

Hearing Specific and Generic Measures of the Psychosocial Impact of Hearing Aids

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Abstract

Hearing-specific and generic measures of hearing aid outcome were examined in order (a) to determine their relative sensitivity to hearing aid use and (b) to examine the relationship between pre-hearing aid use expectations and post-use outcomes. Ninety-two hearing-impaired individuals completed some combination of the Abbreviated Profile of Hearing Aid Benefit, Expected Consequences of Hearing Aid Ownership (ECHO), Satisfaction with Amplification in Daily Life (SADL), and Psychosocial Impact of Assistive Devices Scale, and provided reports of their daily and lifetime hearing aid use. In general, (a) the longer individuals wear hearing aids, the more positive the reported outcome, and (b) ECHO scores of non-hearing aid users are higher than SADL scores of new hearing aid users (six weeks to one year of use) but are similar to those obtained from experienced users (greater than one year of use). Between-questionnaire comparisons showed the generic measure to be as sensitive as the hearing aid specific measures. We suggest that generic measures have some advantages over hearing specific measures but that each has a place in the clinic.

Key Words: Assistive devices, hearing aid outcome, psychosocial, rehabilitation

Abbreviations: 4-frequency PTA = four-frequency pure-tone average (mean of thresholds at 0.5, 1.0, 2.0, and 4.0 kHz); APHAB = Abbreviated Profile of Hearing Aid Benefit; ECHO = Expected Consequences of Hearing aid Ownership; HRQL = Health-Related Quality of Life; MANOVA = Multivariate Analysis of Variance; PIADS = Psychosocial Impact of Assistive Devices Scale; SADL = Satisfaction with Amplification in Daily Life

Sumario

Se examinaron medidas genéricas y específicas de la audición en el rendimiento de auxiliares auditivos, para (a) determinar la sensibilidad relativa al uso del auxiliar auditivo, y (b) examinar la relación entre expectativas previas al uso del auxiliar auditivo y resultados posteriores a su utilización. Noventa y dos individuos hipoacúsicos completaron una combinación del Perfil Abreviado de Beneficio del Auxiliar Auditivo, Consecuencias Esperadas de la Posesión de un Auxiliar Auditivo (ECHO), Satisfacción y Amplificación en la Vida Diaria

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Aspects of this work were presented at the annual convention of American Academy of Audiology 2001, San Diego, CA.

Portions of this work were supported by the Department of Veterans Affairs, Veterans Health Administration, Rehabilitation Research and Development Service Grant #C27091, the National Center for Rehabilitative Auditory Research, the National Institute on Disability and Rehabilitation Research for the Consortium on Assistive Technology Outcomes Research, a U.S. Department of Education grant, and the Ontario Ministry of Health and Long-Term Care (through the Ontario Rehabilitation Technology Consortium).

(SADL), y la Escala del Impacto Psico-social de Dispositivos de Ayuda, aportando reportes del uso de su auxiliar auditivo diariamente y a lo largo de toda su vida. En general, (a) cuanto más tiempo han usado el auxiliar auditivo los individuos, tanto más positivo es el resultado reportado, y (b) los puntajes ECHO de seis no usuarios de audífono fueron mayores que los puntajes SADL de los nuevos usuarios (seis semanas a un año de uso). Las comparaciones entre cuestionarios mostró que las medidas genéricas eran tan sensibles como las medidas específicas del auxiliar auditivo. Sugerimos que las medidas genéricas tienen ciertas ventajas sobre las medidas específicas de audición, pero cada una tiene su lugar en la clínica.

Palabras Clave: Dispositivos de ayuda, resultados con auxiliares auditivos, psico-social, rehabilitación

Abreviaturas: 4-frequency PTA = promedio tonal puro de cuatro frecuencias (umbrales medios a 0.5, 1.0, 2.0 y 4.0 kHz); APHAB = Perfil Abreviado de Beneficio del Auxiliar Auditivo; ECHO = Consecuencias Esperadas de la Posesión de un Auxiliar Auditivo; HRQL = Calidad de Vida Relacionada con la Salud; MANOVA = Análisis Multivariado de Variancia; PIADS = Escala de Impacto Psico-social de Dispositivos de Ayuda; SADL = Satisfacción y Amplificación en la Vida Diaria

As the need to demonstrate efficacy of treatment has become more important, measurement of hearing aid outcomes has become one of the foremost issues for service providers. For the audiologist, outcome measurement tends to focus on communication-specific improvement following intervention. Tools for doing so are either hearing-related questionnaires or tests of speech recognition scores. The basic assumption underlying the measurement of hearing aid outcomes is that it is a process for examining how “well” a hearing aid has “worked.” This question is more complex than it may seem initially since many different aspects of hearing aids can be evaluated, including real ear gain, performance improvement, and user satisfaction. It is no surprise, therefore, that outcome measurement research has been designated as a priority for the field of audiological rehabilitation (Cox et al, 2000).

In the year 2000, an international consensus workshop was held in Eriksholm, Denmark, titled “Measuring Outcomes in Audiological Rehabilitation Using Hearing Aids.” The participants identified four major goals of outcome measurement, one of which was to evaluate the effectiveness of hearing rehabilitation services on *quality of life* (Cox et al, 2000) or, more specifically, Health-Related Quality of Life (HRQL). Measures of HRQL are generic in nature, referring to no

particular disease or condition. The advantages of using generic outcome measures over hearing-aid specific measures include the following: (1) Audiologists would be encouraged to think of aural rehabilitation in the broad context of overall mental/physical status. (2) Comparative cost-benefit analyses across disciplines can be carried out, and thus, better planning for resource allocations can be made. (3) A better understanding of generic issues underlying rehabilitation can be achieved, and (4) direct comparisons can be made between the impact hearing aids and other assistive devices have upon quality of life, especially when the individuals being assessed use more than one category of device.

Unfortunately, with the exception of one measure used in a study by Crandell (1998), studies using generic HRQL scales to examine changes in mental and physical status have failed to show differences in scores between pre- and post-hearing aid use (e.g., Mulrow et al, 1990; Crandell, 1998; Hedley-Williams et al, 1998; Fino-Szumski, 1991 in Bess, 2000). This is most likely because most generic HRQL measures focus on the impact of medical interventions, that is, health and healing. Hearing aids have a different purpose—that of the restoration of functional capabilities and psychosocial well-being. Hearing aids are not unique in this respect; in fact, it has been pointed out that HRQL

scales are equally limited when applied to virtually all forms of assistive technology (Jutai, 1999).

Day and Jutai (1996) thus developed a measure specifically designed to assess the psychosocial impact of assistive technology, called the Psychosocial Impact of Assistive Devices Scale (PIADS). The term “psychosocial” refers to the impact of assistive technology on subjective perceptions of psychological well-being and quality of life. The PIADS makes the assumptions that quality of life is a complex and multidimensional construct and that assistive devices should promote good quality of life so that the user feels competent, confident, and inclined (or motivated) to exploit life’s possibilities. It has been empirically determined that these three key dimensions do indeed underlie how users perceive the psychosocial impact of assistive technology (Jutai, 1999).

The PIADS was designed for completion by current users of an assistive device or devices, although the same scale can also be used to measure the expected impact of a device, such as a hearing aid, prior to adoption (Jutai et al, 2000). It is a 26-item self-rating scale. The user rates each item on a 7-point scale that ranges from -3 (maximum negative impact) to +3 (maximum positive impact). The midpoint, zero, indicates no impact or no perceived change resulting from device use. The PIADS measures three important quality-of-life domains, that is, it has three subscales: (1) Adaptability—reflecting inclination or motivation to participate socially and take risks; (2) Competence—reflecting perceived functional capability, independence, and performance; and (3) Self-Esteem—reflecting self-confidence, self-esteem, and emotional well-being. Research to date by Jutai and colleagues has shown that the PIADS is sensitive across diverse populations of device users, that scores are predictive of device retention and abandonment, that patterns of scores vary across populations of device users, and that the impact of assistive devices can be dissociated from the effects of illness and disability (Jutai and Day, 1999; Jutai et al, 2000, 2003).

The PIADS has been extensively used to examine the impact of mobility aids, visual aids, and electronic aids to daily living (e.g., Jutai, 1999). However, there has been very little research to examine the sensitivity and clinical utility of the PIADS for hearing aids.

Jutai and Day (1999) presented some results from a study of 55 hearing aid users that attempted to correlate PIADS scores with self-reported hearing aid use. The participants had been wearing a hearing aid for at least three months prior to the study. They found that users who reported infrequent use had impact scores close to zero (indicating negligible perceived improvement), while frequent users had much higher, positive PIADS scores. The PIADS subscale scores of infrequent users were undifferentiated, whereas scores from frequent users were higher for Competence and Adaptability than for Self-Esteem. The authors concluded that the PIADS was sensitive enough to subjective reports of hearing aid use to be clinically useful. They hypothesized that experienced hearing aid users would characteristically report that their devices helped them hear more normally and encouraged them to participate socially but did not overcome the embarrassment and stigma associated with hearing loss. This study, however, had several limitations. It did not include measurements of auditory perception and performance. It relied on a nonstandardized measure of self-reported hearing aid use, and it did not attempt to compare the sensitivity of the PIADS with measures specifically developed for use with the hearing loss population.

Each of these limitations is addressed in the study described below, in which responses obtained from measures specifically designed to evaluate the outcomes from hearing aid use are compared with PIADS scores. The study aims to answer two questions: (1) How does a generic impact measure like the PIADS compare with hearing-specific measures in sensitivity to self-reported hearing aid use? (2) How do expectations about hearing aids as measured by the PIADS and by a hearing aid specific questionnaire (the Expected Consequences of Hearing Aid Ownership, ECHO) relate to outcome over time?

METHOD

Subjects

Subjects were 92 individuals who came to an audiology clinic to purchase a hearing aid or to take part in a hearing aid trial. There were 64 males and 28 females. The mean age of the subjects was 69.3 years (SD

Table 1. Numbers of Subjects Completing Each Questionnaire by Hearing Aid User Status at Time of Completion

	Hearing aid user status at questionnaire completion		
	Unaided data only	Aided data only	Unaided initially, aided following hearing aid use
PIADS	17	53	20
ECHO	15		18
SADL		55	20
APHAB	17	47	20

= 6.5). All had symmetrical sensorineural hearing loss (mean 4-Frequency PTA averaged across ears = 53.8 dB HL, SD = 11.5). Thirty-seven subjects were non-hearing aid users at the start of the study, 53 subjects were experienced hearing aid users.

Procedure

All subjects underwent routine audiological evaluation consisting of pure-tone testing, tympanometry, and otoscopic examination. In addition, subjects completed three questionnaires (see below). The specific questionnaires each subject completed varied based on hearing aid user status at the time of completion. One group of individuals, who were non-hearing aid users, completed all questionnaires for unaided listening only. A second group of individuals who came to the laboratory/clinic as hearing aid users completed questionnaires for aided listening. A third group (a subset of the first group) completed a second set of questionnaires for aided listening following 6–20 weeks of hearing aid use. Table 1 shows the number of subjects in each group that completed each questionnaire.

Questionnaires

1. APHAB (Abbreviated Profile of Hearing Aid Benefit; Cox and Alexander, 1995).

The APHAB is a 24-item questionnaire that measures self-assessed hearing aid benefit. It is comprised of four subscales: (i) Ease of Communication (EC), (ii) Reverberation (RV), (iii) Background Noise (BN), (iv) Aversiveness of Sounds (AV). Subjects rate audi-

tory disability in a number of situations with and without their hearing aids. Aided scores are subtracted from unaided scores to compute benefit, so that higher scores represent greater benefit.

2. ECHO (Expected Consequences of Hearing Aid Ownership; Cox and Alexander, 2000).

The ECHO is a 15-item questionnaire. Non-hearing aid users rate the expectations they have about hearing aids on four subscales: Positive Effects (PE), Service and Cost (SC), Personal Image (PI), and Negative Features (NF). Many of the subjects here were research participants and thus received hearing aids free of charge, under nonroutine circumstances; therefore, data from the Service and Cost subscale were not analyzed. For all subscales, a higher score indicates more positive expectations.

3. SADL (Satisfaction with Amplification in Daily Life; Cox and Alexander, 1999).

This is a 15-item questionnaire. Hearing aid users rate hearing aid satisfaction. It is a companion scale to the ECHO and has the same subscales. As above, the Service and Cost scale data were omitted from all analyses. For all subscales, higher scores represent greater satisfaction.

4. PIADS (Psychosocial Impact of Assistive Devices Scale; Day and Jutai, 1996).

The PIADS is a 26-item questionnaire with three subscales (see beginning of article for further details). It was originally

Table 2. Demographic and Audiometric Data of Subjects by Hearing Aid User Status at Time of Questionnaire Completion

	Hearing aid user status at questionnaire completion		
	Unaided data only n = 17	Aided data only n = 55	Unaided and aided data n = 20
Age	73.8 (6.4)	68.3 (6.3)	68.5 (5.7)
Gender	10 males 7 females	40 males 15 females	14 males 6 females
4-frequency PTA	48.8	56.7	50.3

Note: Mean values in bold; standard deviations in parentheses.

designed for completion by current users of an assistive device or devices; here the devices are hearing aids. The user rates the impact the device(s) have on quality-of-life issues. For purposes of this study, some individuals also completed the PIADS prior to use of an assistive device, to rate the impact that these individuals thought hearing aids would have on their quality of life. This was achieved by changing the wording of the instructions slightly.

Hearing Aid Use

The SADL includes additional items that ask respondents to describe their lifetime hearing aid experience and daily hearing aid use. Lifetime use is divided into four categories of response: Less than 6 weeks of use, 6 weeks to 11 months, 1 to 10 years, and over 10 years. Daily hearing aid use is divided into five categories: None, less than 1 hour per day, 1 to 4 hours per day, 4 to 8 hours per day, and 8 to 16 hours per day. For purposes of statistical analysis, the responses to these items were used to form groups of hearing aid users based on daily and lifetime use.

RESULTS

Demographic Data

Table 2 shows demographic data by hearing aid user status at time of questionnaire completion; Figure 1 shows air-conduction thresholds, averaged across ears, grouped by hearing aid user status at the start of the study. As a group, individuals who were hearing aid users at the start of the study had significantly poorer pure-tone averages than

those who were non-hearing aid users (4-frequency PTA: 56.7 versus 49.6, $t = 3.0$, $p = 0.004$). The groups did not differ in age.

Questionnaire Descriptive Data

The means and standard deviations of scores on each questionnaire subscale are in Table 3. Data are shown by hearing aid user status at time of questionnaire completion. Subjects in the "Unaided data only" group were individuals who entered the study as non-hearing aid users and completed only one set of questionnaires. Subjects in the "Aided data only" group entered the study as hearing aid users and completed questionnaires at the start of the study only. Subjects in the "Unaided and aided data" group

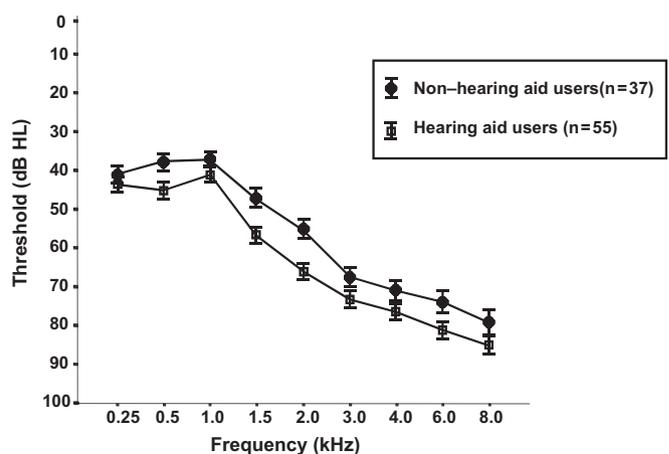


Figure 1. Mean pure-tone thresholds in dB HL with ± 1 standard error bars grouped by hearing aid user status at the start of the study. Non-hearing aid users are depicted by filled circles; hearing aid users are depicted by open squares.

Table 3. Questionnaire Data by Hearing Aid User Status at Time of Questionnaire Completion

Hearing aid user status at questionnaire completion				
	Unaided data only	Aided data only	Unaided and aided data	
APHAB scores				
		Benefit	Benefit	
Ease of Communication	n.a.	23.3 (19.2)	26.6 (18.2)	
Reverberation	n.a.	25.8 (22.7)	23.3 (19.6)	
Background Noise	n.a.	22.1 (19.1)	28.0 (25.0)	
Aversiveness	n.a.	-18.0 (18.4)	-26.0 (20.6)	
ECHO/SADL scores				
	ECHO	SADL	ECHO	SADL
Positive Effect	4.9 (1.4)	4.8 (1.3)	5.6 (0.5)	4.7 (1.2)
Negative Features	4.2 (1.0)	4.1 (1.6)	4.6 (1.0)	4.7 (1.1)
Personal Image	5.4 (1.1)	5.8 (0.9)	5.8 (1.0)	6.3 (0.6)
PIADS scores				
	Unaided	Aided	Unaided	Aided
Competence	1.04 (0.82)	1.17 (0.88)	1.52 (0.68)	1.18 (0.56)
Adaptability	0.86 (0.91)	1.09 (0.90)	1.46 (0.70)	1.14 (0.78)
Self-Esteem	0.73 (0.81)	1.08 (0.96)	1.42 (0.67)	1.13 (0.63)

Note: Mean values in bold; standard deviations in parentheses

entered the study as non-hearing aid users and completed a second set of questionnaires after participating in the study.

A comparison of the two groups of subjects with unaided data revealed that unaided PIADS scores of the "Unaided data only" group were significantly lower on the Adaptability and Self-Esteem subscales than the unaided scores of the individuals in the "Unaided and aided data" group (Adaptability: $F = 4.8$, $p < 0.04$; Self-Esteem: $F = 6.4$, $p < 0.02$). The ECHO scores of these two groups did not differ. Comparison of the two groups with aided data did not differ on any questionnaire subscale.

Relationship of Questionnaire Scores to Demographic and Audiometric Data

Pearson correlations were used to investigate relationships between questionnaire scores, age, and pure-tone thresholds. Only three correlations significant at $p < 0.01$ or less were found between questionnaire subscales and the 4-frequency PTA: aided Adaptability scale of the PIADS ($r = 0.31$), EC scale from the APHAB ($r = 0.40$), and the NF sub-

scale of the SADL ($r = -0.32$). Additional correlations with the 4F-PTA at the $p < 0.05$ level were seen with the Competence and the Esteem scales of the aided PIADS ($r = 0.29$ and $r = 0.24$, respectively) and with the PI scale of the SADL ($r = -0.28$). It thus seems that poorer hearing results in more positive psychosocial outcomes (PIADS subscales) but in less positive outcomes as related specifically to hearing aids. The only questionnaire subscale with which age correlated significantly was the PE scale of the SADL ($r = -0.31$, $p = 0.007$). This correlation became nonsignificant after controlling for 4-frequency PTA.

Relative Sensitivity of Measures to Self-Reported Hearing Aid Use

The following three figures show the relationship between questionnaire data and self-reported daily hearing aid use. The figures show mean questionnaire scores ± 1 standard error, for subjects grouped according to the number of hours per day they report wearing their hearing aids. In Figure 2 there was only one subject in the "<1 hour"

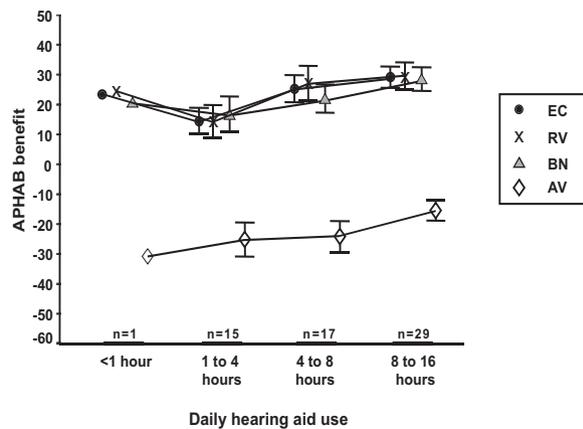


Figure 2. Group mean APHAB benefit scores with +/-1 standard error bars grouped by reported daily hearing aid use. Filled circles show scores on the EC subscale; Xs show scores on the RV subscale; shaded triangles show scores on the BN subscale; and open diamonds show scores on the AV subscale.

group; thus, there are no error bars. In Figures 3 and 4 there were three subjects in this group; thus, the error bars are large. For this reason, data from the “<1 hour” group are excluded from all statistical analyses below.

The APHAB benefit data in Figure 2 shows that the more hours per day an individual wears their hearing aid, the more benefit they report. This holds for all subscales. Multivariate analysis of variance (MANOVA) confirmed that there was a statistically significant effect across use categories ($F = 2.1, p = 0.042$). Univariate F-tests for each scale independently show that this group effect is significant for the Aversiveness subscale only ($F = 3.4, p = 0.045$). Post hoc tests using Tukey HSD method indicate that subjects who wear their hearing aids for 8–16 hours/day report significantly more aversiveness benefit (less aversiveness) than those wearing their hearing aids for 4–8 hours/day ($p = 0.05$). This relationship remains when 4-frequency pure-tone average (4F-PTA) is taken into account as a covariate.

The SADL data are shown in Figure 3. On all subscales subjects who wear their hearing aids up to four hours per day report less satisfaction than subjects who wear their hearing aids for four or more hours per day.

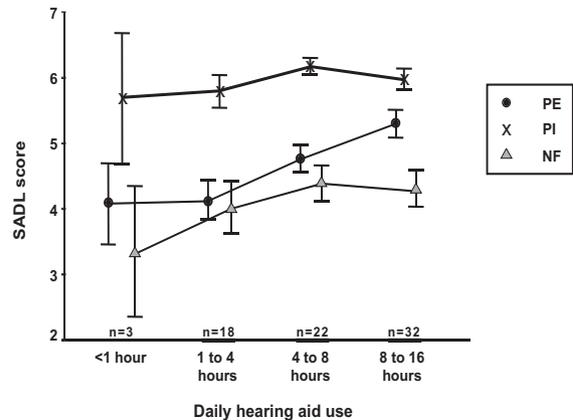


Figure 3. Group mean SADL scores with +/-1 standard error bars grouped by reported daily hearing aid use. Filled circles show scores on the PE subscale; Xs show scores on the PI subscale; and shaded triangles show scores on the NF subscale.

MANOVA shows a significant effect across use categories ($F = 2.4, p = 0.029$). Univariate F-tests indicate that only the PE subscale showed a monotonic relationship to daily hearing aid use ($F = 6.7, p = 0.002$), with subjects in the “8 to 16 hours” group reporting more positive effects than subjects in the “1 to 4 hours” group (Tukey HSD method, $p = 0.001$). Once again, partialling 4F-PTA had no impact on the findings.

The same type of pattern emerges from the PIADS data in Figure 4. PIADS scores increase with each successive increase in self-reported daily hearing aid use. MANOVA does not show a significant effect across use categories ($F = 1.9, p = 0.08$, although univariate F-tests indicate that there is a statistically significant group effect for the Competence subscale ($F = 3.9, p = 0.024$). Post hoc tests (Tukey’s HSD) indicated that the PIADS scores of the “1 to 4 hours” group differed significantly from the “8 to 16 hours” use group ($p = 0.023$). It should be noted, however, that when 4F-PTA is used as a covariate the univariate F-tests for the Competence scale became nonsignificant ($F = 2.4, p = 0.096$).

The data for “Lifetime hearing aid use” show similar trends to those for “Daily hearing aid use.” In part, this is because there is a significant relationship between daily hearing

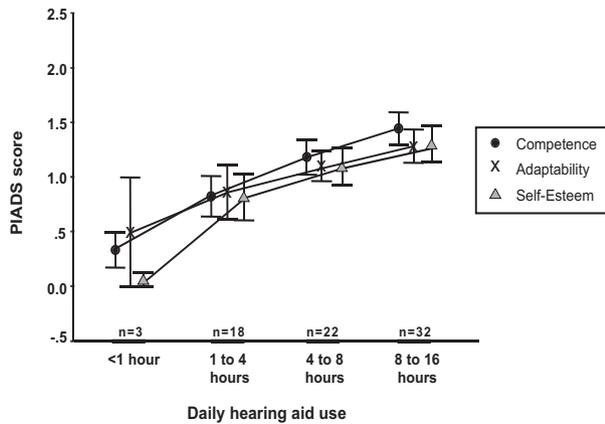


Figure 4. Group mean PIADS scores with +/-1 standard error bars grouped by reported daily hearing aid use. Filled circles show scores on the Competence subscale; Xs show scores on the Adaptability subscale; and shaded triangles show scores on the Self-Esteem subscale.

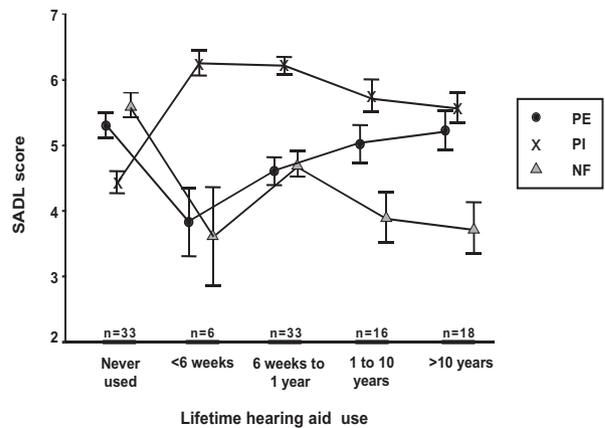


Figure 5. Group mean ECHO/SADL scores with +/-1 standard error bars grouped by reported lifetime hearing aid use. Data for the “Never used” group are from the ECHO; all other data are from the SADL. Filled circles depict scores on the PE subscale; Xs depict scores on the PI subscale; and shaded triangles depict scores on the NF subscale.

aid use and total lifetime use, such that over time individuals wear their hearing aids for longer each day (Pearson $r = 0.88$, $p < 0.001$). MANOVAs also show essentially the same statistical findings, with two exceptions. First, none of the APHAB scores show a significant effect across “Lifetime hearing aid use” categories. Second, all three PIADS scales show significant differences across “Lifetime hearing aid use” categories (Competence: $F = 5.4$, $p = 0.002$; Adaptability: $F = 3.5$, $p = 0.021$; Self-Esteem: $F = 3.4$, $p = 0.024$). Post hoc tests (Tukey HSD method) for all three subscales show significant differences between the group with least lifetime experience (“<6 weeks”) and the group with most lifetime experience (“>10 years”). In addition, on the Competence subscale there are also significant differences between the most experienced group and the “6 weeks to 1 year” group. Following the use of 4F-PTA as a covariate, the only subscale for which a univariate F-test remains significant is the Competence subscale ($F = 3.1$, $p = 0.033$).

Pre-Hearing Aid Use Expectations

Figures 5 and 6 show “Life-time hearing aid use” for the SADL and aided PIADS. ECHO scores are plotted on Figure 5 with the

SADL data, and data from subjects who completed the PIADS prior to hearing aid use are included in Figure 6 along with aided PIADS scores. ECHO data and unaided PIADS data are shown under the category “Never used.” Light grey lines are used to indicate that these data originate from a different

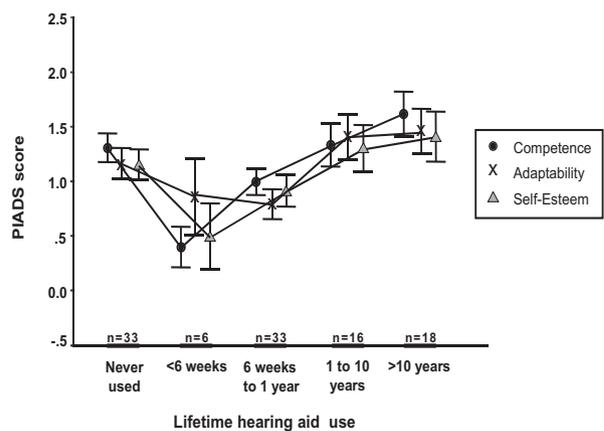


Figure 6. Group mean PIADS scores with +/-1 standard error bars grouped by reported lifetime hearing aid use. Data for the “Never used” group are expectations of non-hearing aid users; data for the other groups aided PIADS scores. Filled circles depict scores on the Competence subscale; Xs depict scores on the Adaptability subscale; and shaded triangles depict scores on the Self-Esteem subscale.

questionnaire. Plotting pre-aided questionnaire scores in the same figure as aided questionnaire scores permits examination of the relationship between expectations and later outcome. Ideally, longitudinal data should be used; however, it is felt that the cohort data here are revealing and provide a basis for planning later longitudinal studies.

The ECHO/SADL data (Figure 5) show the following. First, the PE scores of the nonuser group from the ECHO are higher than the PE scores from the SADL of the groups that had worn hearing aids for less than one year, but are similar to the PE scores of the groups that had worn hearing aids for more than one year. Second, the PI ECHO scores of non-hearing aid users are lower than the PI SADL scores of all the cohorts of hearing aid users; that is, non-hearing aid users believe hearing aids will affect personal image more negatively than hearing aids actually do. Third, the NF ECHO scores of non-hearing aid users are higher than the NF SADL scores of all cohorts of hearing aid users, indicating that non-hearing aid users underestimate the negative features that are encountered with hearing aid use.

The PIADS data in Figure 6 shows the same pattern as the PE data above, namely that preuse expectations are similar to the outcomes obtained from individuals who have worn hearing aids for one year or more.

DISCUSSION

The primary purpose of the study was to determine whether a generic questionnaire measure for evaluating the impact of assistive devices could provide information that hearing-aid specific measures cannot. The tools used were the APHAB, the SADL, and the PIADS. A secondary aim of the study was to compare pre-hearing aid use expectations with post-hearing aid use outcomes.

The metric used for comparison of the generic versus specific questionnaires was reported daily hearing aid use. Reported daily use has been used in various studies and is used clinically to differentiate successful from unsuccessful hearing aid users (Taubman et al, 1999). The accuracy of self-reported hearing aid use varies. Some studies have reported considerable inaccuracy (e.g., Brooks, 1979), while others have reported better accuracy (e.g., Taubman et al, 1999;

Haggard et al, 1981). However, as pointed out by Humes et al (1996), measured and self-reported use are highly correlated.

A comparison of Figures 2, 3, and 4 and examination of the MANOVA results shows that each questionnaire has one or more subscales with a monotonic relationship to reported daily hearing aid use. All three PIADS subscales showed stronger relationships with daily use than either the SADL or the APHAB. In light of the fact that studies have shown the use of amplification to improve various psychosocial aspects of life (e.g., Kochkin and Rogin, 2000; Mulrow et al, 1990; Bridges and Bentler, 1998), this is perhaps not surprising. On the other hand, prior studies using generic measures were not sensitive to hearing aid outcome. The strong association between outcome and hearing aid use found here is presumably because the PIADS was designed specifically to examine the impact of assistive devices, rather than general health issues. A tool that is sensitive to psychosocial benefits of amplification provides new avenues for clinicians to evaluate.

Past studies with the PIADS have shown it to consist of three relatively independent constructs (Jutai et al, 2000). However, in this study, scores on the three subscales did not appear to be differentially sensitive to hearing aid use. This may be either because the emotional issues associated with hearing aids are inextricably intertwined, or because the differential sensitivity of PIADS subscales may have been masked by averaging the responses of subtypes of hearing aid users, classifiable on the basis of nonaudiological variables, such as age, gender, and personality (Kricos, 2000). With increasing hearing aid use and experience, there is some differentiation between scores on the Competence subscale and the other two subscales, but the differences are not statistically significant. Like the PIADS, the APHAB data does not show differentiation in scores among three of the four subscales. This is in line with the data of Cox and Alexander (1995) in their initial article about the APHAB and is probably because the data being examined are group averages, rather than individual scores. The SADL subscales do show differentiation among the subscales. Perceived Positive Effect scores increase with both daily use and lifetime experience, while reported negative features and negative impacts on personal image

increase slightly (scores decrease) with daily use and lifetime experience.

It is interesting to note that the 4-frequency PTA correlates positively with two of the aided PIADS subscales but negatively with two of the SADL subscales. In other words, not unexpectedly, individuals with more severe hearing impairment find hearing aids to have a more positive impact on their psychosocial well-being than do individuals with less severe hearing loss. These same more severely impaired individuals, however, find the hearing aids themselves to be less satisfying than do the individuals with less severe hearing loss, presumably because of the acoustic issues encountered with more severe hearing loss.

These findings indicate that each of the measures has a different clinical application, the measure chosen should be determined by the desired information. The APHAB would be the best tool for troubleshooting a particular hearing aid fitting; the SADL would be most revealing when trying to understand specific issues an individual may have with the concept of amplification and hearing aids; and the PIADS would be the measure most sensitive for documenting overall psychosocial outcome.

The second aspect of the data examined here is the relationship between expected versus measured hearing aid outcome. It makes more sense to examine this in relation to lifetime hearing aid use than to daily hearing aid use although, as mentioned above, both measures yield the same patterns. For the ECHO/SADL combination, the data resemble those reported by Cox and Alexander (1999), namely, that prior to hearing aid use subjects underestimate the positive impact hearing aids have on Personal Image (PI scale) but overestimate the positive effects (PE scale) and underestimate the negative features (NF scale) actually encountered. Previously undocumented, however, is the finding that, for these cohorts at least, the Positive Effects of hearing aids do meet expectations, *among individuals that have worn hearing aids for a year or more.*

The PIADS expectations data have the same relationship to outcome as that seen for the PE scale of the ECHO/SADL. All three PIADS subscales show that expected psychosocial impacts are higher than the resulting outcome from groups of subjects who have worn hearing aids for less than one year,

but that the outcomes expected by non-hearing aid users are equivalent to the actual outcomes of subjects who have worn hearing aids for a year or more. *In other words, benefit expected prior to hearing aid use is similar to that of the attained benefit for individuals who have worn hearing aids for at least one year.*

These findings have important clinical implications regarding counseling of newly fitted hearing aids and the 30-day hearing aid trial period. Although presumably audiologists explain to their clients that "it takes time to get used to wearing hearing aids," explaining that improvements in perceived benefit continue throughout the first year of use is important.

Additional data suggesting that the PIADS is a useful tool for examining expectations as well as outcomes is seen in the data shown in Table 3. All subjects in this study who came to the laboratory without hearing aids were sent a second set of questionnaires to complete after participating in the study. Individuals in the "Unaided data only" group did not return this second set of questionnaires. These individuals had significantly lower expectations as measured by the PIADS than did the subjects who returned their second set of questionnaires. Although we have no outcome data on them, the lack of compliance with the study may suggest a poorer outcome than those who did comply with the protocol. Once again, the PIADS was more sensitive to this than the ECHO, on which expectation scores of the "Unaided data only" group were lower than the scores of the "Unaided and aided data," but not significantly so. In their 2000 paper, Cox and Alexander also found that individuals who did not return questionnaires had lower expectations than those that did.

SUMMARY

Each of the outcome questionnaires evaluated show (a) that subjects who have worn hearing aids for longer have more positive reported outcomes than those with less lifetime hearing aid experience and (b) that preuse expectations are similar to the reported outcomes of individuals who have worn hearing aids for one year or more but are higher than reported outcomes of individuals with less than one year of hearing aid experience.

It seems that the PIADS could be a useful complement to hearing-aid-specific outcome measures. It has the advantage over hearing-aid-specific measures of permitting across-device comparisons, which will allow a disentangling of device-specific from device-general issues associated with underuse of hearing aids and other assistive devices. The PIADS is easy to administer and score and may prove to be very useful in exploring the complex linkages among audiometric, functional, and psychosocial outcomes that is not possible with device-specific tools.

Acknowledgment. We thank Nobuko Ito for data collection.

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