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Which Short Version of the Speech, Spatial, and Qualities of Hearing Scale to Choose: SSQ5 or SSQ12?

Hua Ou[1]* and Elaine Kim[2]

[1]Department of Communication Sciences and Disorders, Wayne State University, United States
[2]Charlotte Eye Ear Nose Throat Associates, United States

***Corresponding author:** Hua Ou, Department of Communication Sciences and Disorders, Wayne State University 207 Rackham Building, 60 Farnsworth Street, Detroit, Michigan 48202, United States, Tel: (313) 577-3339; **E-mail:** huou@wayne.edu

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Abstract

The Speech, Spatial, and Qualities of Hearing Scale (SSQ) were developed to measure a range of hearing disabilities. The five-item version of SSQ (SSQ5) was developed primarily from a cluster analysis, whereas a reduced twelve-item version (SSQ12) was handcrafted based on experts' opinions from the original full version of the SSQ. Both versions may be used to screen hearing disabilities. The purpose of the study was to evaluate the degree of agreement of the SSQ5 and SSQ12 and their psychometrical properties when collected as separate entities. There were a total of 47 participants with hearing loss collected for the SSQ5 and SSQ12. The results indicated that the individual total scores of the SSQ12 were consistently lower than those of the SSQ5. The intraclass correlation coefficient (ICC=0.79) was excellent, which suggested a high level of agreement between the SSQ5 and SSQ12. Factor analyses revealed similar psychometrical strengths between the SSQ5 and SSQ12. However, because the SSQ12 included an additional factor of separation and identification of sounds, we recommended using the SSQ12 over the SSQ5 for the clinical screening of hearing disability.

Keywords: Speech; Spatial and qualities of hearing scale; Short version; SSQ5; SSQ12; Screening

Introduction

Hearing loss encompasses more than the presence of hearing impairment. There are two additional factors to consider when assessing a patient's hearing impairment, otherwise known as hearing handicap and disability. These two factors are the extent of the difficulties experienced due to the impairment on a daily basis. According to the International Classification of Impairments, Disabilities, and Handicaps [1], "hearing impairment" is a measurable dysfunction of the auditory system whereas "hearing disability" and "hearing handicap" are the subjective auditory and non-auditory difficulties experienced on a daily basis relative to the individual's functional hearing. In recent updates in the second edition of the ICIDH [2], reported that the term "handicap" has become obsolete and interchangeable with "disability". In most clinics, the measurement of hearing impairment is part of a comprehensive audiological evaluation, such as speech testing and pure tone audiometry; however, hearing disability and handicap are not. Hearing disability and handicap assessments are important to complete because hearing deficits encompasses difficulties with understanding speech in noise and poor auditory streaming, discriminating speech source and competing noise, all of which include daily auditory and non-auditory difficulties [3,4]. Although the term "handicap" is replaced more commonly with the term "disability", the implications of handicap should remain present and addressed during the clinical assessment. To appropriately develop listening goals and auditory treatment plans, gathering information regarding spatial hearing to hearing disability and handicap in addition to measuring impairment, can help tailor and add case-specific details to treatment approaches.

The Speech, Spatial, and Qualities of Hearing Questionnaire [4] is a 50-item self-reported assessment developed to measure a range of hearing disabilities across domains including: hearing speech in multiple competing contexts, spatial hearing regarding direction, distance, and movement of sounds, and lastly, the quality of hearing in attention for listening effort, speech intelligibility, identify different musical contexts, and everyday sounds. These items can be categorized into three subscales: speech, spatial, and qualities of hearing, with 14 total items in speech, 17 items in spatial, and 19 items in the qualities subscales. Although the original version consisted of fifty items, one item was reportedly omitted (Qualities #15) due to high missing rates and irrelevancy from patient to patient [4]. To elaborate, Qualities Item #15 addressed amplification use, which did not pertain to all individuals completing the scale, if there is no history of use of amplification. Overall scores can be averaged for each subscale on a range of 0-10 as well as the average scores of the three subscales combined.

The SSQ has been used in empirical studies to understand the effects of various interventions including but not limited to: bilateral hearing aids [3,5-7], cochlear implants [8-11], bimodal implantations [12], and bone anchored hearing aids [13,14]. The full-version of the SSQ was used for investigation in both the pediatric, which used the modified version of the SSQ to cater to teachers and parents of children with hearing loss completing the questionnaire, and the adult population across all ages with normal hearing sensitivity [15,16]. Two other editions were developed, one to compare benefit of intervention of before and after amplification and a second version to compare two sets of intervention (e.g. two different hearing aids), each developed from the full version of the SSQ [17]. The SSQ-B and SSQ-C editions inquire the same questions as the original full version of the SSQ but use a different rating scale, with -5 being "much worse", 0 is "unchanged", and +5 is "much better".

It should be noted that Gatehouse and Noble [4] did not conduct a factor analysis to explore the factor structure of the scale due to the small sample size in the original SSQ development paper. Akeroyd and his colleagues [18] completed a factor analysis of forty-eight items from the full version SSQ data collected from 1,200 adult listeners with hearing loss across the span of ten years. Two items were omitted from the analysis, one of which was omitted from the original Gatehouse and Noble [4] version as well, due to a high magnitude of missing-response rates, or unanswered items, for items #15 and #16 in the Qualities subscale. It was reported a total number of 14 items in speech, 17 items for the spatial and 17 items for the qualities subscales were administered via interview-style. The study identified three distinguished factors: "speech understanding", "spatial perception", and "clarity, separation, and identification", otherwise known as speech, spatial, and qualities of hearing. The results indicated that the total variance of 52.4% for the self-reported auditory disability can be explained by the three factors for participants without hearing aids, 48.7% for those with one hearing aid, and 51.9% for those with two. Moreover, other studies indicated that the test-retest reliability of the full-version of the SSQ, was from moderate to strong (0.65-0.83) and the Cronbach's alpha was, in general, excellent (0.88-0.97). It appeared that the administration method (interview vs. self-administered) may impact the psychometrical strength of the questionnaire [18-20].

Shortened versions of the SSQ have been developed and studied for various purposes. For example, a five-item version of the SSQ (SSQ5) was developed for the purposes of screening hearing disability [20]. Demeester and her colleagues [20] investigated the screening reliability of the SSQ5 and the benefit of incorporating self-reported hearing disability, or the perception of one's ability or disability to perform daily hearing tasks, into practice. A cluster analysis and logistic regression analyses were used to develop the screening questionnaire of the SSQ5 to demonstrate the benefit of collecting hearing disability data, in contrast to asking patients a general question of "do you have a hearing loss". The items for the SSQ5 addresses hearing ability of specific scenarios that are described in the Appendix I. The SSQ5 appeared to be a feasible tool to screen hearing impairment. In addition, Mertens, Punte, and Van de Heyning [21] extracted the appropriate items from the full-version SSQ to investigate the SSQ5 for a group of individuals with cochlear implants (CI). Results showed that using the SSQ5 could provide sufficient information to develop a disability profile in the CI population. A Cronbach's alpha of 0.73 revealed a good internal consistency for the SSQ5 when applied to CI users. Intraclass correlation coefficients (ICC) of 0.78 indicated a high agreement between the SSQ5 and the full-version SSQ. However, it should be noted that no factor structure was reported for the SSQ5 in their study [21].

Another short version of this questionnaire, known to be SSQ12, was developed to assess hearing disability in clinical research and rehabilitative settings [22]. The twelve items are described in the Appendix II. The SSQ12 was developed based on 49 items of the full version of the SSQ. The initial item selection constituted of three independent sites selecting their 12 items of choice. The subsequent item selection entailed selecting items based on two terms, 1) items that were similar across two sites, which included ten items, and 2) items nominated by two of the three sites were retained, which were the final two items to complete the SSQ12. The three overlapping items between the SSQ5 and SSQ12 are Spatial #9 ("judging distance of sound"), Qualities #9 ("clarity of everyday sounds"), and Qualities #14 ("the need to concentrate while listening"). Noble and his colleagues [22] recommended combining the SSQ12 with the 12-item Hearing Handicap Questionnaire [4] to obtain information regarding hearing disability and handicap. By doing so, it was expected that hearing health clinicians and researchers can have a full picture of pre-intervention disability and handicap, providing care in best practice [22]. There were no psychometrical strengths reported for the SSQ12.

In terms of accessibility, so far, the full version of the SSQ is available in a wide range of languages including, French, Polish, Afrikaans, Spanish, Turkish, Italian, and Japanese. The SSQ12 has been validated into the following languages: Arabic, Danish, Dutch, German, and Swedish. However, there are currently no validated versions available for the SSQ5 in other languages. It is good to mention there is a six-item version of the SSQ (SSQ6) available. It was developed for research purposes [22]. Currently, SSQ12 and SSQ5 are the two primary short forms for clinical screening purposes.

It is critical for clinicians to understand why and how self-report measures were developed and how those measures should be used in clinic [23]. When there are multiple versions of the same questionnaire available, it is logical to ask which version should be chosen. Can we use either form to get the overall similar assessment? Can we assume that a five-item SSQ5 and a twelve-item SSQ12 measure the same aspect of hearing, as the original 50-item version of the SSQ?

The purposes of the study were twofold: 1) to evaluate the agreement between two stands-alone published shortened versions of inventory, SSQ5 and SSQ12; and 2) to compare the psychometrical properties between the SSQ5 and SSQ12 when collected as separate entities.

Methods

Participants

A total number of 54 participants were recruited at local clinics and word-of-mouth referrals. Forty-seven were eligible for inclusion because they 1) were older than 18 years, and 2) four-frequency pure tone air conduction thresholds average (4 PTA) for 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz were worse than 25 dB HL in either ear. Conductive hearing loss was excluded from the study. Age ranged from 18 to 89 with the median age at 64 years. All participants were native English speakers. Compensation was offered for the participation of the study. Of the 47 participants with hearing loss (24 females; 23 males), 33 were bilateral symmetrical SNHL, 13 were asymmetrical SNHL, and one was asymmetrical mixed hearing loss. Thirty-two out of 47 were bilateral hearing aid users and two were unilateral hearing aid users. The degree of hearing loss varied from mild to severe-profound. Average air-conduction thresholds with standard deviations for 47 participants are displayed in Figure 1. The average educational level was 16.6 years (SD=2.98). The local institutional review board approved the project.

Procedure

Pure-tone air (octave frequencies of 250-8000 Hz) and bone conduction (octave frequencies of 500-4000 Hz) audiometric testing was performed bilaterally for all participants in a sound-treated booth. Following the hearing testing, the participants were administered the questionnaires using paper and pencil. The order to administrate the SSQ5 and SSQ12 was counterbalanced. For those 34 hearing aid users, they were asked to address the questions unaided. All the questions were answered independently; no items were left blank for either short version of the SSQ; all the questionnaires collected in the study were considered valid. In addition, the participants were asked to fill out the Hearing Handicap Inventory for the Elderly screening version [24] and no items were left blank.

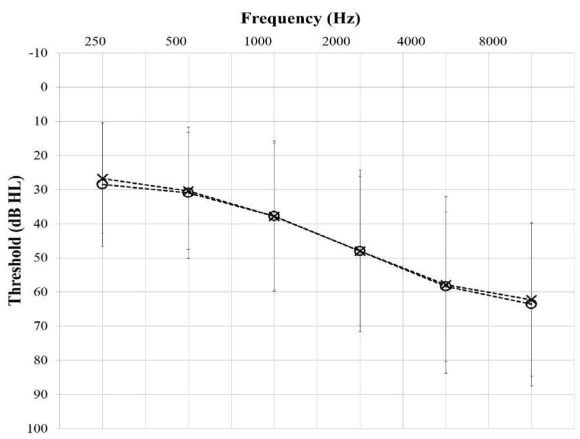

Figure 1: Mean thresholds for the left (X) and right (O) ears. The error bar shows one standard deviation.

Data Analysis

Comparisons between SSQ5 and SSQ12: The descriptive results of the item and total scores of the SSQ5 and SSQ12 were reported, respectively. A paired t-test was then used to assess the total score differences between the SSQ5 and SSQ12 when collected as separate entities for the same group of participants. Finally, the intraclass correlation coefficient (ICC) was investigated to assess the repeatability between the SSQ5 and SSQ12.

Factor analysis for SSQ5 and SSQ12: Before the factor analysis was conducted, both the Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were performed to determine if the factor analysis was appropriate. The item inventory responses comprised the source data for the factor analysis. The exploratory factor analysis (EFA) was administered based on the principle component analysis. The EFA is a method to identify the latent structure of a set of variables. The primary model was established from the EFA results. Arbitrary, but conventional thresholds of 0.40 for the factor loadings and 1.0 for eigenvalues were applied when interpreting and labeling the factors. The eigenvalue for a given factor measures the variance in all the variables that is accounted for by that factor. A Promax rotation was then used after the initial factoring method of principle component analysis. This oblique rotation method assumes that factors are not independent with each other because we believe the latent structures were correlated. The Cronbach's coefficient α and the item-total correlation coefficients were used to assess the internal reliability for each short version of the SSQ. Finally, the sensitivity of the questionnaires was assessed comparing differences between mild versus moderate-to-severe hearing loss as well as between mild-moderate versus significant hearing handicap for all 47 participants. For all tests, statistical significance was defined as a $p<0.05$. Data were analyzed using Statistical Analysis System (SAS) v. 9.4.

Results

Comparisons between the SSQ5 and SSQ12

The average SSQ5 and SSQ12 total scores were 5.47 (SD=1.86) and 4.61 (SD=1.75), respectively, when collected from separate entities. The paired t-test revealed a significant difference of 0.85 (SD=0.85) between the SSQ5 and SSQ12 average total scores (t_{46}=6.89, p<.0001). The 95% confidence interval for the difference between the SSQ5 and SSQ12 was (0.60, 1.10). However, no significant differences were found between the three overlapped individual items of the SSQ5 and SSQ12 (Spatial #9, Qualities #9, and Qualities #14). The individual item scores and the total scores for both SSQ5 and SSQ12 are displayed in a box plot (Figure 2). The most difficult item for the SSQ5 was Qualities #14 (Mean=4.24; SD=2.96). However, the most difficult item for the SSQ12 was Speech #4 "having conversation with five people in noise with vision" (Mean=2.56; SD=2.17).

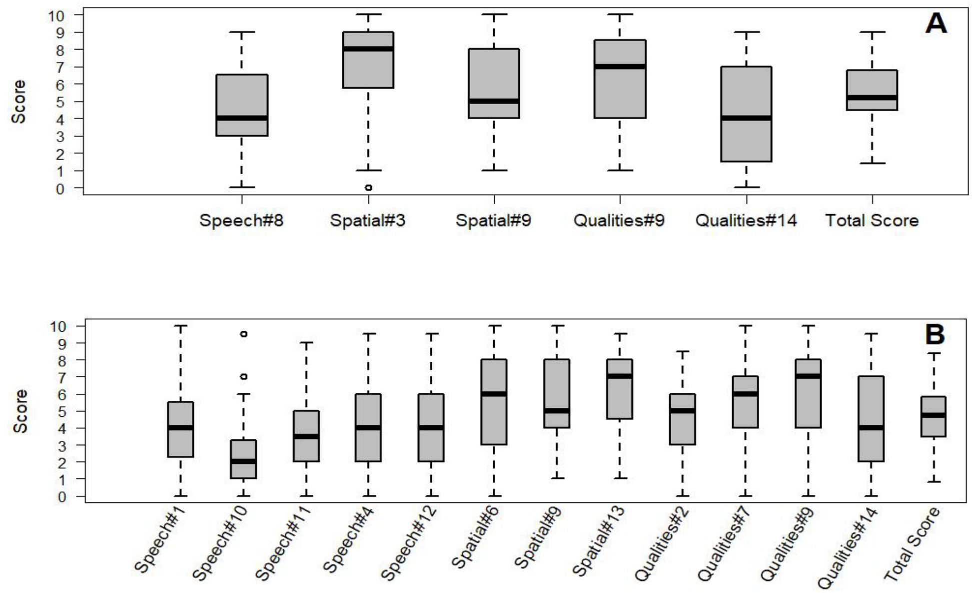

Figure 2: Box plots of the score for each item in SSQ5 (Panel A) as well as the score for each item in SSQ12 (Panel B) from forty-seven participants. The box represents the middle 50% of the data. The lower and upper outer lines that encase the box represent the 25th and 75th percentiles. Solid horizontal lines indicate the median. The whiskers represent the maximum and minimum values of non-outliers for each item. The circles represent outliers.

Intraclass correlation coefficient (ICC)

The intraclass correlation coefficient (ICC) was used to investigate the repeatability between the SSQ5 and SSQ12 when collected from separate entities. The range of the ICC is between [-1, +1]. The ICC of total scores was 0.79, which suggested a high level of agreement between the SSQ5 and SSQ12.

Factorial validity

The five-item and the twelve-item inventory responses comprised the source data for the factor analysis. We conducted factor analysis separately for the SSQ5 and SSQ12 datasets but reported their results side by side for the comparison purpose. The results of the Bartlett's Test of Sphericity indicated that neither the sample intercorrelation matrix came from a population with an identity matrix (SSQ5: χ^2=68.9, df=10, p<.0001; SSQ12: χ^2=372.7, df=66, p<.0001). The overall KMO score was 0.65 for the SSQ5 and 0.81 for the SSQ12. Given these results, it was appropriate to conduct the factor analysis for the current data. A scree plot (i.e., a simple line segment plot to show the eigenvalues and the associated number of factors) and the eigenvalues were used to determine the number of factors for the study.

Two factors (eigenvalue>1.0) were extracted for the SSQ5, accounting for 73.3% of the variance in the SSQ5 data from the factor analysis. Factor 1 (eigenvalue=2.5; 50.6% of variance) is referred to as speech understanding, including items Speech #8 ("Ignore interfering voice of same pitch"), Qualities #9 ("Clarity of everyday sounds"), and Qulities #14 ("Need to concentrate when listening"). This factor accounted for the highest variance. Factor 2 (eigenvalue=1.1; 22.7% of variance), referred to as spatial perception, encompassed Spatial #3 ("Lateralize a talker to left or to right"), and Spatial #9 ("Judge Distance of vehicle").

Three factors were extracted for the SSQ12, accounting for 74.6% of the variance in the SSQ12 data. Factor 1 (eigenvalue=6.2; 51.5% of variance) is referred to as speech understanding, including items Speech #1 ("Talking with one person with TV on"), Speech #4 ("Having conversation with five people in noise with vision"), Speech #10 ("Talk with one person and follow TV"), Speech #11 ("Follow one conversation when many people talking "), Speech #12("Follow conversations without missing start of new talker"), Qualities #9 ("Clarity of everyday sounds"), and Qualities #14 ("Need to concentrate when listening"). This factor accounted for the highest variance for the SSQ12 data. Factor 2 (eigenvalue=1.5; 12.7% of variance), referred to as spatial perception, offloads on items Spatial #6 ("Locate dog barking"), Spatial #9 ("Judge distance of vehicle"), and Spatial #13 ("Identify whether vehicle is approaching or receding"). Factor 3 (eigenvalue=1.3; 10.5% of variance), referred to as separation and identification of sounds, encompassed items Qualities #2 ("Sounds appearing jumbled") and Qualities #7 ("Identify instruments in music"). Tables 1 and 2 display the rotated loadings of each item for the factors of the SSQ5 and SSQ12, respectively.

The communality values for each item on the SSQ5 ranged from 0.53 to 0.85. Because the communality indicates the proportion of common variance in that item, the results suggested that the variation in Spatial #9 and Spatial #3 can be best explained by the factor analysis. The communalities for these two items were greater than 80%. The smallest community was for Qualities #9 but it can still explain 53% of the variance of self-reported hearing disability. The communality values for each item on the SSQ12 ranged from 0.51 to 0.88. Five items (Speech #1, Spatial #6, Spatial #9, Qualities #2 and Qualities #7) with the communalities greater than 80%.

The smallest community on the SSQ12 was for Qualities #9 with the value of 51%.

Reliability

Generally speaking, any Cronbach's coefficient α values at 0.70 or higher suggests good reliability for the psychometric instrument. The results revealed a value of 0.75 of the Cronbach's coefficient α for the SSQ5 and 0.91 for the SSQ12 in the present study. The item-total correlation ranged from 0.41 to 0.58 for the SSQ5 and from 0.37 to 0.79 for the SSQ12 (Table 3).

Sensitivity

We assessed the sensitivity of the SSQ5 and SSQ12 by comparing the scores between participants with mild hearing loss (better 4PTA ≤ 40 dB HL) and moderate-to-severe hearing loss (better-ear 4PTA>40 dB HL). Of the 47 participants with hearing loss, 25 were mild loss, and 22 were moderate-to-severe loss. We expected that the participants with mild hearing loss would report less hearing disabilities compared to those with moderate-to-severe loss. The results from a two-tailed, independent-sample *t* test revealed a significant difference between these two groups for both short versions of the SSQ ($t45=4.31$, $p<.0001$ for the SSQ5 and $t45=3.68$, $p=.0006$ for the SSQ12, respectively) and the self-reported hearing disability was more severe for the participants with moderate-to-severe hearing loss. In addition, we also evaluated the SSQ5 and SSQ12 score differences between those with and without significant hearing handicap (HHIE-S ≥ 26). Of the 47 participants with hearing loss, 25 experienced significant hearing handicap. The two-tailed, independent-sample *t* test revealed a significant difference between the two groups for both SSQ5 ($t45=2.96$, $p=.005$) and SSQ12 ($t45=2.50$, $p=.02$) and the self-reported hearing disability was more severe for the participants with significant hearing handicap. Figure 3 displays the average SSQ5 and SSQ12 total scores with standard errors for each subset group; Panel A is the comparison between those with mild and moderate-to-severe hearing loss; Panel B is for those with and without significant hearing handicap.

Table 1: The factor loadings of the each of five and twelve items for the SSQ5 (rotation method: Promax). Only loadings greater than 0.40 are displayed (n=47)

Items	Factor 1	Factor 2
Speech #8	0.86	-
Spatial #3	-	0.92
Spatial #9	-	0.91
Qualities #9	0.55	-
Qualities #14	0.87	-

Table 2: The factor loadings of the each of five and twelve items for the SSQ12 (rotation method: Promax). Only loadings greater than 0.40 are displayed (n=47)

Items	Factor 1	Factor 2	Factor 3
Speech #1	0.91	-	-
Speech #4	0.76	-	-
Speech #10	0.86	-	-
Speech #11	0.93	-	-
Speech #12	0.76	-	-
Spatial #6	-	0.92	-
Spatial #9	-	0.93	-
Spatial #13	-	0.79	-
Qualities #2	-	-	0.91
Qualities #7	-	-	0.85
Qualities #9	0.58	-	-
Qualities #14	0.72	-	-

Table 3: Item-total correlation coefficients for each item on the SSQ5 and SSQ12 (n=47)

SSQ5 Item	Item-Total Correlation		SSQ12 Item
Speech #8	0.58	0.73	Speech #1
Spatial #3	0.50	0.79	Speech #4
Spatial #9	0.58	0.70	Speech #10
Qualities #9	0.52	0.73	Speech #11
Qualities #14	0.41	0.75	Speech #12
		0.59	Spatial #6
		0.65	Spatial #9
		0.65	Spatial #13
		0.37	Qualities #2
		0.51	Qualities #7
		0.63	Qualities #9
		0.63	Qualities #14

Discussion

This study aimed to compare two shortened versions of the Speech, Spatial, and Qualities of Hearing Scale, SSQ5 and SSQ12, to each other in terms of the agreement, and to compare the psychometrical properties between them. Relative to the first aim, the results indicated that the total scores of the SSQ12 were lower than that of the SSQ5. Figure 4 displays a scatter-plot of average SSQ12 total scores versus average SSQ5 scores. It appeared that most dots were aligned well with the diagonal line but also below the line. It indicated that the majority of the total SSQ12 scores were lower than the total SSQ5 scores. That means, the self-reported hearing disability were measured more severe from the SSQ12 compared to that measured from the SSQ5 for the same group of participants. On the other hand, the intraclass correlation coefficient of 0.79 suggested that the agreement between these two questionnaires was excellent. We speculated that these two questionnaires may not measure exactly the same aspect of the hearing disability from the present study. Although three out of five items from the SSQ5 were overlapped with the SSQ12, the items related to separation and identification of sounds were not included in the SSQ5. In other words, both versions assessed hearing disability in the areas of speech understanding and spatial perception, but separation and identification of sounds were not measured in the SSQ5.

Relative to the second aim, we compared the results of the present study to the factor structure of the full version of the SSQ from Akeroyd et al. [18]. There were two factors in total extracted for the SSQ5 and three factors for the SSQ12. Akeroyd and his colleagues [18] reported that 35 out of 48 items loaded on three similar factors for the full version. Factor

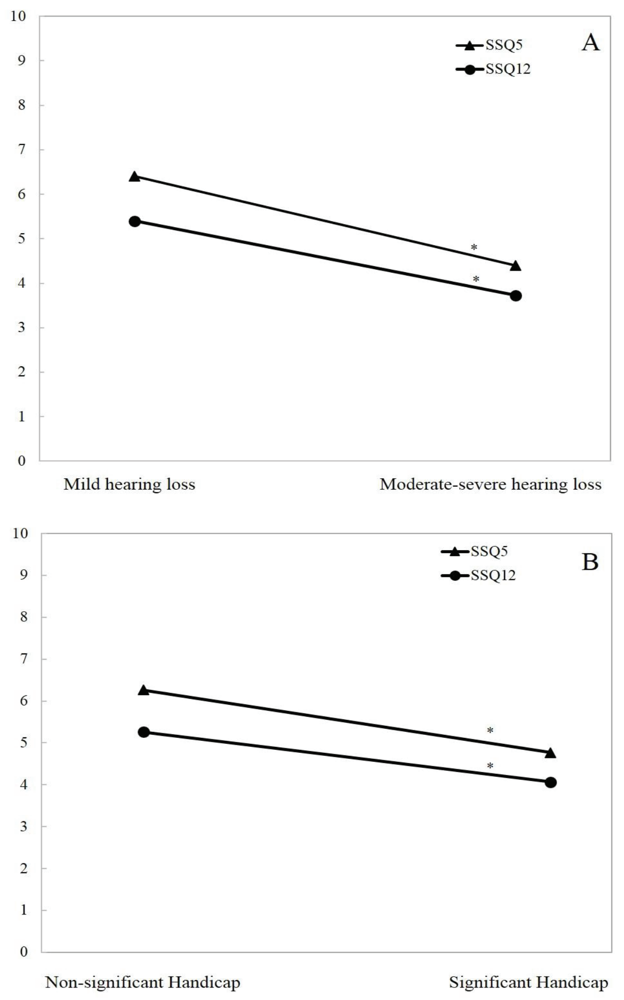

Figure 3: Panel A: Comparison of the total scores of the SSQ5 and SSQ12 between mild and moderate-severe hearing loss. Mild and moderate-severe hearing loss defined as four frequency better-ear pure-tone averages (4PTA) <40 dB HL and ≥ 40 dB HL, respectively; Panel B: Comparison of the total scores of the SSQ5 and SSQ12 between those with and without significant hearing handicap measured by the screening version of the Hearing Handicap Inventory for the Elderly (HHIE-S). The significant handicap defined as a total score of the HHIE ≥ 26. The symbol "*" indicates *p*<.05.

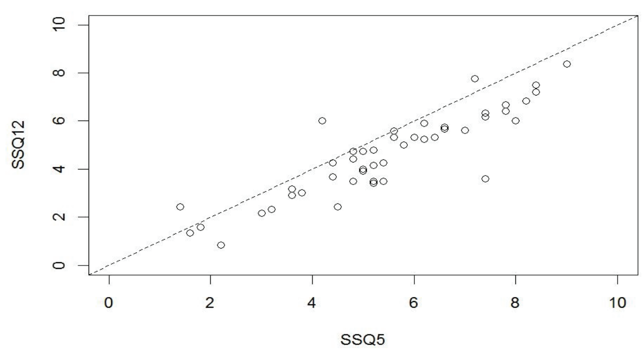

Figure 4: Scatter plot of the total SSQ12 scores as a function of the total SSQ5 scores (n=47).

1 in the full and two short versions of the SSQ reflected speech understanding. Most speech items of the full version and all speech items of the two shortened versions (Speech #8 for the SSQ5 and Speech #1, #4, #10, and #11 for the SSQ12) loaded on Factor 1. Similarly, for Factor 2 related to spatial hearing, all spatial items, including one of the three overlapped items Spatial #9 between the SSQ5 and SSQ12, loaded on the same factor for both shortened versions of the questionnaire. Most spatial items from the full version loaded on Factor 2 as well. However, Spatial #3 did not load on this factor for the full-version SSQ but it loaded on Factor 2 for the SSQ5.

Recall that only two factors were extracted for the SSQ5, whereas there were three factors extracted for the SSQ12 and the full version of the SSQ. Factor 3 was about separation and identification of sounds. The two qualities items in the SSQ12 (Qualities #2 and #7) loaded on Factor 3. Although most of the qualities items in the full-version SSQ, including Qualities #9, loaded on Factor 3, Qualities #14 was not one of them. On the contrary, it was suggested that this item may form the possible fourth factor labeling as listening efforts elsewhere [18]. It is interesting to notice that in the present study, two of the three overlapped items (Qualities #9 and Qualities #14) between the SSQ5 and SSQ12 loaded on Factor 1 regarding speech understanding for both shortened versions. Given the facts that the clarity of sounds (Qualities #9) and listening efforts (Qualities #14) are both important to speech understanding, it can explain why those two items loaded on Factor 1. Although there were some minor differences in terms of the items loading on various factors, the SSQ12 and the full version of the SSQ shared a similar factor structure in the current study. On the other hand, because the SSQ5 had two same factors like the other two, it can still be considered to have a comparable factor structure as the original version of the SSQ.

Regarding the internal consistency between the two questionnaires, it should be noted that the Cronbach's coefficient of the SSQ5 (α=0.75) was lower compared to that of the SSQ12 (α=0.91). That means, the SSQ5 may have 0.44 error variance (1.00–0.75 × 0.75) whereas the SSQ12 had 0.17 error variance (1.00–0.91 × 0.91) in the scores. Because the authors who developed the SSQ5 or the SSQ12 did not report Cronbach's alpha in their studies [20,22], we were unable to make a comparison. One of the reasons for the lower Cronbach's alpha of the SSQ5 observed in the present study may be due to the smaller number of items in the SSQ5 compared to the SSQ12. Since Cronbach's alpha is not the only parameter to determine reliability, we cannot assume that the SSQ5 had a lower reliability compared to the SSQ12. In fact, another parameter of reliability, the item-total correlation, was similar between two inventories.

Clinical applications

Clinicians have a range of materials to evaluate the patient and sometimes, it may be difficult to pick the best option, as there are many contributing factors. The duration of the test time might be one of the factors to help clinicians decide. It is no doubt that it takes less time to administrate a 5-item questionnaire compared to a 12-item questionnaire, but given both questionnaires are relatively short, the duration of testing between them should not be significantly different. The trade-off between the SSQ5 and the SSQ12 may rely on the two items related to the sounds separation and identification. Because the SSQ5 does not include these two items, it cannot give a clinician a complete profile of a patient's hearing disability like the SSQ12 could within the same period. Based on the results from the present study, we recommend using the SSQ12 over the SSQ5 for screening in a busy clinic.

Conclusion

In sum, the use of the SSQ12 may result in poorer self-reported hearing ability compared to the SSQ5 for the same person. However, the agreement between these two short versions was relatively high. Both SSQ5 and SS12 shared similar psychometrical strengths in the present study but the SSQ12 may have the advantage of providing a complete profile of hearing disability compared to the SSQ5.

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Appendix I

Details of the five items of the SSQ5

Subscale with the Item Number	Question
Speech #8	Can you have a conversation with someone when another person is speaking whose voice is the same pitch as the person you're talking to?
Spatial #3	You are sitting between two people. One of them starts to speak. Can you tell right away whether it is the person on your left or your right, without having to look?
Spatial #9	Can you tell how far away a bus or a truck is from the sound?
Qualities #9	Do every day sounds that you can hear easily seem clear to you (not blurred)?
Qualities #14	Do you have to concentrate very much when listening to someone or something?

Appendix II

Details of 12 items of the SSQ12

Subscale with the Item Number	Question
Speech #1	You are talking with one other person and there is a TV on in the same room. Without turning the TV down, can you follow what the person you're talking to says?
Speech #4	You are in a group of five people in a busy restaurant. You can see everyone else in the group. Can you follow the conversation?
Speech #10	You are listening to someone talking to you, while at the same time trying to follow the news on TV. Can you follow what both people are saying?
Speech #11	You are in conversation with one person in a room where there are many other people talking. Can you follow what the person you are talking to is saying?
Speech #12	You are with a group and the conversation switches from one person to another. Can you easily follow the conversation without missing the start of what each new speaker is saying?
Spatial #6	You are outside. A dog barks loudly. Can you tell immediately where it is, without having to look?
Spatial #9	Can you tell how far away a bus or truck is, from the sound?
Spatial #13	Can you tell from the sound whether a bus or truck is coming towards you or going away?
Qualities #2	When you hear more than one sound at a time, do you have the impression that it seems like a single jumbled sound?
Qualities #7	When you listen to music, can you make out which instruments are playing?
Qualities #9	Do every day sounds that you can hear easily seem clear to you (not blurred)?
Qualities #14	Do you have to concentrate very much when listening to someone or something?