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Original Article

Development of the Listening Self-Efficacy Questionnaire (LSEQ)

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Abstract

Objective: Listening self-efficacy refers to the beliefs, or confidence, that listeners have in their capability to successfully listen in specific situations, which may influence audiologic rehabilitation outcomes. The objective of this study was to develop and validate the *Listening Self-Efficacy Questionnaire* (LSEQ), which quantifies listening self-efficacy in a variety of situations where the goal of the listener is to understand speech. *Study sample*: Older listeners with hearing loss (N = 169) participated in the study. *Design*: A factor analysis showed that the LSEQ has three subscales, with beliefs about listening capabilities relating to the following situations: (1) dialogue in quiet, (2) focusing attention on a single source, and (3) complex auditory scenes. Internal consistency reliability was excellent (Chronbach's $\alpha > .80$). *Results*: The validity of the LSEQ was demonstrated by comparing the LSEQ scores to audiologic measures, responses on questionnaires, and to the scores for reference groups of younger and older listeners with normal hearing. *Conclusion*: The findings indicate that the LSEQ is a valid and reliable measure of listening self-efficacy with good potential for use in clinical and research settings.

Sumario

Objetivo: La auto-eficacia para escuchar se refiere a la convicción o confianza que el sujeto tenga sobre su capacidad de escuchar exitosamente en situaciones específicas, las cuáles pueden influir los resultados de una rehabilitación audiológica. El propósito de este estudio fue desarrollar y validar un *cuestionario de auto-eficacia para escuchar* (LSEQ), que cuantifica la auto-eficacia para escuchar en una variedad de situaciones, donde la meta es entender lenguaje. *Muestra del estudio*: Participaron en el estudio sujetos mayores con hipoacusia (n = 169). *Diseño*: Un análisis factorial mostró que el LSEQ tiene tres sub-escalas, con relación a capacidades para escuchar en la siguientes situaciones: (1) diálogo en silencio, (2) concentrando la atención en un fuente única, y (3) escenarios auditivos complejos. La confiabilidad y la consistencia interna fue excelente (Chronbach $\alpha > .80$). *Resultados*: La validez del LSEQ fue demostrada comparando las puntuaciones con las mediciones audiológicas, con las respuestas de cuestionarios, y con las puntuaciones para grupos de referencia de personas jóvenes y viejas con audición normal. *Conclusión*: Los hallazgos indican que el LSEQ es una medida válida y confiable de auto-eficacia para escuchar con un buen potencial para utilizarse en el contexto clínico y de investigación.

Key Words: Self-efficacy; Confidence; Age; Speech perception; Hearing loss; Listening in noise; Audiologic rehabilitation; Questionnaire; Self-report

Older listeners with hearing loss often have difficulty understanding conversation in daily life situations, which leads to communication problems and reduced involvement in social interactions (e.g. Ventry & Weinstein, 1983; Noble & Hétu, 1994). A frequent goal of audiologic rehabilitation is to improve speech perception for listeners with hearing loss, which most often is accomplished through the provision of hearing aids (e.g. Stephens & Hétu, 1991; Noh et al, 1994). Hearing aids can improve the audibility of speech signals, but unfortunately even sophisticated modern hearing aids cannot restore all aspects of auditory function to normal (Edwards, 2007). In a medical model of practice, usually the key focus in rehabilitative audiology is on the restoration of audibility. In an ecological rehabilitation model, however, the focus is not only on optimizing sensory input, but also on improving communicative interactions within the constraints of given environments and a given set of internal variables (Noble, 1983; Noble & Hétu, 1994; Stephens, 1997; Borg, 2000, 2003; Borg et al, 2002, 2008). Self-efficacy, or 'beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments' (Bandura, 1997, p. 3), may be an internal variable which can influence the success of rehabilitation.

In contrast to omnibus traits such as self-confidence or self-esteem, self-efficacy pertains to a set of actions that need to be planned and performed in order to accomplish a specific behavior. Listening to speech, diabetes management, and public speaking are all examples of different domains of activity. Because self-efficacy is domain-specific, an individual could have high self-efficacy in one domain and low self-efficacy in a different domain. Consequently, self-efficacy would need to be measured for each specific domain. Furthermore, because there are individual differences in the degree to which self-efficacy corresponds to actual performance, self-efficacy must be measured for individuals and it cannot be predicted from measures of actual performance. The purpose of the present study was to develop

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Abbreviations

APHAB	Abbreviated Profile of Hearing Aid Benefit
CVI	Content Validity Index
HFPTA	High-frequency pure-tone average
HHIE	Hearing Handicap Inventory for the Elderly
HHIE-S	Hearing Handicap Inventory for the Elderly – Screening Version
LSEQ	Listening Self-Efficacy Questionnaire
NU No. 6	Northwestern University Auditory Test Number 6
PTA	Pure-tone average
S/N	Signal-to-noise ratio
WIN	Words-In-Noise test

and validate a questionnaire to quantify *listening self-efficacy*, or the beliefs (i.e. confidence) listeners have in their capabilities to plan and execute the actions needed to understand speech in a variety of listening situations.

Individuals with high self-efficacy for a particular behavior tend to put forth greater effort in achieving the behavior, persevere when difficulties arise or failures occur, have self-aiding thoughts for achieving the behavior, and cope better with emotional, social, and environmental demands surrounding the behavior (Bandura, 1997). According to Bandura (1997), individuals make self-efficacy judgments based on four sources of information that include (1) mastery experience, (2) verbal persuasion, (3) vicarious experience, and (4) physiologic and affective states. When individuals perform a task or skill, they make self-efficacy judgments based on how well they believe that they have mastered the task or skill. For example, in a difficult listening situation, such as following a conversation in a group setting, regardless of how well the conversation was actually understood, individuals may judge their self-efficacy as higher or lower depending on how frequently they made requests for repetition. Verbal persuasion can influence individuals' judgments of self-efficacy depending on whether or not significant others express faith in their capabilities. For example, if a spouse expresses faith in the capabilities of her husband with hearing loss to be able to follow conversation at a cocktail party, then his self-efficacy is likely to be high compared to the husband of a spouse who tells him that he will not be capable of following the conversation at the party. Vicarious experience provides another source of information that individuals use to judge self-efficacy when they observe the apparent success of others performing a task. For example, if the husband with hearing loss observed a peer with hearing loss communicate successfully in a noisy group situation, then he will likely judge his own capabilities for communicating in that situation as higher compared to if he had observed his peer struggle. Lastly, individuals interpret their physiologic and affective states, such as anxiety levels, stress, and physical comfort, while performing a task or skill when forming self-efficacy judgments. For example, if an individual experiences distress while communicating in a noisy group setting, then self-efficacy may be lower than if the situation was not stressful.

Numerous studies have demonstrated that domain-specific self-efficacy plays an important role in the successful management of a variety of chronic health conditions. For example, patients with high self-efficacy for managing diabetes have more positive outcomes, higher health-related quality of life, increased compliance with rehabilitation recommendations, and better long-term maintenance of the modified behavior compared to patients with low self-efficacy (e.g. Bandura, 1997; van der Bijl & Shortridge-Baggett, 2001; Plack et al, 2010). In general, rehabilitation approaches that incorporate methods for increasing self-efficacy for the actions required to achieve a target behavior have been found to produce better outcomes, particularly when the patient is learning a new set of skills. There is significant potential for self-efficacy enhancing techniques to be used by audiologists to increase the self-efficacy levels of patients at various stages of the rehabilitative process (for a review, see Smith & West, 2006).

Older listeners with hearing loss must adopt a number of new skills to be planned and performed in order to maximize communication. Such skills may be related to hearing-aid use, implementing communication strategies, assertiveness, etc. Research focusing on self-efficacy related to particular communication-related capabilities is emerging, but is still limited. In one study, Jennings (2005) examined the self-efficacy of older listeners who attended group audiologic rehabilitation programs designed to improve strategies for managing specific communication situations (i.e. *self-efficacy for communication management*). The results showed that self-efficacy for situational management improved with group rehabilitation, particularly for those who had medium-to-high self-efficacy levels initially, and that higher levels of self-efficacy for situation management were related to higher reports of daily hearing-aid use. In another study of *hearing-aid self-efficacy*, new hearing-aid users (n = 29) reported increased self-efficacy for using a hearing aid after only one month of hearing-aid experience, with the most dramatic improvements reported specifically in self-efficacy areas related to handling skills (e.g. insertion/removal, care, volume control, troubleshooting) and learning to use a hearing aid (West & Smith, 2007). These encouraging results from attempts to relate self-efficacy to certain aspects of audiologic rehabilitation suggest that it is worthwhile to extend the concept of self-efficacy to listening as another relevant domain addressed in audiologic rehabilitation.

Several questionnaires are available to assess self-reported difficulty in various listening situations and benefit from hearing aids, but these do not specifically target the *beliefs* that individuals have in their capabilities for listening in a given situation given their current skills. The critical difference is that most existing self-report instruments used by audiologists have been developed to measure how individuals rate their ability to perform by asking questions such as 'how much?' or 'how often?', whereas a self-efficacy instrument would measure the confidence of individuals in their current capabilities by asking questions such as 'how certain are you?' or 'how confident are you?' A couple of self-efficacy questionnaires are available to assess self-efficacy related to communication strategies training (e.g. Self-Efficacy for Situational Management Questionnaire; Jennings, 2005), or hearing-aid intervention (e.g. Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids: West & Smith, 2007); however, they may be too specific to measure self-efficacy for listening to speech without intervention or for interventions not specifically related to hearing-aid orientation and communication strategies training.

The development of the *Listening Self-Efficacy Questionnaire* (LSEQ) was accomplished in three phases. In Phase 1, the focus was on constructing the LSEQ itself and assessing the content validity of the items. In Phase 2, the basic psychometric properties (i.e. construct validity and internal reliability) of the initial LSEQ were assessed in a group of older listeners with hearing loss. In Phase 3, the LSEQ was validated further using younger and older adults with good hearing as reference groups.

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Phase 1: Development of the LSEQ items

The intended content of the questionnaire was listening to speech in common, fairly generic listening situations and in specific listening situations presenting various degrees of challenge. The content of the questionnaire items was determined by reviewing existing questionnaires to identify common sources of listening difficulties. These questionnaires included the Abbreviated Profile of Hearing Aid Benefit (APHAB; Cox & Alexander, 1995), Hearing Handicap Inventory for the Elderly (HHIE; Ventry & Weinstein, 1982), Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA; West & Smith, 2007), and the Speech, Spatial, and Qualities of hearing questionnaire (SSQ; Gatehouse & Noble, 2004). Additional content was identified based on common complaints reported by typical patients seen in the audiology clinics served by the authors.

After identifying several situations in which listeners with hearing loss may report listening to be difficult, the listening self-efficacy questionnaire (LSEQ) was constructed. According to the guidelines for developing self-efficacy questionnaires established by Bandura in his seminal writings on self-efficacy in social psychology theory (2001), items for self-efficacy questionnaires should be written in a manner which assesses the judgments individuals make about their current capabilities regarding domain-specific tasks or behaviors. First, Bandura argues that the assessment of current capabilities is accomplished when items are phrased using 'I can' statements rather than 'I will' statements, because the latter assess future expectations about capabilities rather than assessing current capabilities. Second, the items should only target one task or behavior at a time because individuals can have varying levels of self-efficacy for different behaviors simultaneously. Finally, the questionnaire items should describe varying levels of challenge in order to determine how self-efficacy varies over a range of situations. Following these suggestions, 33 items were selected that targeted listening capabilities for speech in quiet, and for speech in more complex listening situations.

Bandura also suggested the use of a response scale that offers respondents a range over which to judge their level of self-efficacy, and is uni-directional (no negative values). Accordingly, after each LSEQ item, listeners are asked to judge 'How certain are you that you can do this *right now*?' on a 0–100% response scale that is divided into 10-unit intervals. A level of 0% corresponds to 'cannot do this at all,' 50% corresponds to 'moderately certain I can do this,' and 100% corresponds to 'I am certain I can do this.' Examples of these responses were provided in the LSEQ instructions. Practice items not related to listening self-efficacy were provided to offer respondents an opportunity to practice making self-efficacy judgments.

Phase 1 of the LSEQ development was concluded by evaluating the content validity of the initial 33 items. Content validity is the extent to which the items represent the aspects of the domain of interest. In this case, items on the LSEQ should represent a range of situations in which older listeners with hearing loss listen to speech.

The content validity was evaluated using the content validity index (CVI: DeVellis, 1991; Polit & Hungler, 1999) and followed the approach used by Yaghmaie (2003). Accordingly, content experts were asked to judge each LSEQ item using a 4-point response scale for the following four content and stylistic areas:

(1) Relevance, or the degree to which the item is relevant to listening self-efficacy (1 = not relevant, to 4 = very relevant),
(2) Clarity, or how clearly the item is written (1 = not clear, to 4 = very clear),
(3) Simplicity, or how simple the item is to understand (1 = not simple, to 4 = very simple), and
(4) Ambiguity, or how clearly the meaning of the item is conveyed (1 = doubtful, to 4 = meaning is clear).

The CVI is calculated the same way for each of the four areas (re: relevance, clarity, simplicity, and ambiguity) for each item as the proportion of experts who provided a judgment rating score of 3 or 4. On any item, if the proportion of experts who judged any one of the four areas falls below .75, then that item should be revised or excluded from the questionnaire. A minimum of three to five content experts is recommended when determining the CVI (Lynn, 1986).

Ten experts (five clinicians and five researchers) were invited to judge the content of the LSEQ. The experts were informed about the goal of the LSEQ and were asked to judge each LSEQ item in terms of the four areas above: relevance, clarity, simplicity, and ambiguity. They also were asked to list any other listening situations that they believed were lacking, and to offer comments about the questionnaire. Eight of the 10 experts anonymously responded. The average CVI value for each area was as follows: (1) relevance = .96, (2) clarity = .88, (3) simplicity = .90, and (4) ambiguity = .84. Because CVIs were proportions of .75 or higher, suggesting good content validity, no item was revised or removed from the initial LSEQ. Only one expert offered a comment, stating that the content of the LSEQ appeared to be 'no different from the APHAB.'

Phase 2: Psychometric properties

The purpose of this phase of the study was to evaluate the psychometric properties of the LSEQ for a group of older listeners with untreated sensorineural hearing loss. The construct validity of the LSEQ was evaluated to determine how well the items corroborate our theoretical model of listening self-efficacy. Based on our model, we predicted that the items would be characterized as relating to (1) listening situations that would pose minimal difficulty for speech understanding, and (2) listening situations that would pose considerable difficulty for speech understanding (i.e. there would most likely be only two subscales). Furthermore, construct validity was examined by comparing responses on the LSEQ to audiometric test results and results obtained using previously published self-report measures. In addition, the reliability of the LSEQ was evaluated to determine how consistently the items assessed listening self-efficacy and by evaluating the inter-item and item-total correlations.

Methods

Participants

A total of 169 participants (166 males; including 155 veterans) were recruited primarily from the audiology clinic at the James H. Quillen Veterans Affairs Medical Center, Mountain Home, Tennessee, but also from the local Johnson City, Tennessee community. All had symmetrical sensorineural hearing loss (i.e. no more than two adjacent frequencies with > 15 dB interaural difference) and no prior hearing-aid experience. The mean age of the listeners was 65.9 years (SD = 6.7; range 55–85). They were all native American English speakers and had no self-reported co-morbid conditions that would preclude them from completing the LSEQ independently (e.g. blindness, neurological conditions, etc.).

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Materials and Procedures

The participants completed the routine audiologic evaluation consisting of otoscopy, pure-tone audiometry (American National Standards Institutes, 2004), word-recognition testing in quiet and in noise, and self-report assessment using the HHIE-screening version (HHIE-S; Venty & Weinstein, 1983) and two self-report questions related to understanding conversation in quiet and in noise (quiet and noise questions).

Word-recognition in quiet was assessed using the Northwestern University Auditory Test Number 6 (NU No. 6; Tillman & Carhart, 1966), with word lists presented in each ear at two levels determined based on the pure-tone average (PTA; re: 500, 1000, and 2000 Hz). NU No. 6 half-lists were presented at 80 and 104 dB SPL for ears with PTAs less than 40 dB HL and at 90 and 114 dB SPL for ears with PTAs between 40 and 60 dB HL. Word-recognition performance in noise was measured using lists from the Words-in-Noise (WIN) test (Wilson, 2003; Wilson et al, 2003; Wilson & Burks, 2005). The WIN test consists of two 35-word lists in which words from the NU No. 6 test are presented in a six-talker multi-talker babble at seven signal-to-noise ratios (S/Ns), ranging from 24 to 0 dB S/N, in 4-dB decrements, with the level of the babble held constant and the level of the words varied. The words in both tests are spoken by the same female speaker (Department of Veterans Affairs, 2006). A different 35-word list of the WIN test was presented in each ear and the presentation level depended upon the aforementioned PTAs. For participants with PTAs less than 40 dB HL, the babble of the WIN was presented at 80 dB SPL and the words were presented from 104 to 80 dB SPL in 4-dB decrements; for participants with PTAs from 40 to 60 dB HL, the WIN babble and words were presented 10 dB higher than the levels used for participants with lower PTAs. The word-recognition materials were reproduced on compact disc and played using a compact disc player (Sony Model CDP-437) routed through an audiometer (Grason-Stadler Model 61) to insert earphones (EAR 3A). All audiometric and word-recognition testing was conducted while the participant was seated in a double-walled sound-attenuating booth. All testing was performed by audiologists who were state-licensed and certified by the American Speech-Language Hearing Association.

The self-assessment portion of the routing audiologic protocol occurred after pure-tone threshold and word-recognition testing was completed. The HHIE-S was administered by pen-and-paper after the instructions were read aloud to the participant. The HHIE-S consists of 10 items that assess the social and emotional handicap secondary to hearing loss. Scores can range from 0 (no handicap) to 40 (significant handicap). Next, two self-report questions, one about listening in quiet and one about listening in noise, were asked in the following order as part of our routine audiologic protocol: 'When listening to a conversation in quiet (without hearing aids), how difficult is it for you to understand what the speaker is saying?' and 'When listening to a conversation in a noisy background (without hearing aids), how difficult is it for you to understand what the speaker is saying?' The quiet and noise questions were provided in written form for the participant while the study audiologist read the questions aloud one at a time. Listeners were asked to rate their difficulty on a 1–10 scale, in 1-unit intervals, in which 1 = no difficulty and 10 = extreme difficulty.

For the experimental portion of this study, the participants completed the LSEQ and the unaided portion of the APHAB in pen-and-paper format. The APHAB consists of 24 items that assess auditory and speech abilities in the following areas: (1) ease of communication, (2) background noise, (3) reverberation, and (4) aversiveness to sound. The results are scored on a 1–99% scale and higher scores are indicative of greater self-perceived difficulties. The order of the questionnaires was counterbalanced so that half of the participants received the LSEQ first and the other half received the APHAB first. Prior to completing each questionnaire, the study audiologist read the instructions aloud to the participant and she remained available to answer any questions as the participant completed the questionnaires. The study procedures were approved by the local Institutional Review Board and by the Veterans Affairs Research and Development Committee, and participants provided informed consent prior to commencing the research.

Results and Discussion

Audiologic evaluation

The mean results of the pure-tone audiologic evaluation, word-recognition testing in quiet, and word-recognition testing in noise (WIN test) were similar in both ears. Thus, the results were averaged across both ears when these measures were used in later analyses. The mean audiogram averaged across the ears of the participants is illustrated in Figure 1 (circles). The mean word-recognition scores in quiet at the lower (80 or 90 dB SPL) and higher (104 or 114 dB SPL) presentation levels respectively were 75.7% (SD = 20.0) and 83.2% (SD = 14.1) for the left ear, and 78.1% (SD = 20.6) and 84.9% (SD = 12.6) for the right ear. In later analyses, the mean performance for the higher presentation level was used because it was better than the mean performance at the lower presentation level. The mean thresholds for the WIN were 13.4 dB S/N (SD = 4.0) for the left ear, and 12.7 dB S/N (SD = 4.1) for the right ear when the SNR corresponding to the 50% correct point was calculated using the Spearman-Kärber equation (Finny, 1952). Figure 2 illustrates the mean psychometric function for the performance on the WIN test averaged across ears, with the filled symbols representing the mean

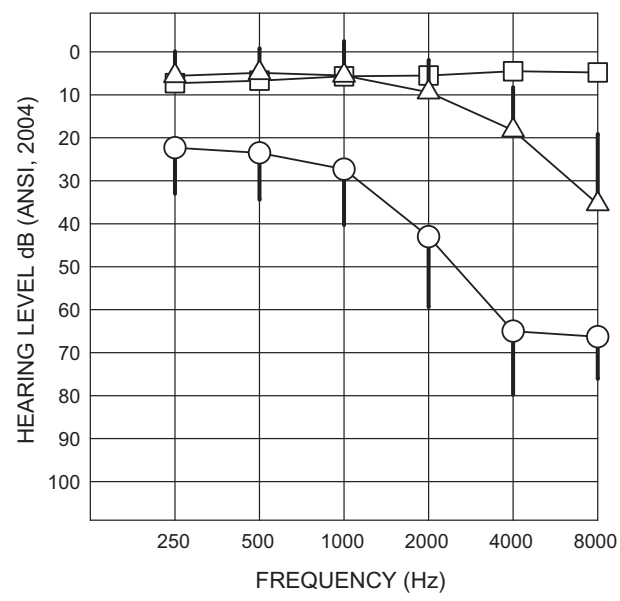

Figure 1. The mean audiogram (averaged across ears) of the older listeners with hearing loss from Phase 2 (circles) are illustrated along with the young listeners with normal hearing (squares), and older listeners with normal hearing through 3000 Hz (triangles) from Phase 3. The error bars represent one standard deviation.

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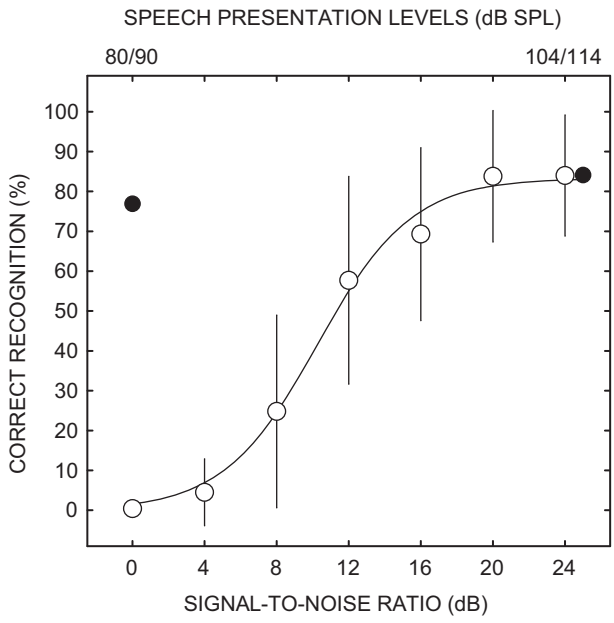

Figure 2. Word-recognition performance (% correct) is listed as a function of signal-to-noise ratio (S/N) and speech presentation level for the lower and higher presentation levels, respectively. The filled symbols represent the mean word-recognition performances in quiet and the open symbols represent word-recognition performances in noise (averaged across ears). The error bars represent one standard deviation.

word-recognition performance in quiet at the two presentation levels, which correspond to the same presentation levels for the words presented at 24 and 0 dB S/N, respectively. These WIN results are similar to those found previously for older listeners with similar degrees of hearing (Wilson et al, 2007) and suggest that overall they need a relatively favorable SNR (approximately 13.0 dB S/N) to achieve 50% correct performance, compared to the SNR required for younger listeners with normal hearing to achieve the same level of performance (< 6.0 dB S/N; Wilson et al, 2003).

Construct validity

Factor analyses often are used to explore the factor structure or the subscale structure of questionnaires. Such analyses facilitate the evaluation of the construct validity of the questionnaire, or how well the observed item responses reflect the target construct; in our case, listening self-efficacy. A Kaiser-Meyer-Olkin test was performed and resulted in a value of .96, which confirmed that the sample size was adequate for conducting a factor analysis (Kaiser, 1970, 1974; Hutcheson & Sofroniou, 1999). The preliminary evaluation of the subscale structure of the LSEQ was explored using a principal components factor analysis with varimax rotation. Only factors with eigenvalues greater than 1.0 were extracted. Only factors that explained at least 5% of the variance and only items with factor loading values .50 or greater on a single factor were considered. Items that failed to load on a single factor or items that loaded on more than one factor were deleted. Based on these criteria, 15 items were deleted from the initial LSEQ.

The factor analysis was repeated with the remaining 18 items and revealed a three-factor solution that explained a total of 74.5% of the variance. A scree plot test also confirmed the three-factor solution. Factor 1, *Directed Listening*, consisted of eight items related to situations in which the listener focused attention on a single source of speech (31.0% variance explained). Factor 2, *Complex Listening*, consisted of eight items related to situations in which speech was presented in difficult situations such as in competing noise, or at a distance (30.5% variance explained). Factor 3, *Dialogue in Quiet*, consisted of two items related to listening to one-on-one conversations in quiet (13.0% variance explained). The factor loading value for each item is listed in Table 1 along with the item means and standard deviations. Overall, the factor loading values were high (mean = .76, range .66–.84), suggesting that the items making up the factors are highly related to each other.

Also listed in Table 1 are the mean subscale scores (% levels of self-efficacy) and standard deviations. The mean scores for the Directed Listening and the Dialogue in Quiet subscales were about 70%; whereas, the mean score for the Complex Listening subscale was 39%. A repeated measures analysis of variance with subscale scores as the within-subject variable showed a main effect for subscale score, $F(2, 336) = 347.9$, $p < .001$. Post-hoc analyses using Bonferroni adjustments for multiple comparisons revealed that the mean scores on the Directed Listening and the Dialogue in Quiet subscales were not significantly different from each other, but both were significantly better than the mean score for the Complex Listening subscale. These results suggest that older listeners with untreated sensorineural hearing loss judged their listening self-efficacy to be moderately high for dialogue in quiet or directed listening situations, but low for more complex situations.

Additional analyses were conducted to further establish the construct validity of the LSEQ. Recall that an expert reviewer from Phase 1 of this project commented that the content of the LSEQ seemed similar to that of the APHAB. Although there may be overlap in the listening situations between the two questionnaires, the two questionnaires are intended to assess different constructs. The APHAB is intended to assess how often one has various difficulties listening whereas the LSEQ aims to assess how confident one is regarding current capabilities to effectively understand speech in the given listening situation. If the two constructs (frequency of difficulty vs. self-efficacy) are different, then a factor analysis should reveal that LSEQ items and APHAB items load on different factors. A principal components factor analysis with varimax rotation was repeated with the 18 LSEQ items and the 24 APHAB items, resulting in an 8-factor solution explaining 69.0% of the variance. The LSEQ items loaded on factors 1 (Complex Listening), 2 (Directed Listening) and 7 (Dialogue in Quiet), whereas the APHAB items loaded on the remaining five factors. Importantly, the LSEQ items and the APHAB items loaded on different factors, suggesting that the items making up the LSEQ and APHAB subscales are independent of each other. These findings confirm that the LSEQ and APHAB are not measuring the same construct.

Despite the confirmation that the LSEQ and APHAB *items* make up independent factors, and thus measure different theoretical constructs, the information gleaned from the two questionnaires should nevertheless be somewhat related. For example, the frequency of perceived difficulty for listeners in the situation 'When I am having a quiet conversation with my doctor in an examination room' (APHAB) should be related to the self-efficacy listeners have in their capabilities to understand speech in 'One-on-one conversation while at a medical appointment' (LSEQ). Pearson *r* correlations were performed using the LSEQ and APHAB subscale means to confirm the expected relations among the questionnaire subscales. The results are summarized in Table 2. As expected, there were moderate (i.e.

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Table 1. The results of the principal components analysis (factor-loading values for each item, percent variance explained for each scale), mean item score (and standard deviation), and scale scores are listed.

Item #	Item topic	Factor loading	Mean (%)	SD
Directed listening (31.0%)				
7	I can understand one-on-one conversation while at a medical appointment.	.72	71.6	21.4
16	I can understand the TV.	.74	64.7	24.1
22	I can understand a lecture in a small, quiet room.	.79	71.0	22.6
23	I can understand a lecture in a large, quiet room.	.69	63.4	23.9
24	I can understand an announcement over a loudspeaker in a quiet place.	.66	68.1	26.4
26	I can understand conversation spoken by a woman.	.81	66.2	24.1
27	I can understand conversation spoken by a man.	.83	71.8	19.8
30	I can understand conversation spoken by a person I know well, such as a close friend or family member.	.84	66.8	22.9
	Subscale summary	.76	67.9	19.5
Complex listening (30.5%)				
3	I can understand one-on-one conversation with continuous background noise, such as a fan.	.68	50.8	24.4
4	I can understand one-on-one conversation when a person is speaking from another part of the house.	.73	36.1	22.9
5	I can understand one-on-one conversation when several conversations are going on at the same time.	.81	33.0	21.9
6	I can understand one-on-one conversation while the speaker is doing dishes and facing away from me.	.69	42.1	24.8
10	I can understand conversation on a cell phone while in a noisy background.	.73	41.2	24.5
17	I can understand group conversations in a noisy background.	.81	36.2	23.4
25	I can understand an announcement over a loudspeaker in a noisy place, such as a sporting event.	.80	42.3	25.8
29	I can understand conversation when someone speaks in a whisper.	.76	30.6	24.2
	Subscale summary	.75	39.0	20.2
Dialogue quiet (13.0%)				
1	I can understand one-on-one conversation in a quiet place.	.79	76.5	20.4
2	I can understand one-on-one conversation in a quiet place when unable to see the speaker's face.	.79	62.2	24.7
	Subscale Summary	.79	69.3	21.0
	Total Scale Summary		55.2	18.0

r = .40–.60) and marked (i.e. r = .60–.80), negative correlations among the LSEQ subscales and the three APHAB communication subscales (ease of communication, background noise, reverberation subscales) (for categorization of correlation strength, see Franzblau, 1958). These findings suggest that greater perceived difficulty is associated with lower self-efficacy. Not surprisingly, the aversiveness to sound APHAB subscale was not strongly related (i.e. $r < .20$) to the LSEQ subscales, presumably because aversion to loud sound should not be related to listening self-efficacy.

Further examination of the construct validity was accomplished by comparing the relations among the LSEQ scales and the audiologic and remaining self-report measures. We hypothesized that high listening self-efficacy would be correlated with good performance on audiometric and word-recognition measures, and with fewer self-reported hearing difficulties. Pearson r correlations were obtained among the LSEQ scale scores and the following measures: hearing sensitivity (traditional PTA [re: 500, 1000, and 2000 Hz] and high-frequency PTA, HFPTA, [re: 1000, 2000, and 4000 Hz]); word recognition accuracy in quiet (NU No. 6 scores at the higher presentation level); word recognition accuracy on the WIN test (50% points); hearing handicap (HHIE-S total score); and self-perceived hearing difficulty in quiet (quiet question), and in noise (noise question). The correlations are listed in Table 3. The results showed that there were significant ($p < .001$) and fair (r = .20–.40) to moderate (r = .40–.60) correlations among the LSEQ subscales and the measures from the audiologic evaluation. The correlations among listening self-efficacy and audiometric (PTA, HFPTA) and word-recognition performance measures (NU No. 6, WIN) were fair. Directed Listening, Complex Listening, and total LSEQ were related moderately to self-perceived hearing handicap (HHIE-S) and self-perceived difficulty in noise (noise question) while only exhibiting a fair correlation to self-perceived difficulty in quiet (quiet question), whereas the opposite pattern was found for Dialogue in Quiet which was correlated moderately to self-perceived difficulty in quiet (quiet question) but only had fair correlations with hearing handicap (HHIE-S) and self-perceived difficulty in noise. Overall, these findings revealed

Table 2. The Pearson r correlations among the LSEQ scales and the APHAB subscale scores.

	Dialogue in quiet	*Directed listening*	*Complex listening*	*Total scale*
APHAB subscales				
Ease of communication (EC)	−.57	−.57	−.48	−.59
Background noise (BN)	−.53	−.57	−.73	−.71
Reverberation (RV)	−.55	−.62	−.61	−.68
Aversiveness (AV)	$-.14^{Ns}$	$-.21^{*}$	$-.25^{*}$	$-.24^{*}$

Note: Ns = non-significant correlation. * = significant at the .01 level (two-tailed). All other correlations were significant at the .001 level (two-tailed).

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Table 3. Pearson r correlations among the LSEQ scales and measures from the audiologic evaluation.

	Dialogue in quiet	*Directed listening*	*Complex listening*	*Total scale*
PTA	−.23*	−.24*	−.18**	−.24*
High frequency PTA	−.21*	−.29	−.25	−.29
Word recognition in quiet	.27	.29	.34	.35
WIN	−.31	−.38	−.36	−.40
HHIE-S	−.38	−.45	−.55	−.54
Quiet question	−.45	−.36	−.30	−.38
Noise question	−.32	−.46	−.56	−.54

Note: * = significant at the .01 level (two-tailed). ** = significant at the .02 level (two-tailed). All other correlations were significant at the .001 level (two-tailed).

that self-efficacy levels may be related more to *perceived* difficulties in given listening situations and hearing handicap rather than to *actual* performance assessed with clinical measures of pure-tone audiometry and word recognition. These findings are consistent with previous studies demonstrating weak relations among various clinical and self-report measures (e.g. Gray & Speaks, 1978; Ventry & Weinstein, 1982; Saunders et al, 2004). It is possible that non-auditory factors, such as cognition, attention, supportive context, etc. may contribute to various perceptions of performance in real-world listening situations (Pichora-Fuller & Singh, 2006).

Reliability

The internal consistency reliability, or how consistently the items measure the target construct of the scales, was measured for each of the LSEQ scales using Chronbach's α. The reliability was assessed further by evaluating the inter-item correlations, or the relations among the items that make up each subscale, and the item-total correlations, or the relation between the item score and the total subscale score. The reliability results are listed in Table 4. Overall, the internal consistency reliability of each subscale and the total scale are high (Cronbach's $\alpha > .80$), suggesting that the items making up the subscales and total scale consistently reflect that the subscale items are related. The inter-item correlations are moderate and the item-total correlations are good (at least .70), suggesting that the items making up the subscales are related and contribute to the overall scale results. Overall, the results suggest that for older listeners with sensorineural hearing loss, responses on the LSEQ consistently assess the aspects of listening self-efficacy corresponding to the subscales.

Phase 3: Further validation

The purpose of this phase of the study was to validate the LSEQ further by evaluating listening self-efficacy in a group of younger adults with normal hearing and a group of older community-living adults with normal hearing (defined as clinically normal pure-tone thresholds through 3000 Hz) in comparison to the listening self-efficacy of older listeners with hearing loss. It was of interest to include an age-matched group with normal hearing for age (ISO 7029-2000) as well as a younger normal-hearing group, given that non-auditory factors, such as cognitive factors, age, and coping (Trouillet et al, 2009), might influence listening self-efficacy. We hypothesized that listeners with normal hearing sensitivity would have higher listening self-efficacy than older listeners with sensorineural hearing loss and that younger adults would have higher self-efficacy than older adults.

Table 4. Summary of the reliability analyses for the LSEQ scales.

	Dialogue in quiet	*Directed listening*	*Complex listening*	*Total scale*
Number of items	2	8	8	18
Chronbach's α	.84	.94	.94	.96
Mean inter-item correlation	.73	.67	.67	.56
Mean item-total correlation	.73	.79	.79	.73

Method

The materials and procedures used in Phase 3 of the study were essentially the same as those used in Phase 2, including the instrumentation, except that the younger group was not administered the HHIE-S because this questionnaire is intended for older adults.

A total of 56 participants (19 male) in the younger group were recruited from East Tennessee State University and from the Johnson City, Tennessee community, and tested at the James H. Quillen VA Medical Center. No audiology students participated owing to their familiarity with the test materials and procedures. The mean age of the younger participants was 23.1 years (SD = 2.5, range 18–30). None of their pure-tone thresholds from 250 to 8000 Hz exceeded 20 dB HL in either ear. A total of 32 participants in the older group (11 men) completed the study at the University of Toronto at Mississauga. The mean age of the participants was 72.4 years (SD = 3.6, range 66–82). Although the inclusion criterion for the older listeners with normal hearing was pure-tone thresholds within normal limits through 3000 Hz, on average, they had pure-tone thresholds within normal limits through 4000 Hz. A repeated-measures analysis of variance confirmed that thresholds were interaurally symmetrical. Figure 1 illustrates the mean averaged thresholds of both ears for the younger (squares) and older (triangles) listeners with normal hearing. The mean audiogram from the older listeners with hearing loss from Phase 2 is illustrated for the purposes of comparison (circles). Table 5 lists the remaining results from the audiologic evaluation (both ears averaged) and self-report measures for all three groups. One-way analyses of variances and post-hoc tests were performed to evaluate group differences separately for each measure listed in Table 5. As seen in Figure 3 and in Table 5, the older listeners with hearing loss performed worse on the audiologic clinical measures and self-reported measures compared to the two reference groups. The two reference groups had similar performances on all measures except the WIN for which younger listeners with normal hearing performed significantly better than older listeners with normal hearing ($p = .005$).

Results and Discussion

The mean LSEQ subscale and total scores for the three groups are illustrated in Figure 3. Listening self-efficacy is higher for both groups

Table 5. Mean scores and standard deviations for the measures from the audiologic evaluation for the young listeners with normal hearing (YN), and the older listeners with normal pure-tone thresholds through 3000 Hz (ONH) from Phase 3, and the older listeners with hearing loss (OHL) from Phase 2.

	YN	*ONH*	*OHL*
Word-recognition in quiet (%)	98.6 (2.0)	95.9 (3.3)	84.1 (11.6)
WIN 50% point (dB S/N)	4.0 (1.7)	6.2 (1.1)	13.0 (3.7)
HHIE-S	–	2.3 (2.6)	23.3 (9.6)
Quiet question	1.2 (0.7)	1.6 (1.8)	3.6 (2.0)
Noise question	3.6 (1.9)	3.8 (2.6)	6.9 (2.1)

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with normal hearing compared to the group of older listeners with hearing loss, but appears to be similar for the younger and older listeners with normal hearing. All listener groups reported higher self-efficacy for the *Dialogue in Quiet* and *Directed Listening* than for the *Complex Listening* subscales. A mixed-model analysis of variance using the LSEQ subscale scores (Dialogue, Directed, and Complex) as the within-subjects variable and Group (younger with normal hearing, older with normal hearing, and older with hearing loss) as the between-subjects variable was performed to evaluate the differences in LSEQ scores within and between groups. The results revealed a main effect for Group, $F(2, 252) = 138.3$, $p < .001$, and LSEQ scale scores, $F(2.0, 493.1) = 187.6$, $p < .001$ (Greenhouse-Geisser correction). There also was a significant group by LSEQ scale interaction, $F(3.9, 493.1) = 21.3$, $p < .001$ (Greenhouse-Geisser correction). The participants judged self-efficacy levels to be similar on the Dialogue in Quiet and Directed Listening subscales, but self-efficacy levels on these two subscales were significantly higher than the self-efficacy levels reported on the Complex Listening subscale. The younger and older listeners with normal hearing, however, reported higher self-efficacy for Directed Listening than for Dialogue in Quiet; whereas, the older listeners with hearing loss reported the reverse pattern with higher self-efficacy for Dialogue in Quiet than for Directed Listening. When collapsed across subscales, the younger and older listeners with normal hearing had similar self-efficacy levels, which were significantly higher than those reported by older listeners with hearing loss. Interestingly, listeners with 'normal' hearing, regardless of age, had high levels of listening self-efficacy. The finding that older adults with good hearing seem to maintain high confidence in their speech understanding capabilities seems surprising given that numerous studies have demonstrated that younger listeners with normal hearing outperform older listeners who have good hearing for their age on various psychoacoustic and speech-in-noise measures (for a review, see Pichora-Fuller & Singh, 2006). Indeed, in the current study, the younger listeners outperformed the older listeners with normal hearing on the WIN even though they had similar scores on the LSEQ. This finding, although somewhat unexpected, may be because older adults with normal hearing are overly confident in their abilities to listen in complex conditions or they simply have poor awareness of their problems, or because deficits in communication that occur from sub-clinical age-related changes in auditory and/or cognitive processing are compensated for by expertise gained from their life-long experiences as communicators (Pichora-Fuller, 2008). Overall, these group differences further support the validity of the LSEQ and demonstrate that the LSEQ is suitable to assess listening self-efficacy in different types of listener groups.

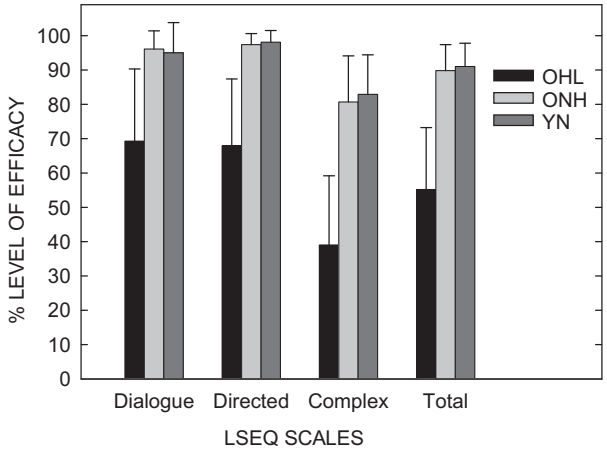

Figure 3. The mean self-efficacy levels as a function of LSEQ for each listener group. The error bars represent one standard deviation.

General Discussion

Self-efficacy questionnaires differ from traditional self-report measures because they directly assess the belief or confidence that individuals have in their current capabilities for attaining a specific activity. Listening self-efficacy may influence individuals' speech perception and spoken language comprehension during daily conversations; however, there are limited measures available to study self-efficacy in this domain (Wingfield & Tun, 2007). Through the use of the LSEQ, investigators may gain a better understanding of how self-efficacy influences speech understanding, listening behavior modification, and/or audiologic rehabilitation outcomes. A deeper understanding of the importance of listening self-efficacy may assist in refining rehabilitation models or developing audiologic rehabilitation techniques that specifically aim to increase self-efficacy.

Clinicians may find that the LSEQ is a useful clinical tool for identifying listening situations in which patients need further assistance because of low self-efficacy. By appropriately modifying the instructions to reflect the condition which the clinician is interested in assessing, the LSEQ could be administered to evaluate listening self-efficacy relative to different interventions (e.g. unaided versus aided conditions or pre- versus post-treatment for an intervention other than amplification). For example, prior to a hearing-aid fitting, the clinician could ask the patient to complete the LSEQ with reference to an unaided condition. After an initial period of hearing-aid use, an aided condition (with appropriately modified instructions) could be administered to determine whether or not the listening self-efficacy of the patient had increased to a target level (e.g. ~80% or higher for a given (sub)scale and/or item; West & Smith, 2007). If the clinician identifies area(s) in which the patient is still reporting low listening self-efficacy after an initial period of hearing-aid use, then the clinician can incorporate self-efficacy enhancing techniques to increase self-efficacy for the targeted listening situation (see Smith & West 2006 for a tutorial on these techniques) and/or offer additional treatment such as auditory training, communication strategies training, or additional technology such as an FM system. If the patient reports that listening self-efficacy is high, then the clinician can encourage the patient and reinforce the behavior change produced by the treatment so that high listening self-efficacy is maintained.

There are some limitations to this study. First, the psychometric properties of the initial LSEQ were assessed on a large group of listeners who were mostly Veterans with moderately-severe, high-frequency sensorineural hearing loss. The psychometric performance of the LSEQ in broader samples of listeners (varying in levels of hearing loss, demographic/socioeconomic backgrounds, etc.) may differ, and as such, assessment of how well the LSEQ generalizes to other samples may be warranted. Second, the final 18-item LSEQ was not evaluated on a similar large-sample of listeners with hearing loss; however, the chances that the items on the LSEQ would result in different subscales in a similar group of listeners are low given that the factor loading values were high, a large percentage of the variance was explained, and additional analyses using the final LSEQ demonstrated strong reliability and validity properties. Third, the test-retest reliability of the final LSEQ was not assessed. As a result, the sensitivity of the LSEQ to detect changes in scores has not yet been realized. Despite these limitations, the overall findings of this

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study suggest that the LSEQ shows promise as a valid and reliable measure to quantify listening self-efficacy.

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