6.50	3	0	10
	9. Clarity of the sounds of the day	7.00	1.80	3	10
	10. Naturalness of voices	6.30	1.70	2	10
	11. Naturalness of the sounds of the day	6.50	2.10	2	10
	12. Naturalness of own voice	7.20	2	2	10
	13. Assessing the mood from the voice	7.20	2.20	0	10
	14. Needing to focus when listening	5.20	2.60	0	10
	15. Effort in conversation	4.90	2.40	0	10
	16. Being able to hear a passenger well while driving	5.40	2.60	0	10
	17. Being able to hear the driver as a passenger	6.00	2.20	2	10
	18. Ability to ignore concurrent sounds	5.80	2.70	1	10
Total		**6.37**	**1.35**	**3.90**	**9.90**

Table 3. Responses to the SSQ–B and SSQ–C questionnaires in the domains Hearing for speech, Spatial hearing, and Qualities of hearing

SSQ–B and SSQ–C	Question	Mean	SD	Min	Max
HEARING FOR SPEECH	1. Talking with someone while the TV is on	2.63	1.45	0	5
	2. Talking with someone in a quiet room where there is a rug	3.43	1.77	0	5
	3. Talking with 5 people in a silent room while seeing them	2.45	1.54	0	5
	4. Talking with 5 people in a noisy room while seeing them	1.60	1.38	0	4
	5. Talking with someone in a continuously noisy room	2.79	1.49	0	5
	6. Talking with 5 people in a noisy room while not being able to see them	1.63	1.40	0	4
	7. Talking in an environment with an echo	1.79	1.42	0	5
	8. Ignoring the interfering voice having a same tone	2.28	1.43	0	5
	9. Ignoring the interfering voice having a different tone	2.50	1.38	0	5
	10. Talking with someone while watching TV	1.40	1.49	0	5
	11. Talking with someone in a room where there are other people talking	2.40	1.42	0	5
	12. Following changes in conversation while in a group	1.97	1.35	0	4
	13. Having a conversation on the phone	2.47	1.79	0	5
	14. Following a person talking and the phone	1.37	1.52	0	4
Total		**2.20**	**2.03**	**0**	**4.4**
SPATIAL HEARING	1. Locating the lawn mower	2.25	1.66	0	5
	2. Locating someone talking while sitting by a table	2.21	1.59	0	5
	3. Locating a speaker to the right or to the left	3.00	1.89	0	5
	4. Locating a closing door in an unknown house	2.21	1.83	0	5
	5. Locating the sound upstairs or downstairs	2.20	1.80	0	5
	6. Locating a dog barking	2.21	1.65	0	5
	7. Locating a vehicle's direction	2.39	1.59	0	5
	8. Guessing someone's distance from their steps or voice	1.97	1.34	0	5
	9. Guessing the distance from a vehicle	2.07	1.58	0	5
	10. Identifying the laterality of a vehicle's movement	2.07	1.54	0	5
	11. Guessing the laterality of someone's movement from their steps or voice	2.27	1.48	0	5
	12. Identifying a person's proximity or distance	2.41	1.42	0	5
	13. Identifying a vehicle's proximity or distance	2.17	1.44	0	5
	14. Non-externalized sounds (inside the head rather than outside)	2.37	1.86	0	5
	15. Closer than expected sounds	2.33	1.46	0	5
	16. Farther than expected sounds	2.18	1.76	0	5
	17. Sounds in an expected location	2.47	1.81	0	5
Total		**2.25**	**2.03**	**0**	**5**

Table 3. Continued...

SSQ–B and SSQ–C	Question	Mean	SD	Min	Max
QUALITY OF HEARING	1. Separation of two sounds	2.50	1.67	0	5
	2. Sounds seem mixed	2.13	1.69	0	5
	3. Listening to voice and music as separate sounds	2.50	1.50	0	5
	4. Identifying known people from their voices	2.77	1.69	0	5
	5. Distinguishing known music	2.40	1.97	0	5
	6. Distinguishing different sounds	2.55	1.84	0	5
	7. Identifying musical instruments in a song	2.10	1.70	0	5
	8. Naturalness of music	2.50	2.03	0	5
	9. Naturalness of the sounds of the day	2.40	1.56	0	5
	10. Naturalness of voices	2.47	1.79	0	5
	11. Naturalness of the sounds of the day	2.27	1.96	-2	5
	12. Naturalness of own voice	1.86	2.19	-2	5
	13. Assessing the mood from the voice	2.17	1.82	0	5
	14. Needing to focus when listening	2.20	1.62	0	5
	15. Conversational effort	2.37	1.69	0	5
	16. Being able to hear a passenger well while driving	2.29	1.48	0	5
	17. Being able to hear the driver as a passenger	2.76	1.50	0	5
	18. Ability to ignore concurrent sounds	1.93	1.66	0	5
Total		**2.35**	**2.50**	**0**	**4.8**

Table 4. Mean, Median, standard deviation, minimum and maximum values for the responses to the SSQ-Base, SSQ–B and SSQ–C questionnaires, by domains and overall

		Mean	Median	SD	Minimum	Maximum
SSQ-Base	Speech - base	5.12	5.1	1.43	3.2	9.1
	Space - basis	5.36	5.79	1.86	2.1	10
	Qualities - base	6.37	6.38	1.35	3.9	9.9
	Overall - base	**5.7**	**5.68**	**1.28**	**3.7**	**9.7**
SSQ–B and SSQ–C	Speech –B and –C	2.2	2.03	1.04	0.2	4.4
	Spatial –B and –C	2.25	2.4	1.33	0.1	4.8
	Qualities –B and –C	2.35	2.5	1.41	0	4.8
	Overall –B and –C	**2.27**	**2.34**	**1.2**	**0.1**	**4.5**

Table 5. Internal consistency measurements of responses, by domains and overall, to the SSQ-Base questionnaire, versions B and C

		N. of questions	Cronbach's Alpha
SSQ-BASIS	Speech - base	14	0.97
	Space - base	17	0.94
	Qualities - base	18	0.88
	Overall - base	**49**	**0.94**
SSQ–B and SSQ–C	Speech –B and –C	14	0.95
	Spatial –B and –C	17	0.97
	Qualities –B and –C	18	0.98
	Overall –B and –C	**49**	**0.99**

The mean domain indexes showed that the lowest score was seen in the Hearing for speech domain, whereas the highest scores were observed in the Spatial hearing, and Qualities of hearing domains. The mean domain indexes ranged from 2.20 to 2.35. The standard deviation ranged from 1.04 to 1.41 (Table 4 and Figure 4).

In the Hearing for speech domain, the lowest score was seen for question 14 and the highest score, for question 2. The average indexes ranged from 1.37 to 3.43, and the standard deviation ranged from 1.35 to 1.79.

In the Spatial hearing domain, the lowest scores were observed for questions 8, 9, 10, whereas the highest score was seen for question 3. The average indexes ranged from 2.07 to 3.0, and the standard deviation ranged from 1.34 to 1.89.

In the Hearing for speech domain, the lowest score was seen for question 15 and the highest score, for question 4. The

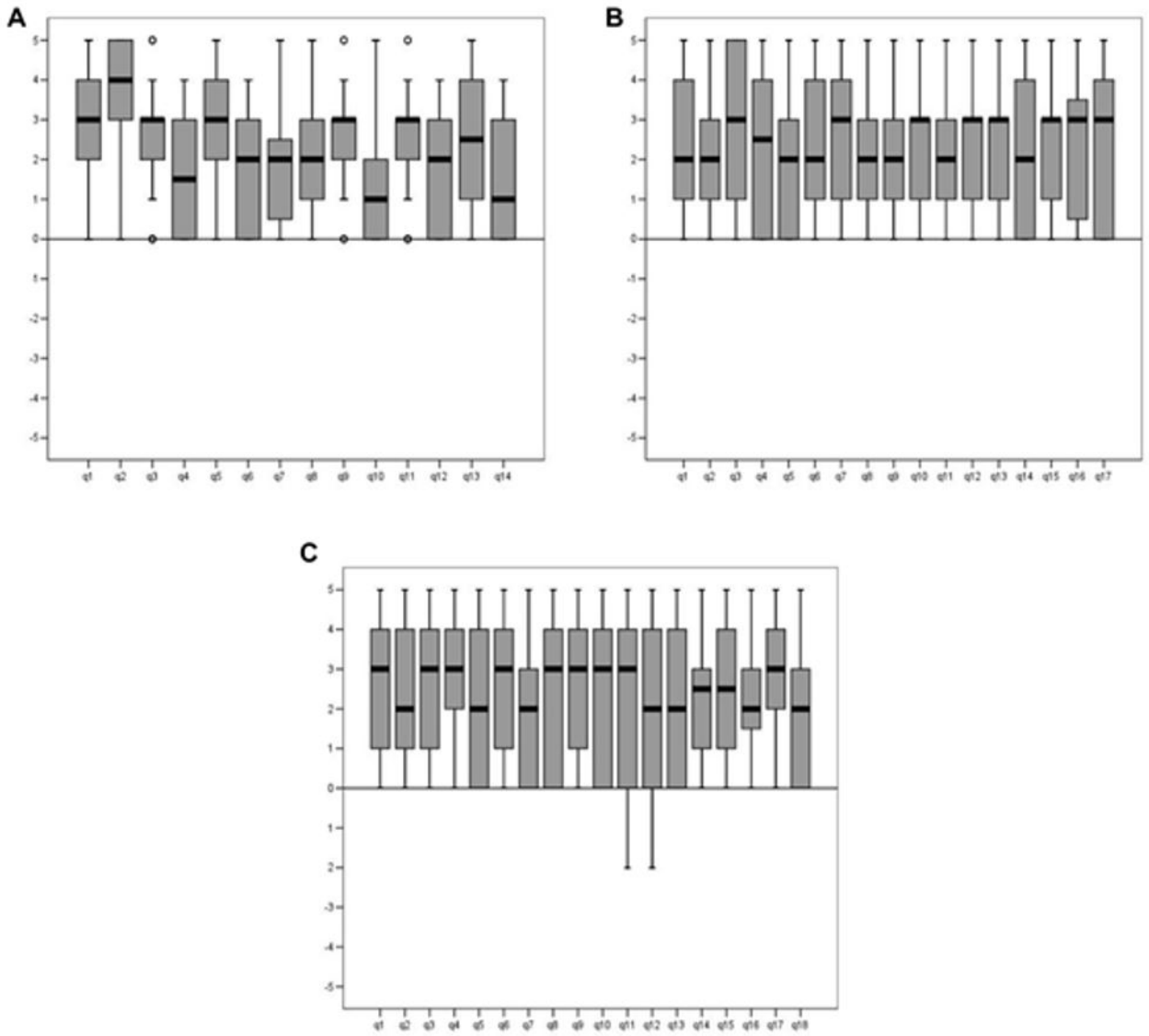

Figure 4. BoxPlot of the responses to the SSQ B and C questionnaire in the Hearing to speech (A), Spatial hearing (B) and Hearing qualities (C) domains

average indexes ranged from 2.37 to 2.77, and the standard deviation ranged from 1.48 to 2.19.

The 49 items of the SSQ – Base in Portuguese produced a Cronbach's Alpha = 0.94, and the SSQ – B and SSQ – C produced a Cronbach's Alpha = 0.99, indicating high internal consistency. The domains also showed good reliability (Table 5).

DISCUSSION

The benefit was considered to be the difference in individual performance, regardless of previous experience, given that previous experience is not a source of variability [3]. The difference in self-perception before and after fitting new hearing aids is an indicator of benefit, which can be assessed by means of objective and subjective procedures. In this study, the benefit was subjectively assessed by using the versions B and C of the Speech, Spatial and Qualities of Hearing Scale – SSQ questionnaire, translated into Brazilian Portuguese [7].

The Speech, Spatial and Qualities of Hearing Scale (SSQ) – version 5.6 is a self-assessment questionnaire in which the individuals quantify the difficulties they experience in different daily communication situations. It is comprised of 49 questions, divided into three domains: Hearing for speech, Spatial hearing, and Qualities of hearing. The first domain, Hearing for Speech, assesses speech comprehension in different daily life situations; the second domain, Spatial hearing, investigates components of spatial hearing, such as laterality and location; and the third domain, Qualities of hearing, assesses the ability to segregate sounds, simultaneous voice flows, ease of listening, naturalness and clarity of everyday life sounds and different musical pieces and instruments.

The SSQ has already been translated into several languages and used in clinical practice in several countries [13]. However, in Brazil, the Brazilian Portuguese version for assessing the benefit had not yet been used. The SSQ was translated into Brazilian Portuguese, back translated and evaluated by a committee

of experts and then culturally adapted [7]. After its linguistic validation, it was used in a pilot study with normal hearing individuals, in which the Brazilian Portuguese versions of the SSQ – B and SSQ – C questionnaires were described and had their psychometric properties tested in individuals with hearing impairment and hearing aid users for later clinical use.

The Speech, Spatial and Qualities of Hearing Scale-SSQ – Base – B and – C questionnaires were administered to all participants by using the interview method [14]. In the SSQ – Base questionnaire, individuals scored their communicative performance, and the results were interpreted as follows: the higher the score [15] in each domain and/or question, the lower the difficulty experienced in the individual's daily communication situations in question, and the lower the score (0), the greater the difficulty. In the SSQ – B and – C questionnaires, in turn, the performance variation was seen to be negative, it was worse (-5), with neutral (0), there had been no change, and positive (+5), better performance.

In an initial study [5], the index found for elderly people with moderate hearing loss was 5.5, whereas in another study involving translation into Portuguese [7] and normal hearing adults, the mean indexes by domain ranged from 5.8 to 9.4, and the standard deviation ranged from 0.57 to 3.32. In the study in question, a mean overall index of 5.70 (1.28 DP) was obtained for the SSQ– Base, showing sensitivity to variation and discriminative power among individuals. However, the absolute differences between the studies were seen for many items, especially in the domains Spatial Hearing and Qualities of hearing. This observation may be due to the different degrees of hearing loss in the sample individuals. The average SSQ– Base indexes were lower in the Hearing for speech domain than in the other domains, as already observed in previous studies [5,14-17].

When analyzing the responses to the questions in the SSQ– Base questionnaire by each domain in the Hearing for speech, the score ranged from 3.30 to 8.63 (out of a maximum score of 10). The most difficult situation was talking in a group with competitive noise and without seeing the speakers, and the easiest one was talking to someone in a quiet room where there was a rug. In comparing to another study [16], overall scores ranged from 2.5 to 7.1, and the questions with the least and greatest difficulties were the same as those found in this study.

In Spatial hearing, the score ranged from 4.20 to 7.40. The question involving the individual's guessing the distance from someone from hearing theirs steps or voice was the one with the lowest score and, hence, the greatest limitation, while the situation in which the individual needed to assess the speaker's location, whether to their right or left side, was the one with the highest score. In comparing those with the initial study [16], the findings are quite similar to the scores from 4.2 to 7.5 in this study.

The answers to the SSQ– Base in the domain Qualities of hearing exhibited a range in score from 4.90 to 7.50. There was greater difficulty reported when the individual really needs to make a hard effort to participate in a conversation and hence with greater difficulty follow what is being said. The easiest activity was recognizing well-known people's voices. In the initial study [16], a score of 3.7 to 8.3 was found, which corroborates our findings.

Based on a study conducted in 2001[18], a 30-day period was established for using the new hearing aids, since the four-week post-fitting interval is likely the clinically most common measurement point. During that period, individuals who needed adjustments to the hearing aids' programming were asked to return for a new visit.

After those 30 days, the SSQ - B (Benefit) questionnaire was administered to novice users, and the SSQ - C (Comparative) questionnaire was administered to the experienced ones. The individuals then scored either their improvement (from +1 to +5), worsening (- 5 to -1), or no change (0) with regard to their communicative performance in the various situations covered by the questions contained in the questionnaires.

The mean indexes, by domain and overall, obtained from administering the SSQ–B questionnaire to novice individuals, who did not use hearing aids, and the SSQ–C to experienced individuals, who had previously used amplification, were: 2.20 for Hearing for speech, 2.25 for Spatial hearing, and 2.35 for Qualities of hearing. The mean overall index for SSQ–B and –C was 2.27. The minimum score was 0, while the maximum score was 4.80 (out of -5, 0 to +5).

Figure 2 depicts the responses to the SSQ questionnaires, versions B and C, by domain and overall, and shows the evolution of hearing skills after the individuals started using new hearing aids.

A descriptive analysis of the responses to the SSQ–B and –C questionnaires by domain was performed. In Hearing for speech, the average scores ranged from 1.37, the lowest score (talking on the phone and with someone), to 3.43, the highest score (talking to someone in a quiet room where there is a rug). The minimum value was 0 (no change) and the maximum one, 5 (improvement in performance).

The responses to the SSQ–B and–C questionnaires in Spatial Hearing revealed a lowest average score of 1.97 (guessing someone's distance from their steps and voice, the distance from a vehicle, and identifying the laterality of the vehicle's movement) and a highest average score of 3.0 (locating the speaker, whether to their right or left side). The minimum value was 0 (no change) and the maximum was 5 (improvement in performance).

The analysis of the responses to Qualities of hearing in the SSQ–B and SSQ–C questionnaires showed mean indexes from 1.86 to 2.77. Positive SSQ–B means were observed for many items as well as negative indexes in the SSQ–C. There was a case of an experienced hearing aid user who scored -2 in the question on the naturalness of their own voice. This may be attributed to the fact that this user is already adapted and therefore accustomed to the amplification provided by their previous hearing aids. This user was switching hearing aids and had their voice as a normality parameter from using previous hearing aids. Without their hearing aids, this individual is unable to hear their own voice.

The data make sense with respect to problematic situations (as measured by the SSQ– Base questions), and the benefit of hearing aids in these situations (as measured by SSQ–B and SSQ–C) is usually classified according to expectations. The High rate in SSQ–B and SSQ–C questions for which the SSQ– Base scores were already high indicates that the SSQ–B and SSQ–C can demonstrate a benefit even when there is a greater effect on the SSQ– Base.

The responses to the SSQ–B and SSQ–C questionnaires showed a lower performance in Hearing for speech than in the

other domains (Spatial hearing and Qualities of hearing). There was a positive response in all domains, thus showing an evolution with regard to using new hearing aids. Low performance in speech would be influenced by the degree of hearing loss rather than the chronological age [16]. The individual variation in scores is quite large across many items (not shown in the data display).

The participants reported that the questionnaire was adequate and reflected the difficulties they experienced in their daily life. Some had never paid attention to certain situations, even those experienced by them. Most of them found the questionnaire easy to answer, but very lengthy, tiring and repetitive in some questions, which made them difficult to interpret. They asked for more details on the questions so that their responses could be more faithful. They suggested using a reduced version of the questionnaire. In the literature, there are other reduced and validated versions of the SSQ, intended for use in clinical practice, but that was not included in the scope of this study [18].

The reliability assessment revealed high internal consistency and good reliability for the SSQ– Base, SSQ–B and SSQ–C questionnaires. Cronbach's alpha coefficient was 0.94 for the SSQ– Base and 0.99 for the SSQ–B and SSQ–C questionnaires. The same result was also obtained for the 49 SSQ items in a study [7] conducted in 2015, in which a Cronbach's Alpha of 0.94 was found for the SSQ questionnaire. In a more recent study, a Cronbach's Alpha of 0.93 was observed, indicating high internal consistency and good reliability in each of the domains [19].

The individuals in the sample reported that the questionnaire describes their needs, hence gathering the requirements to be a valuable tool in the auditory rehabilitation process, despite some limitations with regard to the questions, such as: it is too extensive for the elderly population, and some questions are very long, which leads to greater difficulty in understanding and interpretating them.

It is hereby proposed that this study be continued. To this end, the culturally adapted version of the SSQ to Brazilian Portuguese should be used along with samples having a larger number of participants and verify clinical use with shortened versions [20].

CONCLUSION

In view of the results obtained, we can conclude that:

- The SSQ proved to be an easy-to-use instrument that allows for the assessment of the benefit in individuals who are undergoing auditory rehabilitation.
- It is an instrument with high reliability that can be administered to individuals using different types of hearing aids.

REFERENCES

1. WHO: World Health Organization. Deafness and hearing loss [Internet]. Geneva: WHO [citado em 2017 Fev 17]. Disponível em: http://www.who.int/mediacentre/factsheets/fs300/en/
2. WHO: World Health Organization. International Classification of Functioning, Disability and Health: ICF. Geneva: WHO; 2001.
3. Amorim RMC, Almeida K. Estudo do benefício e da aclimatização em novos usuários de próteses auditivas. Pró-fono Rev. Atual Cient. 2007;19(1):39-48. http://dx.doi.org/10.1590/S0104-56872007000100005.
4. Noble W, Ter-Horst K, Byrne D. Disabilities and handicaps associated with impaired auditory localization. J Am Acad Audiol. 1995;6(2):129-40. PMid:7772782.
5. Gatehouse S, Noble W. The *Speech, Spatial and Qualities of Hearing Scale* (SSQ). Int J Audiol. 2004;43(2):85-99. http://dx.doi.org/10.1080/14992020400050014. PMid:15035561.
6. Jensen N, Akeroyd M, Noble W, Naylor G. English SSQ/SSQ-B/SSQ-C v5.6 (merged pdf) [Internet]. 2016 [citado em 2017 Jan 11]. Disponível em: https://www.researchgate.net/publication/311627649
7. Gonsalez ECM, Almeida K. Adaptação cultural do questionário *Speech, Spatial and Qualities of Hearing Scale* (SSQ) para o Português Brasileiro. Audiol Commun Res. 2015;20(3):215-24. http://dx.doi.org/10.1590/S2317-64312015000300001572.
8. Dillon H. NAL-NL1: A new prescriptive fitting procedure for nonlinear hearing aids. Hear J. 1999;52(4):10-6. http://dx.doi.org/10.1097/00025572-199904000-00002.
9. Seewald R, Moodie S, Scollie S, Bagatto M. The DSL method for pediatric hearing instrument fitting: historical perspective and current issues. Trends Amplif. 2005;9(4):145-57. http://dx.doi.org/10.1177/108471380500900402. PMid:16424944.
10. Keidser G, Dillon HR, Flax M, Ching T, Brewer S. The NAL-NL2 prescription procedure. Audiology Res. 2011;1(1): e24. http://dx.doi.org/10.4081/audiores.2011.e24. PMid:26557309.
11. Holube I, Fredelake S, Vlaming M, Kollmeier B. Development and analysis of an International Speech Test Signal (ISTS). Int J Audiol. 2010;49(12):891-903. http://dx.doi.org/10.3109/14992027.2010.506889. PMid:21070124.
12. ANSI: American National Standards Institute. Methods for calculation of speech intelligibility index. Washington: ANSI; 1997.
13. Singh G, Kathleen Pichora-Fuller M. Older adults' performance on the speech, spatial, and qualities of hearing scale (ssq): test-retest reliability and a comparison of interview and self-administration methods. Int J Audiol. 2010;49(10):733-40. http://dx.doi.org/10.3109/14992027.2010.491097. PMid:20874047.
14. Noble W, Gatehouse S. Interaural asymmetry of hearing loss, *Speech, Spatial and Qualities of Hearing Scale* (SSQ) disabilities, and handicap. Int J Audiol. 2004;43(2):100-14. http://dx.doi.org/10.1080/14992020400050015. PMid:15035562.
15. Banh J, Singh G, Pichora-fuller MK. Age affects responses on the Speech, Spatial, and Qualities of Hearing Scale (SSQ) by adults with minimal audiometric loss. J Am Acad Audiol. 2012;23(2):81-91, quiz 139-40. http://dx.doi.org/10.3766/jaaa.23.2.2. PMid:22353676.
16. Noble W, Gatehouse S. Effects of bilateral versus unilateral hearing aid fitting on abilities measured *by Speech, Spatial and Qualities of Hearing Scale* (SSQ). Int J Audiol. 2006;45(3):172-81. http://dx.doi.org/10.1080/14992020500376933. PMid:16579492.
17. Akeroyd MA, Guy FH, Harrison DL, Suller SL. A factor analysis of the Speech, Spatial and Qualities of Hearing Questionnaire (SSQ). Int J Audiol. 2011;51:262.
18. Moulin A, Richard C. Sources of variability of Speech, Spatial, and Qualities of Hearing Scale (SSQ) scores in normal-hearing and hearing-impaired populations. Int J Audiol. 2016;55(2):101-9. http://dx.doi.org/10.3109/14992027.2015.1104734. PMid:26624277.
19. Aguiar R, Almeida K, Gonsalez E. Test-Retest Reliability of the Speech, Spatial and Qualities of Hearing Scale (SSQ) in Brazilian Portuguese. Int. Arch. Otorhinolaryngol. 23(4):380-3. https://doi.org/10.1055/s-0039-1677754.
20. Moulin A, Vergne J, Gallego S, Micheyl C. A new speech, spatial, and qualities of hearing scale short-form: factor, cluster, and comparative analyses. Ear Hear. 2019;40(4):938-50. http://dx.doi.org/10.1097/AUD.0000000000000675. PMid:30461444.

Author contributions

PTMP research design, study concept and delimitation, data analysis and interpretation, article's penning, submission, and procedures related thereto; KA research design, data analysis and interpretation, study concept and delimitation, article's submission and procedures related thereto, article's proofreading and editing, and approval of its final version.