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Robin L. West[*]
Sherri L. Smith[§]

[*]Department of Psychology, University of Florida, USA
[§]James H. Quillen Veterans Affairs Medical Center, Mountain Home, USA and Department of Communicative Disorders, East Tennessee State University, USA

Development of a hearing aid self-efficacy questionnaire

Key Words
Hearing aids
Self-efficacy
Hearing loss
Older adults
Audiologic rehabilitation

Abbreviations
dB HL: Decibels in hearing level
HHIE-S: Hearing Handicap Inventory for the Ederly-Screening
MARS-HA: Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids
VA: Veterans Affairs

Abstract
Discontinued hearing-aid use is caused by a number of factors, most of which may lead to low hearing-aid self-efficacy (i.e. low confidence in one's ability to be a successful hearing-aid user). This paper describes the development of the Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA), which was constructed in accordance with published recommendations for self-efficacy questionnaire development. The psychometric properties of the MARS-HA were evaluated with new and experienced hearing-aid users. The results revealed strong internal consistency and good test-retest reliability in both groups, with the following subscales identified both for the new users and the experienced users: (1) basic handling, (2) advanced handling, (3) adjustment to hearing aids, and (4) aided listening skills. Validity was established through the examination of expected differences based on group comparisons, training effects, and the impact of particular hearing aid features. The MARS-HA is a reliable and valid measure of hearing-aid self-efficacy and can be used to assist clinicians in identifying areas of low confidence that require additional audiologic training.

Sumario
La suspensión del uso de un auxiliar auditivo es causada por numerosos factores; de ellos la mayoría conllevan a una baja auto-eficacia con el auxiliar auditivo (i.e. baja confianza en la propia habilidad de ser un usuario eficaz de los auxiliares auditivos). Este trabajo describe el desarrollo de la medición de auto-eficacia en la rehabilitación para auxiliares auditivos (MARS-HA) que fue contraída en concordancia con las recomendaciones publicadas para el desarrollo de cuestionarios de auto-eficacia. Se evaluaron las propiedades psicométricas de MARS-HA con usuarios nuevos y experimentados de auxiliar auditivo. Los resultados revelaron una fuerte consistencia interna y una buena concordancia *test-retest* en ambos grupos, con las siguientes sub-escalas identificadas tanto para los nuevos usuarios como para los usuarios experimentados: (1) manipulación básica, (2) manipulación avanzada, (3) adaptación al auxiliar auditivo, y (4) habilidades para escuchar con amplificación. Se estableció la validez a través del examen de las diferencias esperadas, basados en grupos comparativos, en los efectos de entrenamiento y en el impacto de las características particulares del auxiliar auditivo. La medición MARS-HA de la auto-eficacia con el auxiliar auditivo es confiable y válida y puede utilizarse para ayudar a los clínicos a identificar áreas de baja estima que requieren de entrenamiento audiológico adicional.

Numerous investigations suggest that hearing-aid intervention improves the speech perception abilities and quality of life of older adults (Humes et al, 2001; McArdle et al, 2005; Mulrow et al, 1990; Mulrow et al, 1992). Despite positive hearing-aid treatment outcomes, data from several countries suggest that only about 20% of older adults with hearing impairment own hearing aids (Kochkin, 2005; Popelka et al, 1998; Smeeth et al, 2002; Stephens et al, 2001). Of more concern is that up to 30% of individuals who have hearing aids no longer use them (Gusselkoo et al, 2003; Jerger et al, 1995; Kochkin, 2000; Noe et al, 2000; Popelka et al, 1998; Smeeth et al, 2002). A variety of factors have been posited as potential reasons for lack of compliance with hearing-aid usage by older adults, including the leading reasons of poor benefit and handling difficulties (Kochkin, 2000; Meister et al, 2002a,b). Recent discussions about discontinuance of hearing-aid use have focused on the potential importance of personal beliefs or self-efficacy, that is, the confidence one has concerning the abilities to care for and to use hearing aids successfully (Smith & West, 2006a). Self-efficacy may be a key issue in discontinuance because individuals struggling with adjustment to hearing aids are likely to set aside the hearing aid if they lose confidence in their ability to resolve their adjustment problems. If this view is correct, then development of a reliable and valid methodology for assessing self-efficacy beliefs with respect to hearing aids would have considerable value. In this paper, the audiology literature on hearing-aid compliance will be considered first; then the importance of self-efficacy will be explored as a key reason for non-compliant hearing-aid use. Finally, we will describe the development of a measure of hearing-aid self-efficacy.

The most common reasons for rejecting hearing aids can be summarized into three broad categories: (1) poor benefit in various listening situations, especially background noise, (2) concerns about proper device handling such as insertion, changing the battery, volume control adjustments, etc., and (3) difficulty in adjusting to wearing the hearing aids (Brooks & Hallam, 1998; Fino et al, 1992; Kochkin, 2000; Meister et al, 2002a,b; Stephens et al, 2001; Tsuruoka et al, 2001).

First, the most common reason for hearing-aid discontinuance is poor benefit, especially in background noise (Kochkin, 2000). Hearing aids often overcome the audibility component of hearing loss; however, hearing aids are less effective in overcoming the distortion component of hearing loss (Carhart, 1951; Plomp, 1978). A case in point might be an older adult who has poor word recognition abilities in quiet and makes remarks such as '... [the] volume is OK, but I can't distinguish the words' (Kochkin, 2000,

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Robin L. West
PO Box 112250, Department of Psychology, University of Florida, Gainesville, FL 32611-2250, USA.
E-mail: west51@ufl.edu

p. 36). This example demonstrates that hearing aids, presumably in a quiet environment, made the speech audible for this patient, but did not overcome the distortion component. Further compounding matters, many listening situations in which individuals want to use hearing aids contain background noise. In such noisy situations, the distortion component of hearing loss is exaggerated (Plomp, 1978). Kochkin (2000) found that over 25% of individuals ($N = 229, 407$) in his survey reported that they discontinued hearing-aid use owing to poor benefit in background noise. Whether the individuals were using their hearing aids at the optimal settings (i.e. appropriate hearing-aid memory or volume control setting) or employing appropriate communicative strategies was not determined.

Second, because of age-related changes such as diminished vision and loss of manual dexterity, older adults, in particular, may have increased concerns about handling hearing aids (Erber, 2003; Jennings, 2005; Meister et al, 2002a,b; Smith et al, 2001; Weinstein, 2000). In fact, Meister and colleagues (2002 a, b) found that device handling was the only hearing-aid attribute that differed between younger and older users. Automatic features on contemporary hearing aids (e.g. switchless telecoils, automatic memory selectors, etc.) may reduce some of the handling problems for older adults (Meister et al, 2002a), however, many hearing aids with automatic features still include manual volume controls or memory buttons. Other issues related to handling cannot be overcome through automated technology and are related to batteries, hearing-aid care, and insertion/removal. Hearing aids, for example, continue to require the use of small batteries and require the use of brushes, wax loops, or even sophisticated cerumen management systems for routine care. Such routine care activities involve manipulations that may be difficult for older adults with arthritis or vision loss. Many older adults also have difficulty with inserting and removing hearing aids correctly (Meredith & Stephens, 1993). These handling issues may cause increased anxiety, leading to reduced hearing-aid usage (Tsuruoka et al, 2001).

Third, many first-time hearing-aid users have trouble adjusting to wearing hearing aids (Meredith & Stephens, 1993; Palmer & Mormer, 1997). Individuals need to adjust to the sound quality of hearing aids, the physical presence of a hearing aid fitting comfortably in the ear, and irrelevant environmental sounds. Individuals also need to adjust to the sound quality of their own voice while wearing hearing aids. The occlusion effect and/or the ampclusion effect (Kuk, 2005) can contribute to the individual's own voice problems with hearing-aid use (ampclusion is related to hollowness of the own voice of individuals owing to insufficient low-frequency gain). Although acclimatization occurs relatively quickly (Turner & Bentler, 1998), older adults may still reject the hearing aids if they cannot adjust to wearing them. Initially, it is challenging for individuals to become accustomed to environmental sounds such as fans or running water, or the perceived unnatural sound quality of hearing aids. It may be difficult to adjust to the occlusion effect or ampclusion effect even after programming and/or venting modifications have been made to the hearing aids (Dempsey, 1990; Kochkin, 2000; Kuk, 2005). If individuals cannot accept the new sound qualities of hearing aids, then they may decide to stop using them altogether.

Audiologists and hearing-rehabilitation therapists have encountered the aforementioned reasons for patient rejection of hearing aids countless times during daily practice over the years. It has been known for some time that additional training and counseling, over and above basic instruction, results in better outcomes (Brooks, 1979) and reduces hearing-aid rejection (Noble, 1998). What has not been emphasized sufficiently is the potential role of self-efficacy during training and counseling with new and experienced hearing-aid users. Concerns about handling, adjustment, and poor hearing-aid benefit may lead to reduced hearing-aid self-efficacy for the potential hearing-aid user. Self-efficacy is the domain-specific confidence individuals have in their ability to perform the skills necessary to be successful at a particular behavior, including health behaviors (Bandura, 1992). Low self-efficacy for the care and use of hearing aids has been suggested as a major reason for non-use or discontinued use of hearing aids (Carson & Pichora-Fuller, 1997; Kricos, 2000, 2006; Weinstein, 2000), but empirical research has yet to address this issue systematically. How could self-efficacy influence hearing-aid discontinuance? When the individual becomes frustrated, unable to insert the aid quickly or make rapid adjustments to environmental changes, confidence will decline and the hearing aid will be used less often. When individuals no longer believe that they can benefit from using their hearing aids, the hearing aids may be rejected. Thus, individual beliefs may be a critical factor influencing hearing-aid discontinuance.

A large body of literature demonstrates that self-efficacy beliefs concerning health are important for successful self-management of health problems and positive treatment outcomes (Bandura, 1997). When self-efficacy for health management skills is high, then individuals persevere through treatment setbacks, put forth increased effort, set higher goals, and ultimately succeed at managing their health condition (Bandura, 1998). For example, self-efficacy beliefs concerning one's ability to exercise regularly predicted diet, exercise time, and stress management over a 12-month period (Clark & Dodge, 1999) and were associated with better self-reported health and fewer physician visits (Grembowski et al, 1993). Similar results, with higher self-efficacy predicting better health-related self-care, have also been reported for diabetes (Aalto et al, 1997), use of hearing-protective devices (Lusk et al, 1997), and smoking cessation (Strecher et al, 1986). Self-efficacy for hearing-aid care and use, therefore, should be important for hearing-aid success, especially for continued usage in light of the challenges outlined above. Individuals who remain confident that they can overcome initial adjustment problems are likely to keep trying, and to continue working with their hearing aids, but individuals with low hearing-aid self-efficacy should be inclined to discontinue use of their hearing aids (Smith & West, 2006a).

The purpose of this research was to develop and validate a measure of hearing-aid self-efficacy, that is, a questionnaire that assesses the confidence that individuals have in their abilities to care for and to use their hearing aids in various listening situations. This new hearing-aid self-efficacy questionnaire is called the Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA). In designing the MARS-HA, we followed recommendations from the social cognitive literature concerning the appropriate format for self-efficacy measures (Bandura, 2001), and consulted the audiologic literature to ensure full coverage of issues related to hearing-aid usage. Smith and West (2006a) provide an extensive review of the concept of hearing-aid self-efficacy and explain the application of the self-efficacy framework to audiologic rehabilitation practices. Based

How certain are you that you can do this? (circle percentage)

0%	10	20	30	40	50	60	70	80	90	100%
Cannot do this at all					Moderately certain can do					I am certain I can do this

Figure 1. The response scale for each item on the MARS-HA.

on our model of successful hearing aid-use, the items on the MARS-HA were designed to cover specific sub-skills. In particular, the following aspects of successful hearing-aid use were highlighted in this model: the handling of hearing aids (e.g. battery insertion/removal, hearing-aid insertion/removal, etc.); hearing-aid adjustment (e.g. own voice issues, physical fit, etc.); and aided listening skills (e.g. group conversation, telephone, etc.).

Methods

Questionnaire development

A pool of 25 questions was generated for the hearing-aid self-efficacy scale, chosen on a rational basis to represent important target sub-skills related to handling of hearing aids, hearing-aid adjustment, and aided listening skills. The questionnaire was constructed in accordance with the self-efficacy questionnaire guidelines established by Bandura (2001) for: (1) phrasing of the items, (2) response scale format, (3) gradations of challenge, (4) respondent instructions, and (5) practice items, as detailed below.

Phrasing of the items

The MARS-HA uses direct language to ask participants to report whether they would have the capability to perform actions or obtain particular outcomes in the future. The items were unambiguous and healthcare jargon was avoided. Multi-barreled items (i.e. items that inquire about more than one capability) were not included. Because self-efficacy beliefs are judgments of perceived capabilities for certain behaviors, the items were phrased using '*can do*' or '*could do*', which are judgments of capability rather than the words '*will do*', which are judgments of intention (Bandura, 2001). Alternative wording, such as 'I would be able to' or 'I might succeed at' also could be used to reflect this action-orientation, but 'can' and 'could' are more direct ways to ask the question. 'Could' was used when the item was asking about hearing, conditional on wearing a hearing aid. 'Can' was used to ask about knowledge of a specific piece of information or an action that could be done with a hearing aid. As is typical for self-efficacy questionnaires, people can be asked to predict their capability for a task they have not done. Individuals with no experience of hearing-aid use would be making a guess about these capabilities, basing their judgments on similar kinds of activities that they have done in the past.

Response scale format

The customary technique for assessing self-efficacy beliefs is to ask the respondent to judge the strength of certainty on a 0–100, 10-unit interval scale, where 0 represents no certainty in one's capability and 100 represents complete certainty. The response scale used for each MARS-HA item is depicted in Figure 1.

Gradations of challenge

To learn skills associated with a new behavior, individuals must overcome obstacles that vary in difficulty, and to avoid ceiling and floor effects, self-efficacy beliefs should be evaluated against varying skill levels for the target behavior. The items on the MARS-HA were constructed to represent a wide range of skills that a successful hearing-aid user should possess, including skills that would likely be taught during hearing-aid orientation programs.

Respondent instructions

Self-efficacy judgments should be based on current beliefs. That is, judgments should reflect how individuals feel about their capabilities right now, not their future expectations concerning their skills or abilities. Accordingly, the respondent instructions for the MARS-HA were: (1) These questions ask about your ability to do certain activities with a hearing aid, and they also ask about your ability to hear in certain situations. (2) If you have never been in these situations, then make your best guess about how well you could do. (3) Given what you know right now, indicate how confident you are that you could do the things described here.

Practice items

Bandura (2001) recommended that self-efficacy questionnaires have practice items to make certain that respondents understand the instructions. Also, the practice items enable the respondents to become familiar with the response scale. A common topic for practice items on a self-efficacy questionnaire is lifting of objects. To ensure a range of responses for the practice items, the MARS-HA practice items included one behavior that most individuals would be capable of doing ('I can lift a 10-pound object with ease'), and a second that most individuals would not be capable of doing ('I can easily tell the difference between a 19-pound object and a 20-pound object'). Both practice items used the 10-unit response scale described above.

Participants

A total of 83 new hearing-aid users (age, M = 71.8, SD = 8.3), and 128 experienced hearing-aid users (age, M = 73.0, SD = 8.4), all males, were recruited from the audiology clinics at the Veterans Affairs (VA) Medical Center, Mountain Home, Tennessee. There were no significant differences in age between the new users (M = 71.8 years, SD = 8.3) and the experienced users (M = 73.0 years, SD = 8.4), [$F(1, 209) = 1.1$, $p > 0.25$]. Because the VA has a six-month trial period for all new hearing aids issued, and similar to definitions used by others (e.g. Cox et al, 2003, Palmer et al, 2006), the new users were defined as having <6 months of hearing aid use (M = 2.2 months, SD = 1.7) and the experienced users were defined as having ≥ 6 months of hearing aid use (M = 82.4 months, SD = 77.1).

All hearing aids were fitted binaurally and were verified using real ear insertion gain measures (Byrne & Dillon, 1986; Byrne et al, 2001; Hawkins et al, 1987). Table 1 lists information related to hearing-aid features for both the new and experienced hearing-aid user groups. The majority of the new users had manual volume controls whereas the majority of the experienced users did not (see Table 1). Most of the participants did not have a remote control. Also seen in Table 1, ~60% of the new users and ~90% of the experienced users had three to four memories programmed into their hearing aids. In terms of hearing-aid style, the majority of participants from both groups wore either half-shell or full-shell hearing-aid styles (see Table 1).

Procedures

The participants were given a questionnaire packet containing two copies of the MARS-HA. The participants were asked to complete one copy of the MARS-HA immediately and mail the completed questionnaire to the laboratory. A total of 173 participants (82%) completed the first copy of the MARS-HA. In order to assess test-retest reliability, the participants were asked to complete the second copy of the MARS-HA two weeks later. A total of 134 (64%) participants completed both copies.

Prior to participating in the study, all participants completed an audiologic assessment as part of their routine clinical care, including pure-tone audiometry and speech audiometry. An analysis of variance revealed no significant difference between the two ears for the hearing thresholds, at any frequency, for the new user group [F (5, 76) = 1.54, p >0.10], or the experienced user group [F (5, 120) = 1.68, p >0.10]; therefore, the hearing thresholds of the right and left ears of each group were averaged (see Figure 2). There was no significant Ear × Frequency × Group interaction, [F (5, 200) = 0.3, p >0.50], suggesting similar hearing sensitivity for the two groups.

Word-recognition abilities in quiet were assessed with recordings of the Northwestern University Auditory Test No. 6 (Tillman & Carhart, 1966; Department of Veterans Affairs, 2006) that were reproduced by a compact disc player (Sony, Model CDP-437) routed through the audiometer (Grason-Stadler, Models 61). Typically, the word lists were administered at two levels, 24 dB apart (range 60–94 dB HL; Wilson & Burks, 2005). The better word-recognition performance was recorded for each ear. Word-recognition scores for the left ears were comparable for the two groups, [F (1, 192) = 0.9, p >0.25], but there was a statistically significant difference between word-recognition scores for the right ears of the groups, [F (1, 191) = 5.3, p <0.05], with average scores of 64.1% for the experienced users and 72.5% for the new users. An ~8% difference in word recognition scores (i.e. two words on a 25-word list), however, is not clinically meaningful. All testing was performed with insert earphones (EAR-3A) while the participants were seated in a double-walled sound booth (IAC).

A subset of participants (N = 79) also completed the Hearing Handicap Inventory for the Elderly-Screening (HHIE-S; Ventry & Weinstein, 1983). The HHIE-S is a 10-item questionnaire that measures emotional and social hearing handicap in a variety of communication/listening situations. Scores can range from 0–40, with higher scores representing more hearing handicap. There

Table 1. List of the features on the hearing aids worn by the new and the experienced hearing-aid user groups (in percentages).

	Volume control		*Remote control*		*No. of memories*				*Hearing aid-style*				
	Yes	*No*	*Yes*	*No*	*1*	*2*	*3*	*4*	*CIC*	*ITC*	*HS*	*FS*	*BTE*
New	56.3	41.4	25.0	72.7	14.1	8.6	31.3	25.8	14.8	6.3	37.5	26.6	9.4
Experienced	39.8	57.8	39.8	57.8	1.2	8.4	45.8	42.2	16.9	2.4	42.2	19.3	16.9

Note. Due to missing data regarding hearing aid features, not all values sum to 100%. Hearing-aid style abbreviations: CIC: Completely-in-the-canal; ITC: In-the-canal; HS: Half-shell; FS: Full-shell; and BTE: Behind-the-ear.

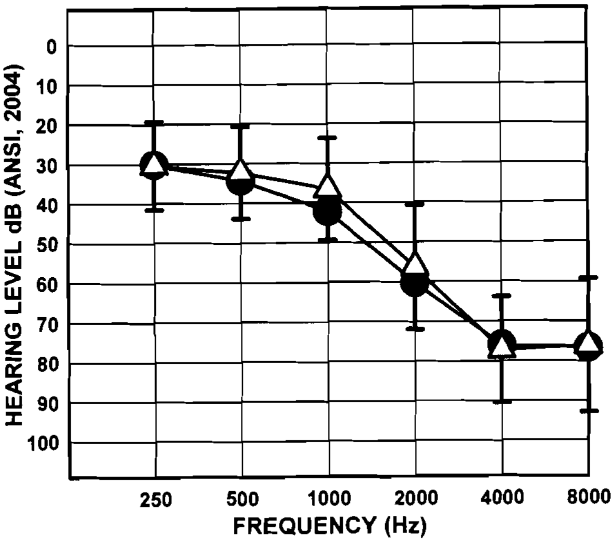

Figure 2. The mean hearing thresholds (averaged across both ears) for the new user group (triangles) and the experienced user group (circles). For graphical clarity, the error bars for the new user group are displayed, which represent one standard deviation.

were no significant differences in HHIE-S scores between the new users ($N = 46$, $M = 28.4$, $SD = 6.6$), and the experienced users ($N = 33$, $M = 29.4$, $SD = 7.9$), [$F(1, 77) = 0.3$, $p > 0.25$].

Results

Psychometric properties

Reliability and validity measurements were conducted to determine the psychometric properties of the MARS-HA, with separate analyses for the two participant groups. Because the new and experienced users vary dramatically in their level of experience with hearing aids containing different features, and because it is likely that scholars and clinicians will want to employ a measure of hearing-aid self-efficacy with both types of individuals, it was important to conduct an independent validation of the questionnaire's psychometric properties with the two groups. Specifically, factor analyses were conducted to identify the most coherent subscale structure for the hearing-aid self-efficacy assessment (that is, we identified sets of items that varied together systematically and also predicted a large amount of the variance in the MARS-HA questionnaire responses). We then evaluated the internal consistency and test-retest reliability for each of the subscales and the questionnaire as a whole. The validity of the MARS-HA was also evaluated, by investigating its relationship to the HHIE-S, and by examining the expected impact of group differences, hearing-aid features, and audiologic training.

Factor analysis

A principal components analysis was conducted to evaluate the factor composition of the MARS-HA for the new users and the experienced users separately. The analysis was conducted with and without varimax rotation (this type of rotation focuses on identifying sets of items that are highly interrelated as one factor, while at the same time ensuring that different factors are relatively independent or uncorrelated). Because the results were similar, the data for the varimax rotation are reported here. The criteria used to interpret the results were factor loadings greater than 0.30, using factors that accounted for at least 5% of the total variance. In the initial analyses, item 8 failed to load on any factor and therefore it was omitted from the questionnaire and from all further analyses. Table 2 lists the factor loadings for the individual items, which were similar for the two groups. As seen in the table, the factor loadings for the new users were greater than 0.44 for all items, with a range of 0.45 to 0.83 (average loading = .70). The four identified factors together accounted for 64.9% of the total variance. The factors were classified as the following subscales, each of which accounted for a significant portion of the variance (as noted in parenthesis): (1) aided listening (24.6%), (2) basic handling (15.2%), (3) adjustment (12.7%), and (4) advanced handling (12.4%). As expected, the correlations were strong between items from the same subscale (average $r = 0.54$ for new users, and $r = 0.49$ for experienced users), and were lower between items from different subscales (average $r = 0.27$ for new users, and $r = 0.25$ for experienced users). The means for each item and subscale can be seen in Table 3. It is important to note that the factor structure was similar for the experienced users' group. The four factors together accounted for 60.6% of the total variance and 21.3%, 16.9%, 11.6%, and 10.8% of the variance for each of the four subscales, respectively (see factor loadings for specific items in Table 2). With identified factors of adjustment, aided listening, and handling, and over 60% of the variance accounted for, the factor analysis supported the validity of the proposed model of hearing-aid self-efficacy as a multifaceted construct. These results suggested, however, that our original model of successful hearing-aid use needs to be expanded to consider two different levels of handling skills—basic and more advanced—as indicated by separate factors for these subscales.

Internal consistency

Internal consistency reliability was calculated using Cronbach's α for the total scale and for the four subscales. A high value for internal consistency indicates that if multiple alternative forms of the test were produced using a variety of items, these multiple forms would be highly correlated with each other. For the new users, Cronbach's α for the total scale was 0.92 (24 items) and the subscale reliabilities were 0.86 (basic handling, 7 items), 0.77 (advanced handling, 5 items), 0.81 (adjustment, 3 items), and 0.93 (aided listening, 9 items). For the experienced users, Cronbach's α for the total scale was 0.91 and was 0.88, 0.67, 0.73, and 0.91 for the basic handling, advanced handling, adjustment, and aided-listening subscales, respectively. These results generally meet the recommended alpha value of 0.7 or greater for internal consistency reliability (although somewhat lower for the experienced users on advanced handling), suggesting that there was a strong relationship among the subscale items, and a well-integrated set of items across the full scale for hearing-aid users (Hyde, 2000; Nunnally & Burnstein, 1994).

Pearson product moment correlations were calculated between the subscales, and between subscales and total scores, to further evaluate the integrity of the MARS-HA measure. As seen in Table 4, all correlations between the subscales were significant at the 0.01 level (two-tailed), with an average value of $r = 0.47$ for the new users and an average value of $r = 0.42$ for the

Table 2. The factor loadings from the principal components analysis for the new and experienced user groups.

Item #	Item content	Factor loadings	
		New	*Experienced*
Factor 1 (aided listening)			
17	I could understand a one-on-one conversation in a quiet place if I wore hearing aids.	0.83	0.48
18	I could understand conversation in a small group in a quiet place if I wore hearing aids.	0.78	0.78
19	I could understand conversation on a standard telephone if I wore hearing aids.	0.60	0.59
20	I could understand television if I wore hearing aids.	0.83	0.79
21	I could understand the speaker/lecturer at a meeting or presentation if I wore hearing aids.	0.83	0.70
22	I could understand a one-on-one conversation in a noisy place if I wore hearing aids.	0.69	0.80
23	I could understand conversation in a small group while in a noisy place if I wore hearing aids.	0.73	0.84
24	I could understand a public service announcement over the loudspeaker in a public building if I wore hearing aids.	0.73	0.75
25	I could understand conversation in a car if I wore hearing aids.	0.79	0.66
Factor 2 (basic handling)			
1	I can insert a battery into a hearing aid with ease.	0.79	0.88
2	I can remove a battery from a hearing aid with ease.	0.79	0.87
3	I can tell a right hearing aid from a left hearing aid.	0.68	0.55
4	I can insert hearing aids into my ears accurately.	0.71	0.84
5	I can remove hearing aids from my ears with ease.	0.69	0.67
7	I can operate all the controls on a particular hearing aid (knobs, switches, and/or remote control) appropriately.	0.61	0.34
11	I can clean and care for a hearing aid regularly.	0.49	0.31
Factor 3 (adjustment)			
14	I could get used to the sound quality of hearing aids.	0.65	0.68
15	I could get used to how a hearing aid feels in my ear.	0.79	0.63
16	I could get used to the sound of my own voice if I wore hearing aids.	0.56	0.65
Factor 4 (advanced handling)			
6	I can identify the different components of a particular hearing aid (i.e. microphone, battery door, vent, etc.).	0.68	0.45
9	I can stop a hearing aid from squealing.	0.45	0.56
10	I can troubleshoot a hearing aid when it stops working.	0.72	0.68
12	I can name the make or model of a particular hearing aid.	0.78	0.75
13	I can name the battery size needed for a specific hearing aid.	0.71	0.63
omitted item			
8	I can adjust a specific hearing aid in each ear so that I feel the hearing aids are balanced.	–	–

experienced users. These data support the notion that the subscales are related to each other but non-overlapping. Each of the four subscales also correlated well with the total scale (r = 0.64–0.84), as expected (see Table 4).

Test-retest

A subset of the participants completed the MARS-HA on a second occasion, approximately two weeks after the initial administration, to determine whether responses to the questionnaire were stable over time, an important characteristic if the scale is to be used for clinical purposes. The test-retest reliability of the total scale, and of each subscale, was calculated using Guttman split-half reliability coefficients, using only those cases that had complete test-retest data for each subscale (this resulted in slight variations in the number of cases used in each calculation). As shown in Table 5, for the new user group, test-retest reliability was $\lambda = 0.92$ for the total scale, and the correlation between forms for the total scale was $r = 0.86$ ($N = 53$). For the experienced users, the full-scale test-retest reliability was $\lambda = 0.88$, with a correlation between the two tests of $r = 0.79$ ($N = 75$). For the new users, the test-retest reliability coefficients ranged between 0.81 and 0.92 for the subscales, with the correlation between the two tests ranging from 0.68 to 0.85 (see Table 5). The test-retest reliability of the experienced users across the subscales showed reliability ranging from 0.59 to 0.90, with the correlation between forms ranging from 0.43 to 0.82 (see Table 5). For the new users, all test-retest

Table 3. The mean scores (%) and standard deviations for each item, for each subscale, and for the total score on the MARS-HA for the new and experienced user groups.

	New		Experienced	
Item No.	*M*	*SD*	*M*	*SD*
Aided listening				
17	94.7	13.5	92.8	14.1
18	87.2	18.2	85.5	16.9
19	82.5	25.0	73.2	26.1
20	91.9	14.2	84.9	19.4
21	83.3	20.9	80.6	20.5
22	74.2	25.6	63.6	26.4
23	72.5	23.3	60.4	26.5
24	80.1	26.5	70.8	24.8
25	84.7	20.2	77.7	22.2
Subscale total	83.4	16.9	76.7	16.9
Basic handling				
1	93.5	13.9	93.4	17.0
5	95.8	13.0	97.2	9.0
7	88.8	19.6	91.3	17.4
11	92.1	16.7	90.8	17.5
Subscale total	93.8	10.4	94.3	10.2
Adjustment				
14	81.9	17.8	84.8	19.9
15	86.6	16.9	89.5	15.8
16	85.5	19.7	88.1	19.3
Subscale total	84.7	15.4	87.5	14.8
Advanced handling				
6	80.1	25.2	84.6	23.7
9	78.0	30.9	84.3	26.0
10	54.7	38.4	57.1	36.9
12	46.2	40.7	46.2	38.3
13	57.7	42.2	78.9	34.8
Subscale total	63.4	25.8	70.2	21.3
Total score	82.4	13.0	81.9	11.8

Note. Item number 8 is not listed because this item was deleted.

reliability coefficients exceeded accepted values of ~0.80 (Hyde, 2000). The full-scale and most subscales exceeded accepted test-retest reliability coefficients for the experienced users, however, the adjustment subscale yielded only a moderate test-retest reliability (λ =0.59), probably due to the recent acquisition of new hearing aids by many of the experienced users, as discussed later.

Validity analyses

Having established that the factor structures for hearing aid self-efficacy were comparable for the two user groups, the two groups were combined for analyses of validity (the extent to which the questionnaire assesses the concepts or constructs which it was intended to measure). Construct validity was investigated by comparing scores on the MARS-HA and the HHIE-S, a frequently-used measure of hearing handicap. Another key indicator of validity would be that varying groups of participants show differential patterns of responses to the MARS-HA. In the sample, a number of different groups could be identified with respect to experience with hearing aids, in general, or experience with particular types of features on hearing aids, and these differential levels of experience could affect self-efficacy for hearing-aid use. Finally, criterion validity was investigated in a sample of hearing-aid novices (less than one month of hearing-aid use), to demonstrate that a general hearing-aid orientation and one month of hearing-aid experience would raise levels of hearing-aid self-efficacy, as expected.

Construct validity

One method of determining construct validity is to demonstrate that questionnaires measuring different constructs are not related. To examine the construct validity of the MARS-HA, the aided listening skills items were compared to responses on the HHIE-S. A principal components analysis with varimax rotation was used to determine whether items from these two scales would load on the same factor. These particular MARS-HA items were chosen because they concerned listening situations, just as the HHIE-S asks participants about listening situations. The MARS-HA items, however, were not expected to mirror the HHIE-S items because of important differences in wording. The MARS-HA asks respondents whether or not they feel that they could hear well under particular conditions if they wore hearing aids. The HHIE-S asks individuals to rate their current ability to hear under a range of conditions. In effect, for those who have little experience with hearing aids, these listening items on the MARS-HA represent a projection of their beliefs

Table 4. The test-retest reliability coefficients and correlations between forms, for the total scale and for each subscale, for the new and experienced user groups.

	Total scale	*Basic handling*	*Advanced handling*	*Adjustment*	*Aided listening*
New users					
Test-retest reliability λ	0.92	0.91	0.92	0.81	0.88
Correlation between forms	0.86	0.83	0.85	0.68	0.80
N	53	57	57	58	53
Experienced users					
Test-retest reliability λ	0.88	0.83	0.81	0.59	0.90
Correlation between forms	0.79	0.72	0.68	0.43	0.82
N	75	77	77	78	75

Table 5. The correlations between the total scale and the subscales for the new and experienced user groups.

	Total scale	*Basic handling*	*Advanced handling*	*Adjustment*	*Aided listening*
Total scale		0.68	0.76	0.77	0.84
Basic handling	**0.76**		0.35	0.53	0.46
Advanced handling	**0.71**	**0.50**		0.50	0.39
Adjustment	**0.64**	**0.46**	**0.37**		0.58
Aided listening	**0.83**	**0.46**	**0.29**	**0.43**	

Note. The correlations for the new user group are above the break and the correlations for the experienced user group are in bold below the break.

about the potential success that they would experience with hearing aids, not an assessment of their current hearing skill. Therefore, we expected that the MARS-HA and HHIE-S items would not load on the same factors.

A three-factor solution emerged for the MARS-HA aided-listening subscale items and the ten items on the HHIE-S. The items on the MARS-HA aided-listening subscale loaded on the first factor (loadings ranged from 0.72 – 0.86), explaining 31.1% of the variance in all items related to listening skills. Most of the HHIE-S items loaded on the second factor (loadings ranged from 0.57–0.82), explaining 18.0% of the variance. The HHIE-S item 10, which asks about hearing difficulties in a restaurant, was the only item that loaded on a third factor (0.79, 7.5% of the variance). HHIE-S item 3 (i.e. difficulty hearing a whisper) and item 7 (i.e. arguments with family members) failed to load on any factor. These results suggest that hearing handicap (i.e. HHIE-S) and aided-listening self-efficacy are not part of the same construct, further supporting the validity of the MARS-HA as an independent measure of hearing-aid self-efficacy.

Impact of long-term experience

The two groups of hearing-aid users in this study differed in terms of their level of long-term experience with hearing aids. A multivariate analysis was conducted to evaluate MARS-HA differences between new and experienced hearing-aid users, with the four subscales as the dependent variables. The results revealed a significant variation in scores as a function of group, multivariate [F (4, 168) = 5.1, $p < 0.001$]. We had expected that the more experienced users would have higher confidence on the advanced handling subscale than the new users. A univariate follow-up analysis, to explore the multivariate data further, showed that the group differences approached significance for advanced handling, [F (1, 171) = 3.6, $p < 0.06$], with the experienced users reporting ~7% more advanced handling efficacy (M = 70.2, SD = 21.3) than the new users (M = 63.3, SD = 25.8). The largest difference between the new users and experienced users for advanced handling occurred on items 9 (being able to stop squealing), and 13 (knowing battery size). The follow-up analyses also revealed a significant group difference on the aided-listening subscale, [F (4, 171) = 6.78, $p < 0.001$]. The experienced users reported ~7% lower aided-listening self-efficacy (M = 76.7, SD = 16.9) than the new users (M = 83.4, SD = 16.9). Examination of the individual items suggested that the experienced users were more cognizant of the difficulty involved in hearing on the telephone and in situations with background noise (items 22, 23, 24, and 25). The mean efficacy levels for the individual items ranged from 46.2 to 96.4 for the new users, and from 57.1 to 97.2 for the experienced users (see Table 3).

Impact of hearing-aid features

A number of different hearing-aid features could have an impact on hearing-aid self-efficacy. Each of the following factors was examined in relation to the four MARS-HA subscales as dependent variables: (1) remote control; present or absent, (2) hearing-aid style, (3) volume control; present or absent, and (4) number of memories.

Remote control

About one-third of the participants in this sample had remote control devices (N = 53). We expected that participants with remote controls would report higher confidence in handling and aided-listening skills than individuals without remote controls. The results of a multivariate analysis of variance revealed a main effect for remote control, [F (4, 163) = 2.6, $p < 0.05$], suggesting that participants who had remote controls responded differently on the MARS-HA subscales than participants who did not have remote controls. The univariate follow-up analysis to explore the basis for this result revealed that participants with remote controls reported significantly higher efficacy (~4%) for both basic handling, univariate [F (1, 166) = 5.1, $p < 0.03$], and aided listening (~9%), univariate [F (1, 166) = 9.3, $p < 0.01$], than participants without remote controls. These findings were expected because remote controls enable individuals to adjust their hearing-aid programs and volume for the appropriate listening situation with relative ease, which should increase a sense of self-efficacy for both handling and aided listening.

Hearing-aid styles

To determine how individuals wearing different hearing-aid styles would respond on the MARS-HA subscales, a multivariate analysis of covariance was performed, examining differences between the following types of hearing aids: behind-the-ear, in-the-canal, completely-in-the-canal, half-shell, and full-shell. Owing to the association between the degree of hearing loss and the style of hearing aids fitted, hearing loss was used as a covariate. Because there was no significant difference between the hearing sensitivity of the two ears of the participants, the pure-tone average (at 500, 1000, and 2000 Hz) of the right ear was chosen arbitrarily as the covariate. There was a significant multivariate effect of hearing-aid style, [F (4, 159) = 3.0, $p < 0.02$], suggesting that participants responded differently on at least one subscale depending on the style of hearing aids worn. In follow-up univariate analyses to explore that significant finding, participants wearing hearing aids completely-in-the-canal were found to be ~10% less self-efficacious on the adjustment subscale (M = 79.7, SD = 16.9) than participants wearing half-shell hearing aids (M = 89.8, SD = 12.9), [F (4, 159), = 2.4, $p < 0.05$]. This finding suggests that older adults have less confidence in adjusting to the physical fit, occlusion effect, and sound quality of completely-in-the-canal hearing aids compared to half-shell hearing aids. There were no other significant differences in hearing-aid styles.

Other features

The final two hearing-aid features that were examined were the presence of a volume control and the number of memories. Neither of these analyses was significant, suggesting that having a volume control or having different number of memories did not affect hearing-aid self-efficacy. In a previous set of analyses, Smith and West (2006b) demonstrated differences in MARS-HA subscale scores based on pure-tone average and word recognition in quiet scores. Participants with mild hearing losses (pure-tone average <40 dB HL) had ~10% higher efficacy for aided listening than did participants with moderately-severe hearing losses. Likewise, participants with poor word recognition (<60%) were found to have lower overall hearing-aid self-efficacy than participants with good-to-fair word recognition (≥60%).

Criterion validity

To validate the MARS-HA as a measure of self-efficacy that is responsive to changes over time, we examined the impact of hearing-aid use on MARS-HA responses. At a minimum, individuals who have been given hearing aids and at least a basic hearing-aid orientation should have higher efficacy than those who have not yet been introduced to hearing aids. In the test-retest reliability comparisons with the new and experienced users (reported above), participants were asked to complete the MARS-HA twice, with a two-week interval between assessments. Test-retest reliability was high, and responses at the two assessments were very similar, with means of 83.5% (SD = 11.6) at the first assessment and 84.5% (SD = 11.5) at the second assessment, demonstrating almost no overall change for a two-week interval. This minimal change observed for test-retest can be compared to changes that occurred as a function of one-month's experience for novice hearing-aid users. This analysis was considered a test of criterion validity because experience with hearing aids should lead to greater confidence in one's hearing-aid skills.

We recruited a sample of new users ($N = 29$), all of whom were fitted with binaural hearing aids after their initial assessment. The second assessment was a month later. During that interval, all of these individuals received a standard, individual hearing-aid orientation, in which they learned about topics such as care, troubleshooting, hearing-aid adjustment, and hearing-aid use. A small subsample of these individuals received more elaborate training (see Smith & West, 2006a), but the focus here is on the overall change for the full sample of hearing-aid novices. As a criterion, we expected to observe significant improvements in self-efficacy, especially in measures of handling and advanced handling, as a function of one month of experience. This hypothesis was tested in a two (time: pre vs. one-month post) × four (MARS-HA subscales) within-subjects analysis designed to identify potential change on these particular subscales as a function of one-month of experience.

When the two assessments were compared, dramatic improvements in self-efficacy were evident. The results of the analysis revealed a main effect of MARS-HA subscale, [$F(3,84) = 35.0$, $p < 0.001$], owing to significant differences between subscale scores. The results also showed a main effect for time, [$F(1, 28) = 77.4$, $p < 0.001$], owing to significant increases in self-efficacy from pretest to one-month post-test. Figure 3 shows the mean pretest MARS-HA scores and the one-month-post-test MARS-HA scores for the 29 new hearing-aid users. Overall, there was about a 30% increase in self-efficacy between the two sessions, a change that is substantially larger than the observed test-retest change. Figure 3 also illustrates the significant interaction between time and varying subscale scores, [$F(3, 84) = 29.3$, $p < 0.001$]. Before training and experience, basic handling efficacy was significantly less than aided-listening efficacy, but it was equal to adjustment and advanced handling efficacy levels (see Table 6). At pretest, only aided listening showed acceptable levels of self-efficacy (above 80%). In contrast, after one month of hearing-aid use, basic handling efficacy was significantly higher than all other subscale scores, at 98%. Similarly, advanced handling scores were significantly lower than all other subscales at pre-fitting, but after one month, advanced handling efficacy was significantly higher than at pre-fitting, and comparable to adjustment and aided-listening subscale scores (see Table 6). This evidence confirmed that the MARS-HA is responsive to changing levels of knowledge and experience, as expected.

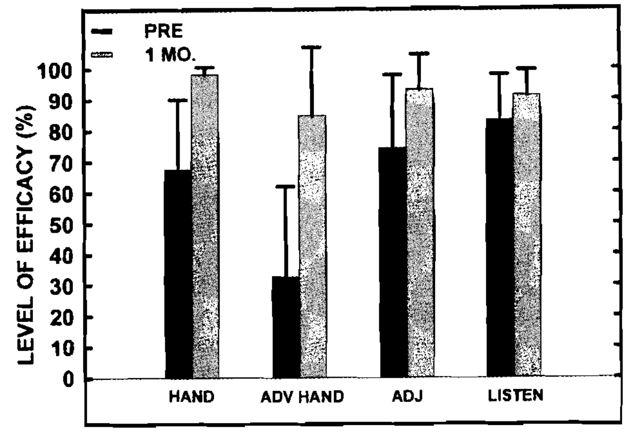

Figure 3. MARS-HA scores for pre-fitting (black bars) and one-month post-fitting assessments for the first-time hearing-aid users. The error bars represent one standard deviation. Subscale abbreviations: HAND: Basic handling; ADV HAND: Advanced handling; ADJ: Adjustment; and LISTEN: Aided listening.

Table 6. The mean scores (%) and standard deviations for each subscale, and for the total score on the MARS-HA, before and after hearing-aid experience.

	Pretest		*One-month post-test*	
Scale	*M*	*SD*	*M*	*SD*
Aided listening	83.2	14.8	91.3	8.2
Basic handling	67.5	22.6	98.2	2.4
Adjustment	74.2	23.6	93.2	11.4
Advanced handling	32.6	29.3	84.8	22.1
Total score	65.1	16.5	91.8	6.4

Discussion

Recent advances in hearing-aid technology are improving the hearing-aid experience, yet hearing aids remain troublesome for many older individuals with hearing loss who either do not pursue hearing aids or who discontinue the use of hearing aids. The application of the self-efficacy framework to hearing-aid use should assist older adults in becoming more successful hearing-aid users. The Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids was developed as a domain-specific measure of hearing-aid self-efficacy. In this paper, the psychometric properties of the items and subscales were presented, and initial tests of validity of the MARS-HA were completed. Because of the potential utility of the MARS-HA with both new and experienced hearing-aid users who have differences in hearing-aid experience, importance was placed on validating the questionnaire independently on both types of user groups.

The factor analyses of the MARS-HA showed four well-integrated subscales: basic handling, aided listening, adjustment, and advanced handling, for both types of hearing-aid users. High internal consistency and strong correlations of the MARS-HA subscales also were observed independently for both samples. For both groups, high test-retest reliability was found for the total scale and for the subscales, except for the moderate test-retest reliability on the adjustment subscale with the experienced users, which we consider below.

In the validity analyses, differences between experienced and new users were evident on some measures, as well as variations in efficacy as a function of some hearing-aid features. In addition, dramatic improvements in self-efficacy occurred with hearing-aid experience and audiologic training, as expected. The strong psychometric properties of the MARS-HA indicate that it may be a very useful tool for measuring hearing-aid self-efficacy in clinical or research settings.

One aspect of the psychometric data which was not as strong as expected was the moderate test-retest reliability for the experienced users on the adjustment subscale. There are two possible explanations for these results. First, the adjustment subscale has three items. With only a few items, the chances of random error are greater, which can reduce reliability (Hyde, 2000). Second, participants completed the second copy of the MARS-HA within a few weeks of completing the first copy. During that interval, about one-third of the experienced users were fitted with new, technologically-superior hearing aids (e.g. from programmable-analog to digital; single-memory to multiple memory; omni-directional to directional microphones, etc.). These participants would have been in the middle of a readjustment period when completing the MARS-HA for the second time. The adjustment period may have been too short for them. Recall that the items on the adjustment subscale were related to own voice issues, adjustment to the sound quality of the hearing aids, and adjustment to the physical fit of the hearing aids. After upgrading to superior technology or changing hearing-aid styles (e.g. in-the-ear to behind-the-ear style), these experienced users had differential responses to change. Overall, there were no differences in self-efficacy on the adjustment scale between the first and second assessment for this group (none of the individual item means changed by more than 2%), but some individuals increased in confidence and others decreased in confidence, by as much as 50%, depending on their initial reactions to the new hearing aids. Thus, responses may have changed for legitimate reasons, resulting in reduced test-retest reliability for the adjustment subscale in this particular sample. The test-retest reliability was not similarly biased in the new user group, who maintained acceptable levels of test-retest reliability on all subscales. Despite this finding, the overall results suggest that the psychometric makeup of the MARS-HA is strong for both new and experienced users.

With the psychometric properties of the MARS-HA established with the two types of hearing-aid users, we conducted additional analyses to assess validity, examining within-group and between-group differences. To determine the impact of long-term hearing-aid use, we examined subscale score means for new and experienced users and found group differences of about 7% on the advanced handling and aided-listening MARS-HA subscales. It is not clear why aided-listening self-efficacy varied between these two groups. It may be that the new users were confident that their recently-acquired hearing aids would eliminate all of their hearing difficulties, whereas experienced users knew that listening problems can still occur even with hearing aids. We expected a difference in advanced handling because experienced users may have had more opportunities in the past than new users to troubleshoot and to perform feedback management skills. For the new users, the total score of 82% revealed a high level of hearing-aid self-efficacy overall, but this group showed much lower self-efficacy for skills related to advanced handling (63.4%). This result is not surprising, as new users have limited experience in using hearing aids. In effect, their lower confidence in advanced handling represents a validation of the questionnaire items on advanced handling. Like the new users, the experienced users scored lowest on the advanced handling subscale, with a total score of 82% and an advanced handling subscale score of 70%. Even though these are experienced hearing-aid users, they clearly were not completely confident of some of their advanced handling skills and may require additional training in this area. In particular, the mean was lower for item 10, which concerns troubleshooting a malfunctioning hearing aid. This finding probably represents the fact that troubleshooting a hearing aid is a challenging sub-skill to master, even with the level of experience of this sample. The mean for item 12, about make and model of the hearing aid, also was low. Although, at face value, this is not a skill related directly to handling of a hearing aid, this item loaded strongly with the other advanced handling items in both groups. Knowing this information may be important for warranty and repair purposes and for battery acquisition. For example, in the VA, hearing-aid users complete forms with make or model information to receive batteries or to request a hearing-aid repair. Other facilities also are likely to require make and model information for similar purposes.

Validity was also examined by looking at the impact of various hearing-aid features and styles. The results suggested that individuals with remote controls were more confident in their basic handling ($\sim$4%) and aided-listening skills ($\sim$9%) than individuals without remote controls. This finding may suggest that individuals with remote controls are able to adjust the settings of their hearing aids more easily, which would enable them to optimize their hearing-aid features appropriately for the listening situation. In these analyses, we also found that individuals with completely-in-the-canal hearing aids were ~10% less confident in their abilities to adjust to wearing hearing aids than individuals with half-shell hearing aids. This finding may suggest that older adults who have completely-in-the canal hearing aids need additional counseling during the adjustment period to help them be successful with this hearing-aid style.

Although the mean differences in these validity analyses were small (e.g. 4–10%), the clinical meaning of such differences has yet to be determined because hearing-aid self-efficacy is a new construct. For example, it may be that a 7% difference in handling self-efficacy is sufficient to discourage a hearing-aid user. Or it may be that individuals who are 10% less confident in their aided listening skills will be more likely to stop using their hearing aids than those with greater confidence. These findings highlight the need for future studies on the impact of variations in hearing-aid self-efficacy as a predictor of discontinuance of hearing aid use. For example, hearing-aid users could be asked to complete the MARS-HA every two months along with reports of the frequency of hearing-aid usage. Such research may reveal, for instance, that declines in efficacy of 5–10% lead to hearing-aid disuse in older populations, or that most people continue using their hearing aids as long as their overall efficacy stays at least around 80%, even if individual subscales dip to lower levels. These are important empirical questions to explore further.

The construct validity of the questionnaire was assessed by comparing the MARS-HA aided-listening subscale to the HHIE-S questionnaire. The results showed no overlap between the MARS-HA subscale with items on the HHIE-S evaluating current hearing ability, demonstrating that the MARS-HA represents a new way of evaluating individuals' perceptions of their own listening skills and therefore, has potential value both as a research tool and as a clinical assessment.

The criterion validity of the MARS-HA was examined by comparing pre- and post-MARS-HA scores in a group of first-time hearing-aid users who received individual hearing-aid orientation. An examination of change after hearing-aid orientation showed marked increases in hearing-aid self-efficacy with training and one month of hearing-aid experience. These findings support the validity of the MARS-HA by showing its responsiveness, over time, to experiential learning. These results also support the seminal work by Brooks (1979), who demonstrated that more elaborate counseling, as compared to basic instruction on hearing-aid use, resulted in better subjective and objective outcomes. For some time, it has been known that additional training and counseling reduces hearing-aid rejection (Brooks, 1979; Noble, 1998). One possible explanation for this improvement is that well-counseled hearing-aid users have higher hearing-aid self-efficacy, and future research should test this hypothesis directly.

Our results suggest that the MARS-HA has strong validity and reliability and is a useful tool for understanding how individuals assess their hearing-aid skills. The true test of the MARS-HA will be in future clinical studies showing its value as a guide for audiologic rehabilitation. The MARS-HA can be administered in a pre-post scenario for first-time users, or to current users who are having continued difficulty with their hearing aids. Additional training can then be provided to raise efficacy. Successful hearing-aid users should have high levels of hearing-aid self-efficacy, such as 80% or higher (Smith & West, 2006a). Also, by measuring self-efficacy across the MARS-HA subscales, clinicians can identify specific skills (i.e. an individual item) or areas (i.e. a particular subscale) in which new or current hearing-aid users are less confident. After identifying these specific skills or areas of less confidence, the clinician can focus on increasing confidence for those skills in special training programs. If a patient reports 40% confidence in their ability to use the phone with the hearing aid, for example, the audiologist can focus on this skill more in the hearing-aid orientation. Similarly, if a patient reports low confidence using the hearing aid in a noisy situation, then the audiologist can use role playing to raise confidence for this skill. If confidence remains low for listening in noise even after additional training, then the clinician may recommend assistive technology such as an FM system, or may recommend auditory training exercises. Both new and experienced hearing-aid users may benefit from additional training to raise self-efficacy for specific skills related to hearing-aid use.

The MARS-HA also may be used to identify whether or not there is a mismatch between the perceptions of the patient's abilities to use their hearing aids and their actual abilities, by using a hands-on assessment of skills and comparing actual abilities with confidence levels. For example, an individual with a physical limitation, such as arthritis or diminished vision, may be overly confident in his/her ability to handle their hearing aids. Such over-confidence may contribute to added frustration or increase the risk of hearing-aid rejection when continued problems occur. Additional counseling and practice should bring the perception and the skill in line with each other and increase the likelihood of hearing-aid success.

There is considerable literature showing a strong connection between positive health behaviors and higher levels of self-efficacy (Bandura, 1998; Schwarzer & Fuchs, 1996). Higher health self-efficacy, in a range of domains, has consistently been shown to predict the initiation and maintenance of health behaviors, as well as the ability to overcome obstacles and persist in self-care routines in the face of difficulty (Bandura, 1998). In audiology as well, higher levels of hearing-aid self-efficacy should be associated with greater compliance with audiologists' recommendations concerning the usage and care of hearing aids. For instance, individuals with higher levels of hearing-aid self-efficacy should be more capable of coping with problems such as own voice issues, and should persist in practicing care routines even when they are challenging. If training can bring older adults to high levels of hearing-aid self-efficacy, then such individuals are less likely to reject their hearing aids and will put forth more effort to maintain successful hearing-aid use.

In short, the usefulness of the MARS-HA in a clinical and research setting has high potential. The questionnaire may help guide the audiologic rehabilitation process. The MARS-HA also may assist in planning initial hearing-aid orientation sessions, or refining goals for follow-up visits with patients who have hearing aids. Using the MARS-HA as a clinical tool should result in better hearing-aid outcomes for patients with hearing aids, including increased hearing-aid self-efficacy. And as a result of successful hearing-aid use, older individuals will likely achieve a higher quality of life (Mulrow et al, 1990).

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