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The Speech, Spatial, and Qualities of Hearing Scale (SSQ12): differences in online versus interview administration

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ABSTRACT

Purpose: To investigate the equivalence of the 12-item speech, spatial, and quality of hearing (SSQ12) scale administered in either the interview or online version to adults with and without hearing loss.

Methods: One hundred fifty-two listeners (99 females) aged 18–81 years ($M = 46.0$, SD = 15.3) participated in this study. Eighty-two individuals were in the normal hearing group and 70 were in the hearing-impaired group. Participants completed the SSQ12 questionnaire twice: 1) interview and 2) online format. The presentation order was randomized (interview or online first); after three to four weeks, the participants completed the questionnaire in another format.

Results: SSQ12 scores differed significantly between formats ($p < 0.001$), but the mean difference was minimal (0.3 points). The internal consistency was high for both formats (Cronbach's alpha >0.9). Intraclass correlation (ICC) values showed excellent agreement for the speech (ICC = 0.88) and spatial (ICC = 0.84) subscales and good agreement for the Qualities (ICC = 0.66). The area under the receiver operating characteristic curve (AUC) was 0.863, indicating good diagnostic accuracy.

Conclusions: The administration method affects SSQ12 scores, but the difference is not clinically significant. Therefore, both methods can be interchangeable, allowing clinicians to choose the most appropriate format based on patient needs. Additionally, the SSQ12 effectively distinguishes between normal and hearing-impaired listeners.

IMPLICATIONS FOR REHABILITATION

- Although there were some minor differences, the interview and online version of the 12-item speech, spatial, and quality of hearing (SSQ12) questionnaire are interchangeable for assessing the listening abilities of adults with and without hearing loss.
- The SSQ12 questionnaire can discriminate between listeners with healthy hearing and hearing loss; hence, it can be used as a screening tool for adults.
- The SSQ12 questionnaire can help clinicians identify specific areas of hearing difficulty and tailor treatment strategies accordingly.

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Introduction

Hearing loss negatively impacts daily life activities, limits interactions with others, reduces participation in social activities, and increases feelings of loneliness and isolation [1,2]. As the consequences of hearing loss are multidimensional, a patient-centered approach is important to comprehensively understand the patient's limitations or restrictions and customize treatment [3].

The use of self-reported measures (e.g., questionnaires) for functional assessment of hearing has become an essential part of the aural (re)habilitation process and is recommended as the best practice by most guidelines for the management of hearing loss in children and adults [4–6]. Questionnaires can provide valuable information regarding a person's listening abilities in different contexts, difficulties, and perceived benefits of using hearing devices [7].

Questionnaires can be administered using different modes, such as interviews, self-administration, telephone, and more recently, online [8]. Each method has advantages and disadvantages that clinicians should be aware of. Interview administration allows the clinician to assist patients by clarifying questions and results in higher completion rates but has some potential limitations, such as social desirability bias (patients providing socially desirable answers) and interviewer bias [8,9]. Online administration eliminates or reduces these biases and implementation costs, and can reach a larger number of potential respondents. However, online administration may result in fewer responses and an increased risk of recall bias when an interviewer is not available to provide prompts. There is also a greater cognitive burden, and online administration can be challenging for patients with low technology literacy or limited access to the internet [8]. The online administration method could also introduce differences in how

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respondents perceive the format; for example, mobile phones versus webpages can change how items are presented (e.g., one item or several items at the same time, different lengths, and layouts), which may affect the results. Additionally, concerns about data security might make people feel uncomfortable disclosing personal information using a digital format, especially in relation to their health problems [10]. Hence, some people may be more reluctant to provide reliable online than face-to-face information. Since the administration method of questionnaires can significantly affect their reliability and utility in clinical settings, it is important to compare the reliability of these two questionnaire formats in the clinical population to provide confidence that the psychometric properties of the SSQ are independent of the administration method.

In recent years, audiology services have expanded, with diagnostic evaluations, hearing device fittings, follow-up and rehabilitation performed remotely as well as in person, using the Internet or other tele-audiology systems [11]. Clinicians have access to a range of different questionnaires to assess hearing, tinnitus, and vertigo [12] however, evidence for the inter-format reliability for hearing-related questionnaires is still sparse. This is particularly important because most questionnaires were developed to be used in interview format or self-administered mainly in the clinic [12] Thus, the equivalence across administration methods should be established to determine the appropriateness of online formats for commonly used self-report instruments utilized in tele-audiology services [8,13].

There are some published reports on the differences in hearing questionnaire results depending on the mode of administration. Thorén et al. [14] investigated differences in outcomes between self-administered and online formats for three widely hearing-related questionnaires in adults with hearing loss (Mean age 68.3, SD 11.3): (1) Hearing Handicap Inventory for the Elderly (HHIE), (2) International Outcome Inventory for Hearing Aids (IOI-HA), and (3) Satisfaction with Amplification in Daily Life (SADL). Fifty-five hearing-aid users completed the questionnaires twice using self-administration and online formats. The results for the IOI-HA and SADL questionnaires did not differ between the administration methods; however, the HHIE had higher scores (more disability) for the online format. The authors concluded that the difference in scores between formats might depend on the context in which they are used. Singh and Pichora-Fuller [15] compared interview and self-report (postal mail) methods for the Speech, Spatial and Qualities of Hearing Scale questionnaire (SSQ-46 items) in a sample of 159 older adults (60–88 years) with hearing ranging from normal to slight hearing loss (Mean age 72.8, SD 5.6). Although the interview format showed higher test-retest reliability than the self-report administration, the questionnaire administration mode had no systematic impact on the SSQ scores.

Saunders et al. [16] compared paper and electronic formats for the Attitudes Toward Loss of Hearing Questionnaire (ALHQ) in 100 hearing-impaired adults (Mean age 65.6, SD 8.9) (both experienced and non-experienced hearing aid users). Participants were assigned to one of four groups of 25, who completed the questionnaire twice over a 1–2 week period in either paper (twice), electronic (twice), or both versions (paper-electronic, electronic-paper). When changes in the administration format were introduced (e.g., paper versus electronic), participants' responses were more variable than when the same format was used twice (not specific to the administration format). Therefore, the authors suggested maintaining the same administration format to optimize the test-retest reliability.

The SSQ measures hearing disability and has been widely used in research and clinical populations [17–20]. The 12-item version of the SSQ (SSQ12) is supported for use in the clinic as it only requires a short time to complete and has good reliability and consistency [21,22]. Despite its utility, there is a lack of information regarding the interformat equivalence of the SSQ12 questionnaire. This study aimed to compare the outcomes of two SSQ12 administration methods, online and interview, in adults with and without hearing loss and to establish cutoff scores for identifying hearing difficulties.

Method

Sample size

The confirmatory factor analysis goodness-of-fit method suggested by MacCallum et al. [23] was used to calculate the sample size. In this approach, a root mean square error of approximation (RMSEA) test was used to determine the sample size required to test the close-fit hypothesis of the confirmatory factorial model. Considering an RMSEA = 0.08 (fair fit) with 80% power and $\alpha = 0.05$, the sample size required was 122 participants. Given the potential for attrition (estimated to be 20% of the sample), 146 participants were sought. A second sample size estimation was performed since we needed to compare the online and interview versions. Thorén et al. [14] reported a Cohen's d effect size of 0.37 when comparing two administration formats of a similar questionnaire. Considering this effect size, 80% power, $\alpha = 0.05$, and a possible dropout rate of 10%, a final sample size of 69 participants per group ($n = 138$) was sought for a paired Wilcoxon signed-rank test to compare questionnaire administration formats.

The SSQ questionnaire

The SSQ assesses the listening disability for speech, sound localization and qualities of hearing (e.g., listening effort, clarity/naturalness) in daily life contexts [24]. The original version of the questionnaire was administered as an interview [24]. Currently, several SSQ versions are available for parents/children [25], and there are five-, 12-, and 15-item versions [26–28] that can be used for different purposes. Patients respond using a graduated scale of 0 to 10 points, where 0 indicates no ability or maximum difficulty and 10 indicates maximum ability or no difficulty in performing the situation stated in the question. A not applicable (NA) option was available if the participant believed he/she had not experienced the situation. The higher the score obtained, the lower the difficulty experienced by the patient. The Spanish 12-item SSQ version [21] was used in the current study because it requires a short administration time and can be easily implemented clinically.

Administration method

Interview format

An experienced audiologist interviewed the participants in the clinic or remotely via a videocall due to the COVID-19 pandemic mobility restrictions. In both cases, the audiologist guided the participants, as required. For remote interviews, a scale was provided on the screen. The duration of the interviews was approximately ten minutes. For face-to-face interviews, participants were provided with a printed response scale where they could select their responses, whereas, for remote interviews, responses were

given verbally and registered by the audiologist. The interview format ensured that participants directly interacted with the audiologist to clarify their doubts or questions.

Online format

The questionnaire was presented using Qualtrics (Provo, UT, USA). Participants were sent a link to the questionnaire by the same audiologist who conducted the interview, which they could complete independently on their personal computer or mobile phone at their own pace, without real-time assistance from the audiologist. Written instructions were provided directly on the first screen of the questionnaire, and there were no oral instructions or recordings in the online format. The presentation format consisted of three pages (screens): the first page presented the instructions and four items, the second page presented five items, and the last page presented three items. The scoring scale resembled the original version, with a scale of 0–10, and was presented using a slider bar. Ratings between integer numbers were allowed (e.g., 5.4) and a "not applicable (NA)" option was provided for each item.

Participants who did not complete the online questionnaire within a week received a reminder via text message. Participants were withdrawn from the study after three reminders without a response. This exclusion procedure was applied only to the online format and did not affect the interview format as the interviews were conducted during a scheduled clinic appointment.

Participants

One hundred ninety-two listeners (115 females) aged between 18 and 81 years (Mean 47.1, SD 15.4) with and without hearing loss were recruited to participate in the study. Only fully completed questionnaires were included in the analyses. Data from six participants were excluded because although they completed both formats, one or more items were not answered in either administration format. An additional 34 participants were excluded because they did not complete one or both of the questionnaire administration methods. This resulted in a final sample size of 152 participants (Table 1). Participants were recruited from private clinics in Argentina, primarily Ciudad Autónoma de Buenos Aires; recruitment was facilitated through word of mouth, which helped reach individuals with normal hearing (NH) and hearing loss (HL). Only participants who were able to understand the questionnaire and were confident enough to use their PC/mobile phone were included in the study.

Participants were randomized into two groups: (1) interview first ($n = 76$) and (2) online first ($n = 76$). After three to four weeks, they completed the questionnaire in another format. Group randomization was independent of hearing status and conducted after participants agreed to participate in the study.

All the participants provided written informed consent. This study was approved by the Institutional Ethics Committee of Universidad de Buenos Aires.

Table 1. Participants' demographic information ($N = 152$).

	NH	HI
n	82	70
Age (mean years, SD)	39.0 (13.1)	54.2 (12.6)
Sex		
Male	33	26
Female	49	44
Education level (mean years, SD)	20.4 (6.7)	18.7 (5.1)
Better ear PTA4 dB HL (mean, SD)	5.8 (5.5)	23.6 (13.9)
Worse ear PTA4 dB HL (mean, SD)	8.6 (5.8)	55.5 (30.7)
Hearing loss type		
Conductive		2
Sensorineural		57
Mixed		11
Severity*		
Mild		30
Moderate		24
Severe		5
Profound±		11
Laterality		
Bilateral		31
Unilateral		39

PTA4: Pure tone average at 500, 1000, 2000, & 4000 Hz.
NH: Normal hearing; HI: Hearing impaired.
*According to the worse ear/± includes unilateral hearing losses.

Procedure

The participants provided pure-tone audiogram information; if the hearing test was older than one year or the participants noted changes in their hearing status, a new assessment was conducted. Participants who presented with hearing thresholds ≤20 dB HL based on their pure tone average at 0.5, 1, 2, and 4 kHz (dB PTA4) were allocated to the normal hearing group (NH). Participants with a PTA4 > 20 dB in one or both ears formed the hearing-impaired group (HI). The participants were classified according to the British Society of Audiology [29] and adapted criteria for hearing loss severity (WEA, worse ear). Data regarding participants' educational attainment were collected to investigate the potential influence of educational status on differences in responses across administration methods.

Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics version 26.0 (IBM Corporation). Statistical significance was set at $p < 0.05$, and Bonferroni correction was applied to adjust for multiple comparisons. The following analyses were conducted:

Repeated measures analysis of variance (ANOVA)

Repeated-measures analysis of variance was used to investigate differences between administration methods (interview vs. online) and their interaction with the SSQ12 subscales. When Mauchly's test indicated that the assumption of sphericity was violated, the Greenhouse–Geisser or Hunh-Feldt correction was applied. This analysis assessed whether there were significant differences in the SSQ12 scores based on the method of administration and presentation order (whether the interview or online was completed first).

To obtain a more stable estimate of participants' SSQ12 scores, the mean of both administration formats (interview and online) was used when it was determined that there was no effective difference related to the mode of administration. This approach accounts for potential format-related variations and reduces the individual response fluctuations. However, while averaging scores may mitigate test-retest variability at the individual level, it may not substantially reduce the overall variability in the sample. This was considered when interpreting the findings.

Internal consistency (Cronbach's alpha)

The internal consistency of the SSQ12 items was assessed using Cronbach's alpha to measure the reliability of the scale for both

administration methods. A Cronbach's alpha value greater than 0.7 was considered acceptable for clinical purposes [30], indicating good internal consistency among the items, was considered acceptable for clinical purposes.

Inter-rater reliability (intraclass correlation coefficient – ICC)

The Intraclass Correlation Coefficient (ICC) assessed the reliability and consistency of responses among participants. ICC provides a quantitative measure of agreement or correlation between different raters or measurements. ICC values were interpreted according to Cicchetti's guidelines [31]: values between 0.40 and 0.59 indicate fair agreement, 0.60–0.74 indicate good agreement, and 0.75–1.0 indicate excellent agreement. This analysis assessed the consistency of the participants' responses across the two administration methods.

Discriminant validity

Receiver operating characteristic – ROC curve

Discriminant validity of the SSQ12 for detecting hearing impairment was assessed using ROC curve analysis. The ROC curve depicts the sensitivity against specificity at various cutoff values to evaluate the SSQ12 classification accuracy for hearing impairment. Multiple cutoff values were examined to determine the sensitivity and specificity of different thresholds for detecting hearing impairment based on the audiogram (PTA4 ≥ 21 dB HL in the worse ear). This methodology identifies the optimal cutoff score that balances sensitivity and specificity. The area under the curve (AUC) quantified the SSQ12's overall discriminative ability to predict hearing impairment.

A series of cutoff values, accompanied by their respective sensitivity and specificity metrics, were computed, providing a detailed assessment of the efficacy of the SSQ tool for identifying hearing loss. This approach facilitates the identification of the optimal threshold cutoff for the specific population under study, flexibility in clinical application based on the desired balance between sensitivity and specificity, comparability with existing literature utilizing different cutoff points, and adaptability of the results to various clinical settings.

Group comparisons

To assess group differences, between-group comparisons of normal hearing (NH) and hearing-impaired (HI) participants were conducted using Mann–Whitney *U* tests to evaluate the discriminative ability of the SSQ12 questionnaire, complementing the ROC analysis.

Results

Repeated measures analysis of variance (ANOVA)

A two-factor repeated measures ANOVA was conducted with the administration method (interview vs. online) and SSQ subscales (Speech, Spatial, Qualities, Effort) as within-subject factors and presentation order (interview first or online first) as a between-subject factor. Sex and years of education were included as covariates to control for their potential influence on the SSQ12 responses for the two modes of administration.

The analysis revealed a significant main effect of administration method on SSQ12 scores, $F(1, 144) = 7.197$, $p = 0.008$, $\eta^2 = 0.048$. The participants reported significantly higher SSQ12 scores in the interview condition ($M = 7.8$, 95% CI [7.5–8.1]) than in the online condition ($M = 7.5$, 95% CI [7.2–7.8]).

The interaction between administration method and SSQ subscales was not significant, $F(1.911, 275.188) = 1.750$, $p = 0.177$, $\eta^2 = 0.012$, indicating that the effect of administration method was consistent across all SSQ scales.

No significant interaction was observed between administration method and presentation order, $F(1, 144) = 0.726$, $p = 0.396$, $\eta^2 = 0.005$, suggesting that the sequence in which participants completed the interview or online format did not influence their SSQ12 scores.

The interaction between the SSQ subscales and presentation order was not significant, $F(1.931, 278.036) = 2.009$, $p = 0.112$, $\eta^2 = 0.014$, indicating that presentation order did not differentially affect the scores on the various SSQ subscales.

Sex, $F(1, 144) = 2.765$, $p = 0.099$, $\eta^2 = 0.019$, or years of education, $F(1, 144) = 1.648$, $p = 0.201$, $\eta^2 = 0.011$) showed no significant interaction effects with the administration method. Thus, these demographic variables did not influence the relationship between the administration method and the SSQ12 scores.

However, there was a significant three-way interaction between the administration method, SSQ subscales, and presentation order, $F(1.849, 432) = 2.228$, $p = 0.040$, $\eta^2 = 0.023$. Thus, the effect of the administration method on the SSQ subscale scores depended on the order in which the questionnaire was completed, and this order effect varied across subscales. More specifically, participants' subscale scores were differentially affected by whether they completed the interview or the online format in a specific order. The small effect size for this three-way interaction, $\eta^2 = 0.023$, indicated that the clinical impact was minimal. The overall effect size for the main effect of the questionnaire modality was more robust, $\eta^2 = 0.048$, albeit still small (Figure 1).

Internal consistency (Cronbach's alpha)

The reliability analysis of the 12 items for each method (Table 2) for the total sample ($N = 152$) showed a Cronbach's alpha values of 0.95 and 0.93, indicating excellent internal consistency for both the interview and online methods. The lowest Cronbach's alpha value was obtained for the Qualities subscale of the online administration ($\alpha = 0.71$). A high internal consistency was maintained when the scores of both formats were combined (Table 2).

Inter-rater reliability (intraclass correlation coefficient – ICC)

The ICC values indicated a high degree of agreement for the speech (ICC = 0.88, 95% CI 0.84–0.91) and spatial (ICC = 0.84, 95% CI 0.76–0.90) subscales, indicating consistent ratings across

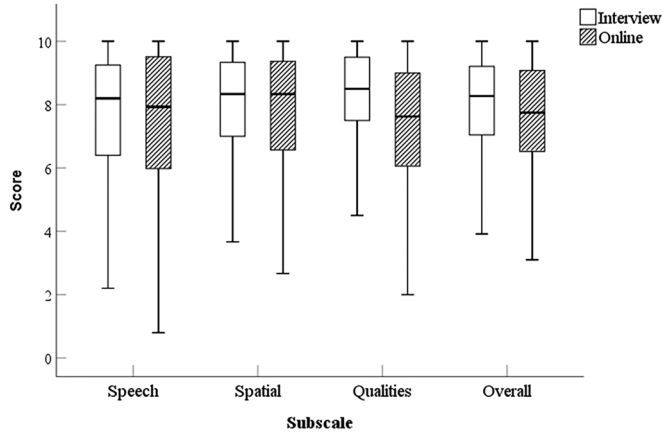

Figure 1. SSQ12 scores for the three subscales and overall scores as a function of the administration method (regardless of the administration time).

Table 2. Internal consistency (Cronbach's α) for SSQ12 as a function of the administration method for each subscale and overall.

		Cronbach's α		
Subscale	Items	Interview	Online	Combined*
Speech	5	0.92	0.95	0.95
Spatial	3	0.89	0.91	0.93
Qualities	4	0.83	0.71	0.83
Total	12	0.94	0.93	0.95

*Combined SSQ12 scores for the interview and online format.

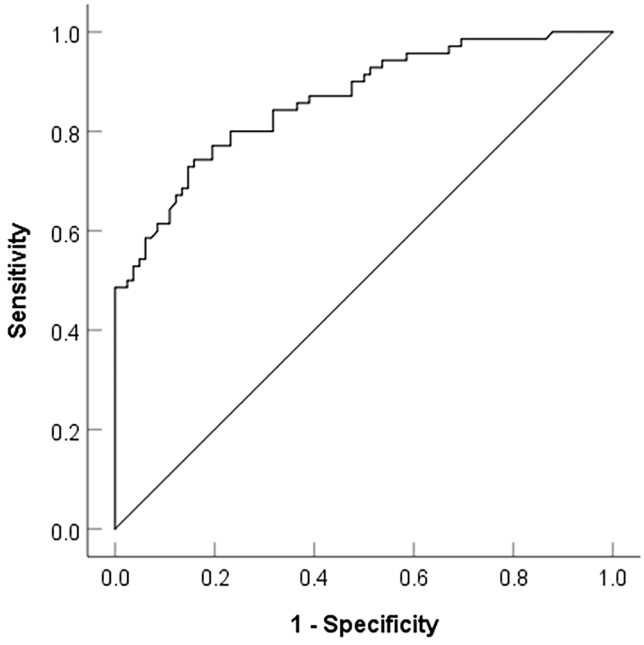

Figure 2. Receiver operating characteristic curve for using the SSQ12 overall score to predict a hearing loss (AUC = 0.863).

administration methods. The Qualities of the hearing subscale had a lower ICC value of 0.66 (95% CI 0.54–0.77), indicating lower agreement, although this was still classified as good agreement by Cicchetti [31]. For the overall score, ICC values indicated also a high degree of agreement (ICC = 0.93, 95% CI 0.83–0.90)

Given that differences between administration methods are likely to have a minimal clinical impact, and that there was high internal consistency and ICC between methods, combined SSQ12 scores across different formats were used for subsequent discriminant analyses. This approach reduces score variability.

Discriminant validity

ROC analysis

The SSQ12 scores range from 0 to 10 points (0 indicating maximum difficulty and 10 indicating no difficulty). The ROC curves for SSQ12 prediction of hearing impairment based on the audiogram, defined as the Pure Tone Average at four frequencies (PTA4) (500, 1000, 2000, and 4000 Hz) of 21 dB HL [29] or greater in the Worse Ear Average (WEA), are presented in Figure 2. The Area Under the Curve (AUC) calculated using the ROC analysis was 0.863 (95% CI, 0.806 – 0.921) (Figure 2).

Based on the Youden Index [32] (used to select the optimal cutoff, assuming equal importance of sensitivity and specificity), an SSQ12 total score of ≤8.0 detected hearing impairment (PTA4 ≥ 21 dB HL) with 80.0% sensitivity and 75.6% specificity (Table 3).

Table 3. Sensitivity and specificity for hearing loss for SSQ12 total score.

	PTA4 ≥ 21 dB HL†	
Positive if ≤ to the following values:	Sensitivity	Specificity
7.5	72.9	85.4
7.6	74.3	84.1
7.7	74.3	81.7
7.8	75.7	80.5
7.9	77.1	80.5
8.0	**80.0**	**76.8**
8.1	80.0	75.6
8.2	80.0	72.0
8.3	84.3	68.3
8.4	85.7	63.4
8.5	87.1	61.0

The values in bold indicate the recommended cutoff point.
†PTA4: pure tone average for 0.5, 1, 2, & 4 kHz; hearing loss ≥21 dB HL.

Table 4. Mean SSQ12 scores*, standard deviations for NH and HI listeners for both administration methods.

		NH	HI	p Value
#	*Speech hearing items*			
1	Talking with one person with TV on	9.0 (1.3)	6.8 (2.2)	<0.001
2	Talk with one person and follow TV	7.9 (1.7)	5.5 (2.5)	<0.001
3	Follow one conversation when many people talking	9.1 (1.2)	6.5 (2.3)	<0.001
4	Conversation 5 people noise with vision	8.6 (1.6)	6.0 (2.3)	<0.001
5	Follow conversation switching in a group	8.9 (1.4)	6.4 (2.3)	<0.001
	Speech subscale	8.7 (1.2)	6.2 (2.1)	<0.001
	Spatial hearing items			
6	Locate dog barking	8.9 (1.3)	6.3 (2.8)	<0.001
7	Judge distance of a vehicle	8.5 (1.3)	6.4 (2.4)	<0.001
8	Identify if a vehicle is approaching or receding	9.0 (1.1)	6.9 (2.4)	<0.001
	Spatial subscale	8.8 (1.1)	6.5 (2.4)	<0.001
	Qualities of hearing items			
9	Sounds appearing jumbled	8.2 (1.9)	6.4 (2.1)	<0.001
10	Identify instruments in music	8.5 (1.7)	7.0 (2.4)	<0.001
11	Clarity of everyday sounds	9.5 (0.8)	7.6 (1.8)	<0.001
12	Need to concentrate when listening	8.4 (2.0)	5.9 (2.5)	<0.001
	Qualities subscale	8.7 (1.2)	6.8 (1.8)	<0.001
	Overall	8.7 (1.0)	6.5 (1.9)	<0.001

NH: normal hearing listeners; HI: hearing impaired listeners.
*Combined SSQ12 scores for both interview and online formats.

Group comparisons

The Mann–Whitney U test indicated that there was a significant difference between the NH and HI groups for all subscales (Speech: $U = 887.50$, $z = -7.33$, $p < 0.001$; spatial: $U = 1066.00$, $z = -6.67$, $p < 0.001$; Qualities: $U = 1032.00$, $z = -6.80$, $p < 0.001$; overall: $U = 784.50$, $z = -7.71$, $p < 0.001$). Individuals with hearing impairment reported significantly poorer perceived abilities in speech understanding, spatial awareness, and overall quality of hearing than normal-hearing listeners (Table 4).

Discussion

Although the results indicated that the administration method had a statistically significant effect on SSQ12 scores, the effect size was small (mean difference 0.3) and unlikely to have clinical relevance, consistent with previous studies comparing questionnaire administration formats [15,33]. Given the minimal difference observed, these variations may be attributed to participant-related factors, such as higher engagement, a tendency for participants to present themselves in a favorable manner to others (social desirability), or hearing loss denial [34,35] in the interview format which yielded slightly higher scores (less reported difficulty). In contrast, participants reported slightly more hearing difficulties

(marginally lower scores) for the online version, possibly because of the lack of interaction with a clinician. However, these small differences do not impact the interchangeability of the formats or the clinical utility of SSQ12.

Differences in the administration method without a significant clinical impact have been previously reported in hearing questionnaires when different formats were compared. Thorén et al. [14], compared administration methods (online versus paper) for four questionnaires (HHIE, IOI-HA, SADL, and HASD) among 53 hearing-aid users. The results showed that reliability was consistent regardless of the administration method; only the HHIE questionnaire presented significant differences between formats, with a small effect size. Similarly, Singh et al. [15] examined the variations between face-to-face interviews and self-completed questionnaires for a 49-item SSQ among adults aged 60–80 years. The results showed that the administration method did not impact SSQ49 overall scores; however, the interview format presented more reliable results (higher test-retest correlation), which might be related to increased levels of participants' engagement. The self-report method showed acceptable reliability. Despite the differences in reliability between the methods, the SSQ49 overall scores did not vary significantly.

Recently, Ahlberg et al. [33] investigated the psychometric properties of the Swedish SSQ12 questionnaire and the differences between two administration methods (paper-and-pen and online) in a group of 125 adults with and without hearing loss. The differences between the two methods are not significant, indicating that both approaches can be considered interchangeable. The authors mentioned that despite having excellent reliability and agreement, 8% of the participants were outside the 95% limits (test and retest scores), suggesting that there were some differences between the methods for a small number of individuals. Because a minimal clinically important difference (MCID) has not been established for the SSQ12, it is not possible to establish the impact of such small differences.

Consistent with earlier research, the results of the current study showed that the administration method had no significant interactions with subscales, sex, education, or presentation order. Thus, the small effect of the administration method on SSQ12 scores did not depend on the order or demographic characteristics. The overlapping confidence intervals, high internal consistency, and correlations indicated good agreement between the methods, suggesting that such a small difference in scores between test modalities is unlikely to have a clinical impact. The ICC values revealed good-to-excellent levels of agreement between the administration formats (speech, 0.88; spatial, 0.84; qualities, 0.66; overall, 0.93). For comparison, previously reported test-retest reliability analysis for the Spanish SSQ12 interview format in hearing-impaired individuals yielded an ICC of 0.79 (95% CI 0.50–0.91) for overall scores, classified as fair to excellent [21]. The agreement observed in this study for the overall score (ICC = 0.93) exceeded the benchmark.

In this study, the ICC values show high agreement between the administration formats, but the test-retest variation of the scores of the SSQ12 at different time points was not specifically investigated. Further studies might investigate the consistency of self-reported listening difficulties across different testing times to confirm that SSQ12 is valid for use in different assessment settings.

The SSQ12 can differentiate between people with normal hearing and hearing-impaired listeners (Table 3), supporting its potential use as a screening tool in settings where access to audiological assessments is limited, such as general practitioner clinics and community centers. The high AUC value indicates that the SSQ12 questionnaire can effectively differentiate between hearing conditions, similar to other self-reported hearing questionnaires used for screening purposes [36].

Using an approach similar to that of Cañete et al. [21] to determine a recommended cutoff score ($N = 150$), we observed differences primarily in sensitivity when slightly different cutoff values were used between the studies. In the current study, a cutoff score of ≤8.0 optimized sensitivity (80%) and specificity (75.6%) using the Youden Index, whereas Cañete et al. [21] reported sensitivity and specificity values of 87 and 76%, respectively, at a cutoff of ≤8.5 for the interview format. These differences may be attributed to differences in population characteristics, as in previous reports, similar populations (e.g., individuals with normal hearing) from different countries showed differing SSQ12 scores [21]. Cutoff scores should be determined for different populations or regions, considering demographic factors and cultural contexts, to obtain an appropriate cutoff value that can be used as a screening criterion for a specific context. Furthermore, it is important to consider that sensitivity and specificity should be based on the purpose of the evaluation, population characteristics (including differences in prevalence or severity of the hearing impairment), and the impact on decision-making (e.g., the weighting of false-positive versus false-negative outcomes) [37].

Clinical applications and considerations

Overall, the results indicate that both the methods are interchangeable. This provides clinicians with the flexibility to choose the most appropriate method according to the patient's needs or circumstances. This will be particularly relevant in conditions where face-face interactions are limited, such as when remote follow-ups are required.

Despite the potential benefits of the SSQ12 online version, during the study the researchers noted during the interview that some participants faced difficulties with some SSQ12 items and clarification from the clinicians was needed. For instance, some items in the Qualities subscale required clarification, for instance, for item 9, which refers to the ability to segregate sounds ("When you hear more than one sound at a time, do you have the impression that it seems like a single jumbled sound?"), some participants required clarification. For the Spanish SSQ12 version [21] administered here, the term "jumbled sounds" was translated as "sonido único" (single sound) to make it more familiar to the patient. Access to a clinician who could provide additional explanations may account for the better results (less disability and more reliable responses) for this item administered in the interview format. Similarly, item 10 assesses the ability to identify sounds ("When you listen to music, can you make out which instruments are playing?") Some participants said that they did not have musical experience or training, so it was difficult to give the names of the musical instruments (note that the question did not require people to name musical instruments). Lastly, some participants had difficulties answering questions from the speech subscale because they reported that the situation presented in the item was not exactly as they had experienced. For example, Item 1 ("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?"), some people commented that they had not experienced this specific situation, here the clinicians should provide additional context for the question, as it is applied to similar listening situations, for instance, "news on TV" could be replaced by "a TV show." For these items, the researchers administering the SSQ in the interview format were able to provide clarification to address these concerns during the assessment, a situation in which online delivery was not possible, as conducted

in the current study (with no additional explanations provided). Consistent with this, Singh and Pichora-Fuller [15] noted that, during an interview the clinician can provide clarification and contextual guidance; in the online method, as in the present study, respondents have to read and understand each item without the possibility of asking for clarification, especially for items where the wording may be more problematic such as the three items noted here that resulted in the most patient queries.

Limitations and future research

It was not possible to rule out the audiologist factor. Three audiologists collected the data, and each was responsible for both the interview and the online administration of the same participants, ensuring consistency within individuals. However, despite standardized training and instructions, differences in how audiologists addressed participants' questions or provided clarifications may have introduced some variability. Since each participant interacted with only one audiologist, intra-individual consistency was maintained, but we did not assess whether differences between interviewers influenced the SSQ12 scores across participants. Future research could investigate whether inter-clinician variability affects responses to the interview format. A competent interviewer can potentially clarify the listening context in the SSQ. However, it is important to ensure that any clarification aligns with the intended use of an instrument. This will require further investigation in future studies to determine how to minimize the interviewer variability. In addition, because of the COVID-19 pandemic, some interviews were not face-to-face (in person); it is possible that online interviewing could have affected these responses. However, for both online and in-person interviews, the audiologist provided face-to-face assistance, which is unlikely to have significantly influenced the results.

While averaging SSQ12 scores may help reduce individual fluctuations between administration methods, it does not necessarily minimize the overall variability in the sample. This should be considered when interpreting the findings, and future studies should explore the sources of variability in different populations.

Finally, there is currently no consensus on meaningful differences in SSQ12 scores; therefore, it would be useful to determine meaningful clinical differences to determine minimal clinically important differences in future research. This would help clinicians to interpret SSQ12 changes more reliably to determine the appropriate diagnostic or intervention approach.

Conclusions

The administration method has an impact on the SSQ12 scores; however, the difference is unlikely to be clinically significant. Therefore, these methods can be considered interchangeable. This gives clinicians the flexibility to select a more suitable format according to patient needs. SSQ12 is a reliable tool for discriminating between normal and hearing-impaired listeners.

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