Measuring Satisfaction with Amplification in Daily Life: The SADL Scale

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Objective: **To develop a self-report inventory to quantify satisfaction with hearing aids.**

Design: **The inventory was developed in several stages. To determine the elements that are most important to satisfaction for most people, we conducted structured interviews and then designed a questionnaire. Hearing aid owners responded to the questionnaire, indicating the relative importance of 14 different elements in their hearing aid satisfaction. Analyses indicated that the elements could be placed into four importance content areas. Trial satisfaction items were designed for each content area and submitted to focus groups to identify highly salient items as well as ambiguous items. A 25-item satisfaction questionnaire then was developed and disseminated to hearing aid owners. Results were obtained from 257 individuals. These data were analyzed to generate the final questionnaire.**

Results: **Fifteen items, divided into four subscales, were selected for the final Satisfaction with Amplification in Daily Life (SADL) questionnaire. The questionnaire yields a Global satisfaction score and a profile of subscale scores, which address Positive Effects, Service and Cost, Negative Features, and Personal Image. A preliminary evaluation of retest stability was conducted with 104 subjects. Ninety percent critical differences for the various scores ranged from 0.9 to 2.0 score intervals on a 7 point scale.**

Conclusions: **The SADL scale is both brief enough to be clinically acceptable and comprehensive enough to provide a valid assessment of an inherently multidimensional variable. Additional assessment is necessary to refine understanding of its test-retest properties, explore validity issues, and determine clinical, research, and administrative applications of the data.**

(Ear & Hearing 1999;20;306–320)

In the prevailing atmosphere of zeal to improve services and to demonstrate their effectiveness, hearing aid practitioners have embraced the collection of self-assessment data with considerable enthusiasm. Service providers have found that self-reports of disability and handicap yield valuable insights into the impact of impairment on everyday life and promote planning and execution of a rehabilitative strategy that pragmatically addresses the needs of the hearing-impaired person. Further, self-reported outcome data can be used to document the merit of the treatment program and can point to areas that are meeting expectations as well as those that are in need of improvement.

Although a triad of variables—use, benefit, and satisfaction—has been recognized for many years as providing valuable hearing aid outcome data, many current outcome assessments focus only on quantifying benefit. Popular approaches measure benefit in terms of situational communication improvement, reduction in disability, and reduction in handicap. The reliance on benefit as an index of quality is understandable because prospective hearing aid wearers routinely report that improved everyday communication is their primary requirement from a hearing aid (Barcham & Stephens, 1980). Nevertheless, it is the premise of this article that the focus on benefit as an outcome measure is in danger of becoming too narrow.

There is a substantial body of literature examining experienced hearing aid consumers that establishes that improved speech communication, while essential, is only one of several elements needed for a fully adequate hearing aid fitting. For example, Hawes, Durand, and Clark (1985) determined that the six most frequently mentioned attributes of the fitting were noticeability, comfort, ability to hear speech in a quiet room, ability to hear better when talking to other people in a noisy room, ease of operating controls, and ease of inserting and removing. Stock, Fichtl, and Heller (1997) reported that the top seven consumer requests for improvements in hearing aids encompassed speech understanding in noise, sound quality, cleaning ease, volume control use, music transmission, earmold fit, and speech in quiet. Kochkin (1992), based on an extensive survey of hearing aid wearers, determined that the most important features of the fitting are improved hearing, sound quality, reliability, usefulness in multiple environments, postpurchase service, and fit/comfort. These and other similar studies suggest strongly that reduction of disability or handicap in daily life (i.e., benefit) is not, by itself, sufficient to

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ensure ultimate approval by the patient of the amplification aspect of the rehabilitation program.

Satisfaction is the outcome variable that appears to encompass the full constellation of factors needed for a positive fitting result. Although the importance of satisfaction has been appreciated from a marketing point of view for many years, it has not received much attention from researchers, probably because benefit is coupled more closely to the performance of the hearing aid itself whereas satisfaction seems to include non-hearing aid variables such as professional service, personal stigma, etc. Nevertheless, we propose that when the overall outcome of amplification provision from the patient's point of view is the variable of interest, satisfaction is perhaps more important than benefit alone.

Most reported measurements of satisfaction have employed one Global item, such as "Rate your overall satisfaction with the hearing aid." This approach, which produces a single score, has provided data that lead to valuable insights about the relationship between Global satisfaction and other variables (e.g., Brooks, 1990; Humes, Halling, & Coughlin, 1996; May, Upfold, & Battaglia, 1990; Oja & Schow, 1984). For clinical use, however, a single Global satisfaction score is of limited value. Consider, for example, a situation in which two patients each rate their global satisfaction as 6 on a scale from 1 to 10. Clearly, neither is fully satisfied with the amplification program, but the practitioner cannot use this information to determine why they are dissatisfied or whether both are unhappy about the same things. Thus, a single Global score provides an index of satisfaction but offers no insights that might be useful to the dispenser in addressing problem areas. There is a need for an instrument to assess satisfaction that could be used clinically to provide not only an overall index of satisfaction, but also an indication of problem areas that could be addressed to improve satisfaction in the individual case.

This article reports development and evaluation of the Satisfaction with Amplification in Daily Life (SADL) scale. The goal was to devise a method of quantifying satisfaction through the measurement of its constituent elements (i.e., the word "satisfaction" is not actually used in the questionnaire). Further, it was essential to generate a scale of appropriate length for clinical use. The final scale yields a Global satisfaction score and four subscale scores. We report the procedures used to identify the constituent elements of satisfaction, the development of trial items, selection of final items, and development of interim norms for Global and subscale scores. We also present an estimate of the stability of satisfaction scores over a period of 3 to 6 mo. Finally, we discuss some potential applications of the SADL and present some illustrative cases.

TABLE 1. Matrix of variables defined for interviews of hearing aid owners about elements important to hearing aid satisfaction. Symbols show number and gender of individuals who were interviewed in each matrix cell (n = 21).

Hearing Loss Category	60–75 yr		>75 yr	
	Daily Use	Non-Daily Use	Daily Use	Non-Daily Use
Mild flat	—	👤👤	👩	👩👩
Mild sloping	👤	👤👤👤	👩	👤
Moderate flat	👤👤	👩	👤👩👩	—
Moderate sloping	👤	—	👤	👤👩

Determining the Elements of Satisfaction

Many researchers have used plausible arguments based on clinical expertise to postulate important variables in patient satisfaction with hearing aid fittings. However, relatively few studies have been reported in which subjects experienced with hearing aids have been asked directly "what things are important to your satisfaction with a hearing aid?" To determine the building blocks of satisfaction, we began with a search of the literature. After review and synthesis of published work, it appeared that the putatively important elements reasonably could be categorized into six domains. The domains were labeled tentatively as: cosmetics and self-image; sound quality/acoustics; benefit; comfort and ease of use; cost; and service. Using these categories as a guideline, we designed a structured interview to explore the actual salience of each domain and to attempt to elicit any additional domains that might not have been addressed.

The structured interview then was implemented with a series of individuals who had owned a hearing aid for at least 1 yr. Before recruiting interview subjects, appropriate individuals for the interview were predefined in terms of a matrix including hearing loss category, age, and hearing aid use. The matrix was established to ensure that we obtained data from individuals having a range of ages and hearing losses as well as those who, despite owning hearing aids for a year or more, had chosen not to wear them often, if at all. Most of the interviewees were recruited through a newspaper advertisement. A few additional people were selected from clinic records. Table 1 shows the distribution of persons interviewed. Three matrix cells remained empty

because no suitable subjects were located for them. This was not considered a problem because the accumulating interview data suggested considerable agreement across subjects in different cells. The final interviewees included 13 men and eight women.

The interviews were tape recorded and later transcribed. Subjects were asked about the importance of each content domain to their satisfaction with a hearing aid. We were particularly interested in exploring any differences in satisfaction domains for more- versus less-elderly individuals and persons reporting frequent versus infrequent hearing aid use, mild versus moderate hearing loss, and flat versus sloping configurations.

The subjects all asserted the importance of each of the six domains previously identified. Further, despite probing by the interviewer, no additional distinct domains of satisfaction were elicited by the interviews. Thus, the consensus about elements of satisfaction that we had drawn from published work was validated by the interview process.

Assessing Relative Importance of Elements of Satisfaction

We hypothesized that, even though each of the identified domains was an important component of satisfaction, they would not all be equally important. Therefore, in computing a Global satisfaction score, it might be appropriate to weight some domains more heavily than others. In addition, we wished to explore statistically the interrelationships among the contents of the six domains. To address these issues, a 14-item questionnaire was generated. The questionnaire comprised two items from each content domain except benefit, which was represented by four items. The particular items were chosen and worded, based on the interviews, to address the most salient and general issues raised by the interview subjects. The items and the precursory question are shown in Appendix A.

Subjects responded to the importance questionnaire using a seven-category scale. The words used to describe each category were based on an empirical determination of the value assigned to each descriptor in a study reported by Levine (1981). Levine asked subjects to rate descriptors on a scale of 1 to 7. Based on ratings for 43 different descriptors, he concluded that six to seven clear semantic distinctions can be made. A set of seven descriptors was chosen to cover the response range and to fulfill the following criteria: approximately equal intervals apart; substantial consistency in interpretation (small standard deviation); and clear semantic distinctions (minimal overlap). The results for the chosen descriptors were equally applicable to low and high-educational groups, and the subjects included a substantial proportion of low-income, older individuals. The set of seven descriptors used in the importance questionnaire also was used in the subsequently developed SADL questionnaire. The mean values assigned by Levine's subjects to each of the descriptors, as well as the score values assigned to these descriptors in the importance and SADL questionnaires, are illustrated in Figure 1.

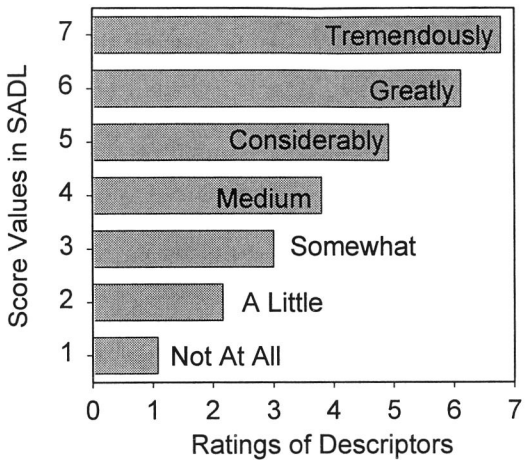

Figure 1. The x-axis gives mean values assigned by subjects to each of seven descriptive words/phrases (Levine, 1981). The y-axis shows the value given to each descriptor in scoring the importance and satisfaction questionnaires.

The importance questionnaire was mailed to 246 individuals aged 61 to 91 (mean = 76) who had purchased hearing aids in the recent past. Of these, 145 lived in the Memphis metropolitan area and 101 were residents of northern California. Fifty-nine percent were men. Usable responses were received from 165 individuals, 107 from Memphis and 58 from California. Of the final group, 62% were men and 38% were women. This gender distribution is identical to that of hearing aid owners in the country, according to a recent survey (Kochkin, 1999). Respondent's ages ranged from 61 to 91 yr with a mean of 75. The subjects reported hearing aid ownership ranging from less than 1 yr to 50 yr with a mean duration of 8.4 yr. Their reported daily hearing aid use ranged from none to 18 hr per day with a mean use per day of 9.0 hr. Their distribution of self-assessed hearing difficulty was: mild = 10%; moderate = 65%; and severe = 25%.

Analysis of the importance rating data addressed two questions. First, were there substantial differences among the 14 items of the questionnaire in their importance to satisfaction with a hearing aid? Second, were the 14 items separate and distinct or did they cluster into groups or factors? It was anticipated that the answers to these questions would be

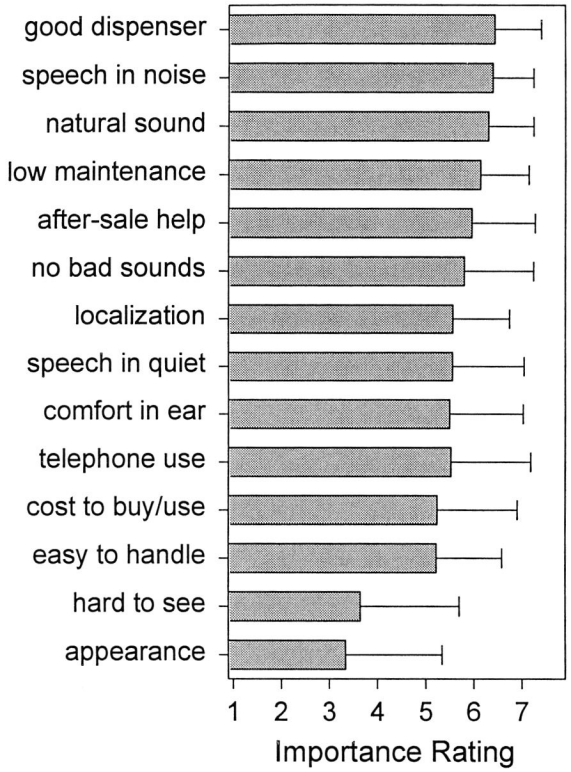

Figure 2. Mean importance-to-satisfaction rating given by hearing aid owners to each of the 14 items in the importance questionnaire, arranged in descending order. Bars give 1 SD.

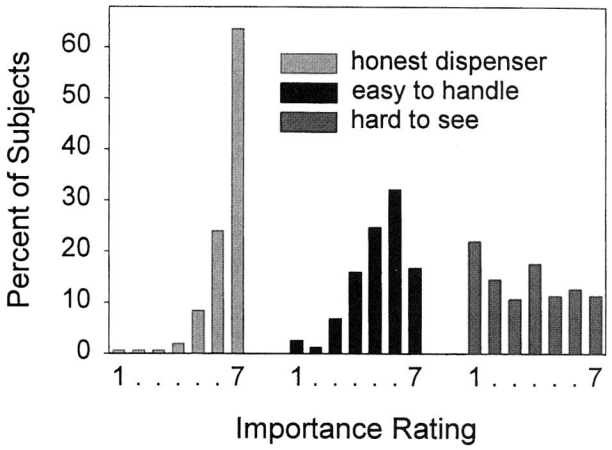

Figure 3. The distribution of importance ratings for each of three items from the importance questionnaire.

used to construct the initial form of the satisfaction questionnaire. Figure 2 depicts the mean importance rating and standard deviation for each of the 14 items arranged in order of importance. Four of the items (good dispenser, speech in noise, natural sound, and low maintenance) elicited mean ratings near the top of the importance scale. Two items, both relating to appearance, generated mean ratings in the three to four range (somewhat to considerably important). The remaining eight items all obtained mean importance ratings between five and six (considerably to greatly important). These results indicate that there were differences among the 14 topics in their rated importance to satisfaction with a hearing aid. Nevertheless, all of the topics included in the questionnaire were at least somewhat important, on average.

It was interesting to note that there was almost unanimous agreement among subjects about the importance of some topics while other topics revealed much more disparate evaluations. Figure 3 illustrates this by showing the distribution of importance ratings for each of three items. The distribution of ratings for "hard to see. . ." is fairly flat with all levels of importance represented, indicating that some subjects reported having a small hearing aid to be very important while others found it of no importance and yet others were between these two extremes. On the other hand, almost all subjects reported that having an honest, knowledgeable hearing health professional was of very great importance to their satisfaction. The distribution of ratings for "easy to handle" was different again: most subjects reported that it is fairly important but not at the end of the scale.

To determine whether the 14 items could be grouped into related clusters, the importance ratings were subjected to principal component analysis with varimax rotation. The procedure extracted four factors (eigenvalue >1.0) that together accounted for 68% of the variance in importance ratings. Table 2 gives the loadings of the 14 items on each rotated factor with loadings less than 0.45 not shown.

Factor 1 (40% of the variance) was interpreted as relating to benefit and sound quality. It included items for improved communication in quiet and noise and on the telephone, as well as improved localization ability and clear, natural sound.

Factor 2 (12% of the variance) was interpreted as encompassing physical and psychological comfort. It included a comfortable feeling in the ear and an absence of irritations such as feedback and internal noises, as well as the confidence that comes from interacting with a dispenser who displays knowledge, integrity, and a sincere interest in the patient's welfare.

Factor 3 (8% of the variance) was interpreted as including matters relating to value. It covered not only the financial cost of purchase and batteries but also the element of minimizing day-to-day vexations (the hearing aid should be dependable and easy to use).

Factor 4 (8% of the variance) was interpreted as addressing hearing aid stigma. It encompassed the notion of minimizing the obviousness of the impair-

TABLE 2. The loadings of the each of 14 items on four factors extracted from the importance questionnaire data. Loadings less than 0.45 are not shown.

Brief Item Content	Factor 1	Factor 2	Factor 3	Factor 4
Improved understanding in noise	0.61	—	—	—
Comfort in ear	—	0.68	—	—
Appearance to others	—	—	—	0.92
Absence of annoying sounds	—	0.45	—	—
Easy to handle	—	—	0.65	—
Knowledgeable, honest dispenser	—	0.85	—	—
Improved localization	0.48	—	—	—
After-sale help and guidance	—	0.78	—	—
Improved ability on the telephone	0.82	—	—	—
Improved understanding in quiet	0.70	—	—	—
Inconspicuous, hard to see	—	—	—	0.89
Natural and clear sounds	0.55	—	0.53	—
Cost of buying and using	—	—	0.75	—
Dependable, low maintenance	—	—	0.76	—

ment and maintaining an acceptable image to other people.

Construction of Trial Items to Sample Importance Domains

The results of the importance questionnaire suggested that hearing aid satisfaction could be conceived of as encompassing four important domains: benefit and quality, physical and psychological comfort, value, and image. Based on this outcome, we returned to the literature to compile a database of items that seemed to address these domains (Bentler, Niebuhr, Getta, & Anderson, 1993; Harrowven, Greener, & Stephens, 1987; Kochkin, Reference Note 1; Kricos, Lesner, & Sandridge, 1991; May et al., 1990; Surr & Hawkins, 1988; Welsh, 1994). In addition, some trial items were created from scratch, based on comments from the interviews. The list of items assigned to each importance content domain then was reviewed for high salience to hearing aid satisfaction as we understood it, based on the interviews with hearing aid wearers. Across all domains, the 67 items judged to be the most salient to satisfaction were selected.

The selected items then were reviewed by two different focus groups of five to six elderly hearing aid wearers recruited from clinic files. The group members were shown the list of items in each importance content domain in turn. For each domain, they were asked to comment on the meaning and relevance of each item. After this discussion, each focus group member was asked to choose the five items in that content domain that were the most salient for him or her. Based on the focus group results, the lists of items were reduced further. Items that were not interpreted consistently across subjects were eliminated. From those remaining, some items were slightly reworded. Finally, a collection of the most universally salient and consistently interpreted items was selected for further trial.

This process produced a list of 25 trial items to quantify hearing aid satisfaction in the four importance content domains. Eight were assumed to address the benefit and quality domain, seven were assigned to physical and psychological comfort, six tapped the value domain, and four were associated with Personal Image.

Acquisition of Responses to Trial Items

The 25 trial satisfaction items were assembled in random order to comprise a questionnaire. Each item was a complete question intended to assess satisfaction in one of the four importance domains. The response to each item was chosen from the same list of seven descriptors that was used for the importance questionnaire.

The satisfaction questionnaire was mailed to 365 hearing aid owners. Subjects originated at three clinical sites—a community speech and hearing center (N = 104, mean age = 77), a Veterans Affairs medical center (N = 204, mean age = 72), and a private practice audiology clinic (N = 57, mean age = 76). All those contacted from the VA site were men. Across the two non-VA sites, we contacted 61% men and 39% women. The goal was to obtain responses to the questionnaire items from hearing aid owners with all levels of satisfaction. To maximize the likelihood of this, it was considered important to sample individuals with a variety of hearing aid experience and use as well as different ages (above 60 yr) and hearing impairments. Responses were obtained from 257 individuals, 60 women and 197 men. The gender distribution of respondents from the non-VA sites was 58% men and 42% women.

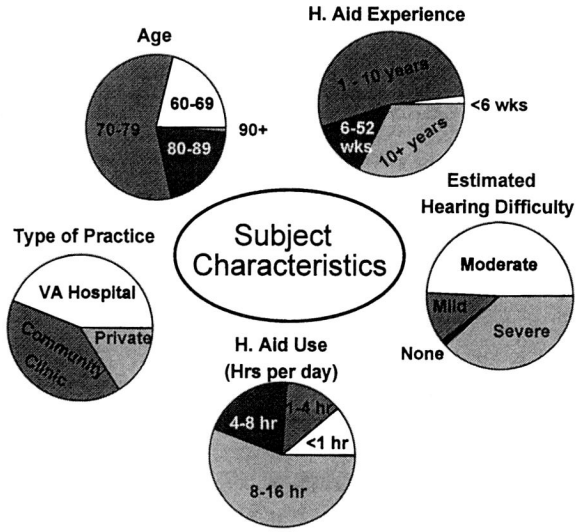

Figure 4. Characteristics of the 257 hearing aid owners who responded to the first satisfaction questionnaire.

Other characteristics of the final subject group are illustrated in Figure 4.

Selection of Final Items

To evaluate relationships among the satisfaction items, the data were subjected to a principal component analysis with varimax rotation. We should not necessarily expect the factors extracted from satisfaction data to parallel those found in the importance data. The importance factors reveal the types of issues that make a contribution to an individual's satisfaction with his or her hearing aid. The satisfaction factors reveal the relationships among the important matters in terms of satisfaction actually obtained. To illustrate, it is possible for two different matters (e.g., improved localization and better telephone communication) both to contribute to the same importance area of improved functioning. However, a hearing aid wearer might be rather satisfied with obtained improvements in localization but quite dissatisfied with obtained improvements in telephone use. These two matters, which were in the same factor for importance, then might appear in different factors for satisfaction.

Five factors (eigenvalue >1.0) were found to account for 57% of the variance in satisfaction data. Two items (7 and 21) did not load highly on any factor, and they were discarded. The remaining 23 items were distributed among the five factors without overlap when loadings less than 0.45 were suppressed. Table 3 gives the rotated factor loading for each item. The factors were interpreted as follows:

Factor 1 (23% of the variance) embraced overall positive effects along both acoustical and psychological dimensions. Eleven items loaded on this factor, with the highest loading for "Compared to using no hearing aid at all, does your hearing aid(s) help you understand the people

TABLE 3. The loadings of the each of 25 items on five factors extracted from the satisfaction questionnaire data. Loadings less than 0.45 are not shown.

Brief Item Content	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1. Hearing aids help you understand?	0.81	—	—	—	—
2. Frustrated when hearing aid picks up unwanted sounds?	—	—	0.72	—	—
3. How close to "normal" is aided hearing?	0.60	—	—	—	—
4. Provider concerned about helping?	—	0.67	—	—	—
5. Convinced that purchasing was in best interests?	0.66	—	—	—	—
6. Does ***feel*** in ear bother you?	—	—	—	0.55	—
7. How pleased with the battery life?	—	—	—	—	—
8. How helpful with four or more people?	0.72	—	—	—	—
9. Do people notice loss more?	—	—	—	—	0.65
10. Do aids improve localization?	0.63	—	—	—	—
11. Reduce asking people to repeat?	0.75	—	—	—	—
12. Hearing aids worth the trouble?	0.77	—	—	—	—
13. Controls easy to use?	—	—	—	0.58	—
14. Bothered by feedback?	—	—	0.61	—	—
15. Content with the visibility?	—	—	—	0.68	—
16. Wearing improve self-confidence?	0.72	—	—	—	—
17. How natural is the sound?	0.57	—	—	—	—
18. Help understand people with soft voices?	0.61	—	—	—	—
19. On most telephones, how pleased?	—	—	0.54	—	—
20. How competent was provider?	—	0.65	—	—	—
21. How content with volume level on?	—	—	—	—	—
22. Does wearing make you seem less capable?	—	—	—	—	0.80
23. Does cost seem reasonable?	—	0.71	—	—	—
24. How pleased with dependability?	—	0.56	—	—	—
25. How clear are people's voices?	0.52	—	—	—	—

you speak with most frequently?" This item was judged to exemplify acoustic benefit. The next highest loading was for "Do you think your hearing aid(s) is worth the trouble?" This type of item represents a psychological or comfort level improvement.

Factor 2 (11% of the variance) comprised four items encompassing Service and Cost. The highest loading was for "Does the cost of your hearing aid(s) seem reasonable to you?"

Factor 3 (9% of the variance) consisted of three items addressing issues that are often especially problematic for hearing aid wearers. The highest loading item was "Are you frustrated when your hearing aid(s) picks up sounds that keep you from hearing what you want to hear?"

Factor 4 (8% of the variance) was composed of three items that were judged to address ergonomic issues. The highest loading item was "How content are you with the visibility of your hearing aid(s)?" Based on the content of the other items in this factor, we concluded that this item had been interpreted as asking about the extent to which the hearing aid wearer could clearly see the important features of the instrument such as volume control markings, battery orientation guidelines, etc. This was not the meaning we had intended; the item was written originally to ask about the visibility of the hearing aid to others.

Factor 5 (6% of the variance) encompassed two items relating to hearing aid stigma. The highest loading item was "Do you think wearing your hearing aid(s) makes you seem less capable?"

There were several a priori goals for design of the SADL scale. These included a relatively short scale to optimize clinical utility, items that address content areas found to be important to satisfaction, and, in addition to a Global score, there should be a profile of subscale scores to promote the analytical/diagnostic use of the instrument. The final SADL items were selected from the 25 trial items with these goals in mind as well as several additional considerations. Desirable item features included a mean score nearer the middle of the scale, a wide range of distribution of responses, and relatively few occurrences of no-response to the item.

Fifteen items distributed across four subscales were chosen for the SADL scale. Each subscale was modeled on one of the five factors extracted from the analysis of the satisfaction questionnaire. In the interest of minimizing length, the content domain of factor 4 was not included as a subscale. This factor focused on the ergonomics of hearing aid use, which was a content area that had not been emphasized in our interviews and focus group meetings with hearing aid owners. The instructions, response choices, and items of the SADL are reproduced in Appendix B.*

Most of the items are written so that a response of "tremendously" indicates high satisfaction and receives a score of 7. However, four items are written in the opposite sense. For those items, the scoring is reversed so that a response of "not at all," indicating high satisfaction, receives a score of 7. Thus, all items are scored so that more satisfaction is reflected in a higher number score. Table 4 gives the mean score, standard deviation, and the corrected item-total correlation for each item as well as Cronbach's alpha for each subscale. For these analyses, only those subjects who provided a response for every item in the subscale were used (N ranged from 126 to 225). The four subscales were constituted as follows.

Positive Effect • The importance questionnaire clearly reinforced the significance of improved performance and function to hearing aid satisfaction. Analysis of the trial satisfaction items revealed that, in addition to encompassing reduced communication disability, improved localization, and natural sound quality, this domain includes a psychological satisfaction component. Based on the results of the interviews, the importance questionnaire, and the satisfaction questionnaire, this domain appears to be the largest single contributor to variance in satisfaction data. To reflect the importance of this content area in the overall score, a relatively large number of items (six) was chosen for this subscale. Two items concern acoustical benefit, one is about sound quality, and three address psychological dividends. All six items loaded highly on factor 1 of the satisfaction questionnaire. Table 4 shows that the six items have similar mean scores and standard deviations. They also have relatively high corrected item-total correlations, which indicates that the individual items are highly related to one another—a high score on one item tends to be predictive of high scores on the other items. This inter-item similarity also is reflected in the high value of Cronbach's alpha (0.88) for this subscale.

Service and Cost • Of the four items loading on this satisfaction factor, three addressed the service

* The questionnaire can be downloaded from the Website www.ausp.memphis.edu/harl. Software to score the questionnaire and display the results has been written. Further information is available on the Website.

TABLE 4. The mean score, standard deviation for each item, and the item's corrected item-total (IT) correlation, as well as Cronbach's alpha (α) for each subscale of the SADL.

Subscale and Item	Mean	SD	Corrected IT	α
Positive Effect (N = 225)				
Help you understand people.	4.9	1.35	0.76	
Was in your best interests.	5.7	1.56	0.72	
Reduce asking for repetition.	4.6	1.42	0.69	
Worth the trouble.	5.6	1.61	0.80	
Improve your self-confidence.	4.2	1.82	0.67	
How natural is the sound?	4.4	1.44	0.57	0.88
Service and Cost (N = 126)				
Competent hearing aid provider.	6.1	1.03	0.46	
Cost seems reasonable.	3.5	1.65	0.45	
Pleased with dependability.	4.9	1.48	0.45	0.61
Negative Features (N = 217)				
Frustrated with background sounds.	3.5	1.81	0.38	
Bothered by feedback.	4.1	1.96	0.39	
Helpful on the telephone.	3.0	1.73	0.30	0.54
Personal Image (N = 219)				
Others notice loss more.	5.5	1.46	0.37	
Makes you seem less capable	6.4	1.10	0.37	0.52
Content with the appearance.	*	*		

* *Not reported because wording of item was changed.*

provided by the dispenser and one concerned cost. Both of these content areas had been identified as very important to satisfaction. Three items were chosen for the subscale—two on service and one on cost. The item statistics provided in Table 4 for this subscale were obtained only from the non-VA subjects because the VA subjects did not pay for their hearing aids and, therefore, were not eligible to respond to the "reasonable cost" item. In applications of this subscale, subjects who have not paid for their hearing aids should omit the cost item and the subscale score should be computed on the two remaining items only.

The range in mean scores was fairly large for this group of items. Subjects typically reported a high level of confidence in their dispenser but were much less certain about whether the cost was reasonable. The inter-item correlations are quite modest, indicating that the response to one of these items is not necessarily highly predictive of responses to the other items. The modest value of Cronbach's alpha (0.61) reflects the moderate inter-item relationships as well as the small number of items in the subscale.

Negative Features • The three items encompassed in factor 3 comprise this subscale. Each item addresses a different aspect of hearing aid use, and, because of this, the relationships among the items, reflected by the inter-item correlations, and Cronbach's alpha are quite low. This means, for example, that an individual who reports a high level of frustration with background sounds is not necessarily seriously concerned with feedback problems. Nevertheless, the commonality among these items that resulted in their constituting a separate factor in the statistical analysis is that all three were identified often by hearing aid wearers as relatively unsatisfactory. We view this subscale as providing an estimate of the status of matters that often can detract from an otherwise highly satisfactory fitting.

Personal Image • The fourth subscale is intended to address the domain of self-image and hearing aid stigma. We had noted with interest that the hearing aid wearers we interviewed and surveyed tended to report that this issue, while important, was less salient to their satisfaction than other matters such as benefit, service, etc. Furthermore, the responses to the satisfaction questionnaire indicated that the typical hearing aid owner is highly satisfied with this aspect of his or her hearing aid. This constellation of outcomes—lower average importance level combined with high satisfaction level—might be seen as an argument for excluding image/stigma from the satisfaction scale. This probably would be a mistake.

The image/stigma content area has been implicated repeatedly over time in anecdotal forums as highly influential in hearing aid satisfaction. Many of the hearing aid owners we interviewed reported the opinion that the matter was highly significant to other people in other circumstances (e.g., younger and/or employed individuals). Further, although the mean importance of this domain was less than the average importance of other content areas, an examination of the data shows that subjects revealed a wide range of attitudes about the importance of self-image and stigma. This can be seen in Figure 3. Two of the items illustrated had a clear maximum in the distribution of responses. However, the "hard to

TABLE 5. Item statistics for the three items of the Personal Image subscale based on the results from the retest group (including the item reworded after the first questionnaire).

Subscale and Item	Mean	SD	Corrected IT	α
Personal Image (N = 92)				
Others notice loss more.	5.5	1.49	0.49	
Makes you seem less capable	6.4	1.23	0.41	
Content with the appearance.	5.0	1.57	0.33	0.59

see" item elicited an essentially flat distribution: every response alternative was selected by about 10 to 20% of the subjects. Clearly, some people find the appearance of the hearing aid and the impression it imparts to others to be of very great significance, whereas others report that it is a non-issue for them.

Based on these considerations, we decided to include a subscale in the SADL that addresses self-image and stigma. The subscale comprises the two items that loaded on factor 5 and a reworded item that loaded in its original form on factor 4. As described above, this item was originally worded "How content are you with the visibility of your hearing aid(s)?" It was reworded "How content are you with the appearance of your hearing aid(s)?" in the hope of capturing the original intention of the item. Because one item was reworded, the item statistics reported in Table 4 encompass only the two items that address impressions of hearing aid stigma (the hearing aid makes others notice the hearing loss more, and the hearing aid makes the individual appear less capable). Despite the apparent similarity of these two items, the inter-item correlations are fairly low, indicating that they address somewhat different content areas. Nevertheless, each item addresses an issue that was reported to be important to satisfaction by hearing aid owners. Cronbach's alpha is also quite modest, reflecting both the diversity of the items and the small number of items in the subscale. Application of the Spearman-Brown formula to the obtained value of Cronbach's alpha (0.52) suggests that the addition of the third item to this subscale will result in an increase of alpha to about 0.62 (Allen & Yen, 1979).

Scoring • The score for each subscale is computed by averaging the responses to the subscale items. In addition to the profile of four subscale scores, the item responses are combined to produce a Global score that is intended to provide an index of overall satisfaction. The Global score is generated by computing the mean of responses to all 15 items (14 items if the "reasonable cost" item has been omitted). This strategy weights the six-item Positive Effect subscale twice as heavily as the other subscales, which each comprise three items. We elected this scoring method because the analyses of both the importance and satisfaction data revealed that the positive effect content domain explained more of the variance than any other domain. Whether this weighting procedure produces a valid estimate of overall satisfaction is an empirical question that will be addressed in the future.

Missing Items • One of the criteria for item selection was a low occurrence of no-response to the item. Nevertheless, items occasionally were omitted by subjects. In scoring each subscale for data analyses reported below, we adopted a rule that at least two-thirds of the items must be completed for the score to be considered valid and used in the analyses. Further, to preserve the comprehensiveness of the Global score, it was computed for a subject only when there was a valid score for each subscale.

Evaluation of Retest Stability

After the 15 items were selected, the final version of the SADL was sent to 149 of the original subjects. The goal was to obtain an estimate of retest stability and to obtain statistics for the reworded item in the Personal Image subscale. For several reasons discussed below, these data should be viewed as an initial, and perhaps conservative, estimate of test-retest reliability. Nevertheless, they provide an interim basis for score interpretation until additional data can be obtained.

Responses to the second mailing were received from 104 subjects who were still using the same hearing aid. These subjects were very similar in demographic characteristics to the original group illustrated in Figure 4. The time elapsed between the first and second responses to the SADL items ranged from 12 wk to 30 wk with a mean duration of 23 wk.

Table 5 reports the item statistics for the Personal Image subscale, including the item that was reworded for the retest. The first set of mean scores and distributions for the two items addressing stigma (Table 4) were repeated very closely on the retest. The pattern of modest inter-item correlations indicated again that the items in this subscale focus on somewhat different areas of the image/stigma domain. The moderate value of Cronbach's alpha (0.59) reflects the small number of items in the subscale as well as their modest intercorrelations. This data set comprising the final 15 items also

TABLE 6. The correlation coefficients among the four subscales of the SADL, computed on the retest administration of the final 15 items.

	Positive Effect	Service and Cost	Negative Features
Service and Cost	0.58*		
Negative Features	0.33*	0.17	
Personal Image	0.29*	−0.08	0.34*

* $p < 0.05$.

provided an opportunity to compute Cronbach's alpha for the Global score. It was found to be 0.85.

Table 6 shows the correlation coefficients computed among the four subscales. The retest data were used for this analysis because it encompassed the reworded item in the Personal Image subscale. Most of the relationships are significant ($p < 0.05$) but not very impressive. The strongest relationship is between Positive Effect and Service and Cost. This indicates that a lack of improvement in acoustical and psychological state when the hearing aid is used is associated with a lower opinion of the dispenser's competence and with a lack of confidence in the instrument's quality.

Retest stability of the SADL was evaluated for the global score and for each subscale score. Because one item was reworded for the retest, it could not be included in the test-retest comparisons of Global scores. To underscore the fact that this estimate of global score is based on a maximum of 14 rather than 15 items, the overall score is called the Global14 score. In cases in which the subject did not pay for the hearing aid, the "reasonable cost" item was omitted, resulting in a Global score that was computed on 13 items. The subject group was divided about equally between paying and nonpaying individuals. Figure 5 depicts the distribution of test and retest Global14 scores. Repeatability of this overall satisfaction score was generally good: 71% of the subjects provided a retest Global14 score within 0.5 of a point of their original score. The correlation coefficient computed between test and retest scores was 0.81.

Figure 6 illustrates test and retest scores for the four subscales. The number of subjects included in each analysis is different because some items were not completed by some subjects. The score for the service and cost subscale was computed on the appropriate number of items for the subject: two items for those who did not pay for their hearing aids and three items for those who did. Even though the Personal Image subscale comprises three items, one item was reworded for the retest. Therefore, the personal image scores for Figure 6 were computed only for the two items that were repeated. Test-retest correlation coefficients for the four subscales were quite high for Positive Effect (0.81) and service/cost (0.80) and moderate for Negative Features (0.69). The lowest correlation (0.52) was seen for Personal Image. This result probably reflects the more restricted range of scores for the Personal Image subscale as well as the absence of data for one item.

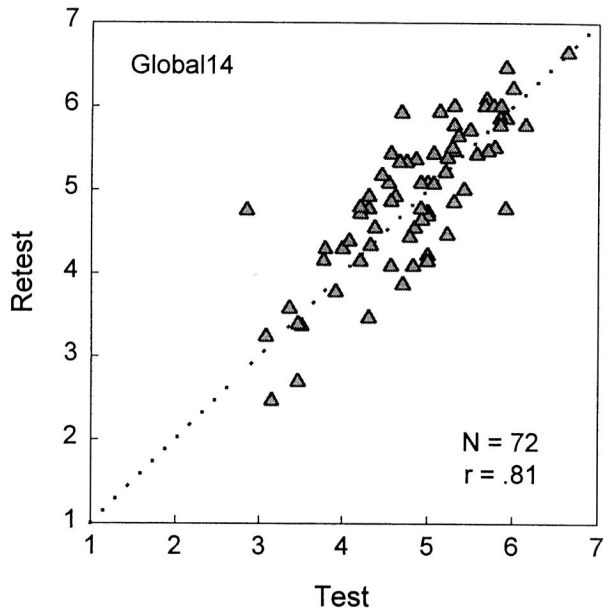

Figure 5. The distribution of test and retest Global scores, and the associated linear correlation coefficient, derived from 14 items of the SADL scale. One item could not be included in the analysis because it was reworded before the retest.

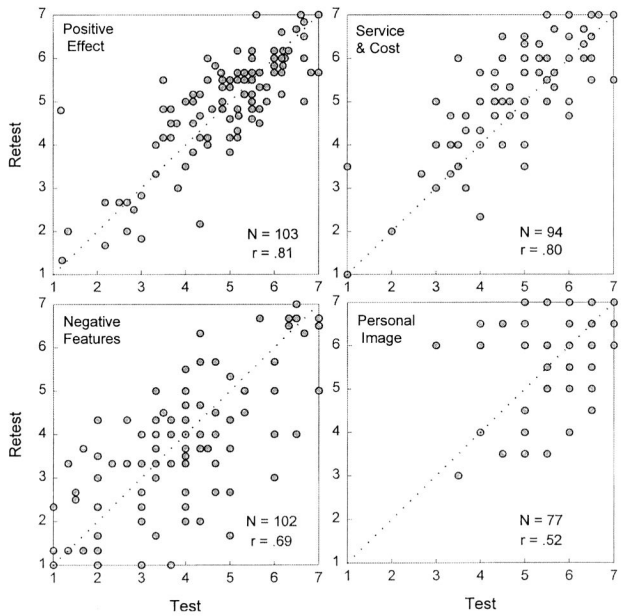

Figure 6. The distribution of test and retest scores for the four SADL subscales. The number of subjects included in each analysis is different because some items were not completed by some subjects. The Personal Image scores were computed only on the two items that were retested. The linear correlation coefficient is given for each subscale.

TABLE 7. The 90% and 95% critical differences (CDs) estimated for Global scores and for each subscale. The CDs for the Global scores are based on 14 items. The CDs for the Personal Image scores are based on data for two of the subscale's three items.

Score	90% CD	95% CD
Global	0.9	1.0
Positive Effect	1.3	1.6
Service and Cost	1.3	1.6
Negative Features	2.0	2.3
Personal Image	1.6	2.0

Critical Differences for SADL Scores

Although test-retest correlations provide a useful means of assessing the reliability of scores in a general sense, and also of comparing data for the SADL with other outcome inventories, they are of limited value to a practitioner who needs to interpret a difference between two scores for a given individual. The critical difference is the statistic of choice for this task. A critical difference provides a statistically based approach to evaluating differences between test and retest scores obtained by the same individual under two different conditions. Using the distributions of test-retest differences, the 90% and 95% critical differences were estimated for global14 scores and for each subscale. The computed critical differences are shown in Table 7.

The critical differences can be used in several ways. For example, consider SADL Global scores obtained from the same subject wearing two different hearing aids. Based on the 90% critical difference, we know that within-subject Global score differences larger than 0.9 occur by chance only 10% of the time. Therefore, if the two scores differ by more than 0.9, we can conclude with a fairly high level of certainty that the difference did not occur by chance and that the two hearing aids really have provided significantly different overall satisfaction. However, it is also important to keep in mind that this conclusion will be wrong about 10% of the time. If the practitioner desires to operate at a higher level of certainty than this (i.e., with a lower percentage of wrong decisions), a more strict critical difference value should be used, perhaps 95%.

Generation of Norms for Global and Subscale Scores

To facilitate interpretation of SADL responses, a set of interim norms was generated for Global and subscale scores. They include mean score and 20th and 80th percentile score values. There are two sets of norms for Global scores and for Service and Cost scores, one set including the "reasonable cost" item and another omitting this item. Norms for the Service and Cost, Positive Effect, and Negative Features subscales were computed using the original test data. Norms for the Personal Image subscale were computed using the retest data so that the reworded item could be included. Norms for the Global score, which encompasses all the subscales, also were based on the retest data. Table 8 depicts the norms as well as some additional descriptive data on the SADL scores. Some of the norms are based on relatively few subjects. Additional data are needed to refine the precision of these values.

Potential Applications

Clinical Applications

We envision three main clinical applications of scores from the SADL inventory:

1. Comparing satisfaction obtained by the same patient under two different conditions.
2. Determining satisfaction in a normative sense by comparing a patient's scores with those of a norm group.
3. Using the profile of subscale scores to gain insight into the underlying reasons when a patient expresses Global dissatisfaction and to plan appropriate intervention to improve satisfaction.

Scores obtained from the same individual under different conditions can be compared using critical differences, as described earlier and shown in Table 7. For example, a patient might report limited satisfaction with a current fitting, and the dispenser might wish to attempt to achieve greater satisfaction with a different fitting or with adjustments to the current fitting. The SADL inventory would be

TABLE 8. Mean, standard deviation, and 20th and 80th percentile values for Global scores and each subscale of the SADL.

Score	N	Mean	SD	20th	80th	Application?
Global*	44	4.9	1.0	4.2	5.9	Third-party pay
Global	53	4.9	0.8	4.3	5.6	Private pay
Service and Cost*	101	5.4	1.2	4.5	6.5	Third-party pay
Service and Cost	142	4.7	1.2	4.0	5.7	Private pay
Positive Effect	257	4.9	1.3	3.8	6.1	All patients
Negative Features	256	3.6	1.4	2.3	5.0	All patients
Personal Image	103	5.6	1.1	5.0	6.7	All patients

** The "reasonable cost" item is omitted.*

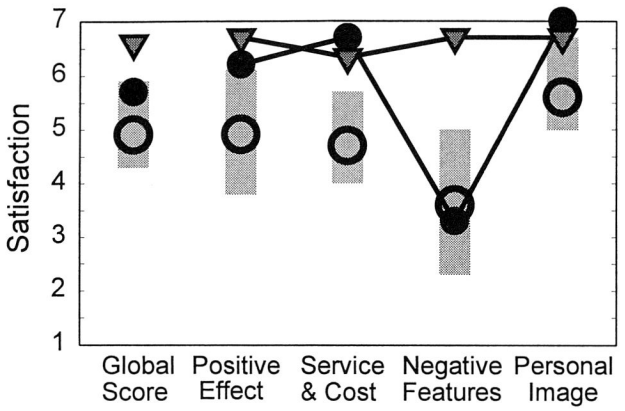

Figure 7. Mean scores (open circles) and typical range of scores (gray bars) for SADL Global and subscale score data. Also shown are Global and subscale scores for two individual hearing aid wearers (filled circles and triangles).

administered to assess the current fitting, then the new fitting would be tried for several weeks. Finally, the SADL would be administered again to assess the new fitting. Critical differences for Global and subscale scores would be used to determine the significance of any differences between scores for the two fittings.

Sometimes a patient is interested in comparing his or her own reaction to a fitting with the typical reaction of a group of peers. The patient wants to know whether others are usually more or less satisfied and/or whether they tend to have the same types of problems and concerns. This can be facilitated by comparing the patient's scores with the norms given in Table 7 and illustrated in Figures 7 and 8. The known characteristics of this comparison group are illustrated in Figure 4. It is possible to imagine other norm groups that might be of interest to patients. For example, norms that are limited to individuals wearing a particular hearing aid style or type of circuitry might be useful for comparison purposes.

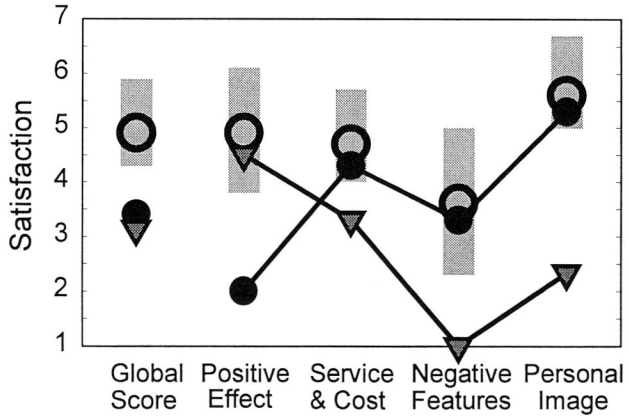

Figure 8. Same as Figure 7 but illustrating Global and subscale scores for two different hearing aid wearers.

The profile of subscale scores depicting different domains of satisfaction is a unique feature of the SADL inventory. These data can be used to help practitioners and patients understand both the positive features and the limitations of hearing aid rehabilitation for a particular individual in a particular treatment situation. It is quite likely that two patients who have about the same Global satisfaction score will have different reasons for any lack of satisfaction they report. When the reasons underlying dissatisfaction can be identified, it is more likely that the practitioner will be able to plan an intervention strategy that will be effective in improving the situation for a particular patient. We chose some individual data to illustrate the insights that potentially can be gained from examining the profiles. While the SADL was under development, subjects were provided with a space to write comments on their questionnaires. They were not specifically requested to write comments, but some chose to do so. We have assumed that their comments are an accurate indicator of their general state of mind vis à vis satisfaction with their hearing aid(s). Figures 7 and 8 depict their profiles.

In Figures 7 and 8, the open circles indicate the mean score from the norms in Table 8 and the gray bars show the 20th to 80th percentile of scores from the same table. Scores occurring either above or below the gray bars are unusually high or low, respectively. For all scores, a higher number means greater satisfaction. Thus, a high score on the Negative Features subscale indicates that the patient is relatively satisfied with this content area (i.e., he or she is not experiencing problems).

Figure 7 also shows Global and profile scores for two subjects. Both subjects have high Global satisfaction scores, indicating a high degree of overall satisfaction, as quantified by the SADL. Even so, the comments made by these two individuals were rather different. Subject 45, shown with triangles, wrote that she is "very satisfied." This comment suggests that there are no areas of concern for S45, and an examination of the SADL profile reinforces this: every profile subscore is well above the norm range.

On the other hand, subject 12, shown with filled circles, wrote "background noise really bothers me." S12's comment is indicative of some problems despite the high overall satisfaction score. When faced with this kind of comment about background noise, the practitioner might wonder whether the remark accurately identifies the true nature of the problem or whether it is concealing more widespread concerns. In this case, an examination of the SADL profile is reassuring. It shows that all of the scores are relatively high except the score for the Negative

Features subscale, which is slightly below the mean. This indicates that the problems experienced by S12 are limited to the domains of this single subscale. The subscale's individual items should be examined and can serve as the starting place for a discussion with the client about his concerns. This process should help in the formulation of intervention options that might improve satisfaction in the troublesome content domain. It is also interesting to notice that even though the Negative Features score is within the norm range, it is relatively low for this subject when compared with his other scores. S12's comment combined with his profile suggests that his expectations are for uniformly high performance from the hearing aid and that average performance in any area will not be acceptable.

Figure 8 provides examples from two other subjects, both of whom had overall satisfaction scores below the norm range, indicating low satisfaction. Each subject volunteered a comment about the hearing aids that was both negative and nonspecific. Subject 93, shown with filled circles, wrote that his hearing aid was "almost worthless," whereas subject 53, shown with triangles, noted that her hearing aid had "lots of room for improvement." This example provides a good illustration of the potential value of the profile of SADL subscale scores. If these two individuals had each provided only a Global satisfaction score, both would receive a similar low score. Most practitioners would want to address the patient's concerns in some way in the hope of improving satisfaction, but the comments provide no guidance about how to proceed. However, evaluation of the SADL profiles reveals that these two patients have diametrically opposed concerns and probably require very different intervention strategies.

The SADL profiles reveal that S93 reported a very low Positive Effect score, but scores on the other subscales are all within the norm range. We could summarize his situation as being not especially troubled by the potentially Negative Features of hearing aids and fairly comfortable with his image as a hearing aid wearer. He is also reasonably content with the competence of the dispenser and the cost of the hearing aid. However, he is deriving very low acoustical and psychological benefit from the hearing aid as measured by the Positive Effect subscale. Despite its many acceptable features, the hearing aid is not helping him to hear better.

Subject 53's profile yields an opposite pattern. She reported Positive Effects that were within the norm range. However, scores for every other subscale were well below the norm. In summary, this individual does notice definite improvements in her functioning as a result of using the hearing aid. However, she is despondent about her own image as a hearing aid wearer, and she is experiencing a high degree of negative impact from the instrument. Perhaps because of these factors, she is not convinced about the quality of the service she has received or that her money has been well-spent. In short, even though the hearing aid is helping her to hear better, she dislikes using it.

Improving satisfaction for these two patients (S93 and S53) probably will require very different intervention strategies.

Research Applications

There appear to be two main types of research applications for the SADL:

1. Comparing satisfaction achieved with hearing aid conditions that differ in terms of styles (e.g., in-the-ear versus completely-in-the-canal), processing (e.g., compression A versus compression B), or other variables.
2. Compiling outcome data for administrative purposes. These might include justification of continued services and/or funding and support for policy decisions about resource allocation.

Continuing Issues

All new measurement tools must undergo extensive use and evaluation by a variety of interested parties before their full complement of strengths and weaknesses becomes clear. There are several aspects of the SADL scale that need continued scrutiny. For example, the scale was developed for and with elderly subjects. Can it validly be used with younger adults? Preliminary data based on about 50 subjects indicate that there are no differences between results for the elderly group and results for those adults under 60 yr of age. More data are needed to fully answer this question. Another matter of considerable importance is the timeframe for satisfaction evaluation. How soon after the fitting does satisfaction stabilize, and does it increase or decrease in the interim? Is satisfaction measured after 2 wk of use predictive of the satisfaction that will be seen after 1 yr for the same fitting? There are very few data to help us address this issue at this time.

The reported data on reliability of the SADL should be regarded as preliminary because the subjects did not respond to exactly the same questionnaire on both occasions (the first questionnaire comprised 25 items). Further, these data are probably conservative because of the relatively long period of time that elapsed between test and retest. Additional studies of reliability are needed to refine the critical differences for Global and subscale scores. Studies also are needed of the validity of the satis-

faction scores provided by the SADL. It also will be important to explore the relationship between SADL scores and patient personality, lifestyle, expectations, and other outcome data such as self-assessed benefit if we are to fully understand and appropriately utilize satisfaction data.

FINAL COMMENTS

The pressures of daily practice in hearing health care demand that treatment outcome measures such as the SADL be brief enough to fit into a crowded schedule and easy enough to be completed by patients with limited education and ability. In addition, because the outcome data will provide a basis for decisions about the effectiveness of treatment and services, measures must be comprehensive enough to encompass the necessary content domains and data must display respectable psychometric properties. These demands are not mutually compatible, and compromises always will need to be made. The 15 items of the SADL are written at about a seventh-grade reading level and typically require less than 10 minutes to complete. Together, the items comprising the four subscales address a large proportion of the content domains that are important to hearing aid wearers, yielding good breadth of coverage. The psychometric properties of the Global score and of the Positive Effect and Service and Cost subscale scores are relatively good. On the other hand, because of the small number of items and the diversity of content, scores from the Negative Features and positive image subscales are somewhat less reliable. It will be necessary to accumulate experience with the inventory before we can determine whether the compromises selected were appropriate or whether modifications, such as additional items, appear advisable.

The SADL has been used over a period of months in several clinical settings. Comments of practitioners and patients have identified some limitations of the inventory. Two of the items would benefit from minor rewording. Item 7 (feedback problems) is currently only clearly applicable for hearing aids with manual volume control. Item 11 (telephone problems) is difficult to answer for individuals who use an unaided ear for the telephone. Patients who have worn hearing aids continuously for many years may have difficulty responding to item 10 (natural sound), whereas those who have not worn the instrument very long may find item 15 (instrument dependability) hard to answer. It might be possible to address some of these issues with refined wording of items, but also it should be realized that these kinds of concerns are typical for standardized questionnaires. It is difficult, perhaps impossible, to generate a standard set of items that apply equally well to all patients. Dispensers should be alert to the possibility of some items presenting problems for certain patients and fittings. The questionnaire's results should be interpreted with due attention paid to the constraints of each patient's individual situation.

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Appendix A: Items of the Importance Questionnaire

If you were to get a new hearing aid, how important would each of these things be in determining your overall satisfaction with it?

- Improved speech understanding in noisy places.
- The comfort of the hearing aid in my ear.
- The way I look to others when I wear it.
- The absence of annoying sounds coming from the hearing aid such as whistling and loud noises.
- How easy it is to handle.
- A knowledgeable and honest hearing health professional.
- Better ability to tell where sounds are coming from.
- A hearing health professional who encourages me to return after the sale for help and guidance.
- Improved ability to use the telephone.
- Improved speech understanding in quiet places.
- An inconspicuous hearing aid (hard to see or invisible).
- Natural and clear sounds through the hearing aid.
- The cost of buying and using the hearing aid.
- A dependable hearing aid that doesn't need much maintenance.

Appendix B: Instructions, Responses, and Items of the SADL.

INSTRUCTIONS

Listed below are questions on your opinions about your hearing aid(s). For each question, please circle the letter that is the best answer for you. The list of words on the right gives the meaning for each letter.

Keep in mind that your answers should show your general opinions about the hearing aids that *you are wearing now or have most recently worn.*

A Not At All
B A Little
C Somewhat
D Medium
E Considerably
F Greatly
G Tremendously

1.	Compared to using no hearing aid at all, does your hearing aid(s) help you understand the people you speak with most frequently?	A	B	C	D	E	F	G
2.	Are you frustrated when your hearing aid(s) pick up sounds that keep you from hearing what you want to hear?	A	B	C	D	E	F	G
3.	Are you convinced that obtaining your hearing aid(s) was in your best interests?	A	B	C	D	E	F	G
4.	Do you think people notice your hearing loss more when you wear your hearing aid(s)?	A	B	C	D	E	F	G
5.	Does your hearing aid(s) reduce the number of times you have to ask people to repeat?	A	B	C	D	E	F	G
6.	Do you think your hearing aid(s) is worth the trouble?	A	B	C	D	E	F	G
7.	Are you bothered by an inability to turn your hearing aid(s) up loud enough without getting feedback (whistling)?	A	B	C	D	E	F	G
8.	How content are you with the appearance of your hearing aid(s)?	A	B	C	D	E	F	G
9.	Does wearing your hearing aid(s) improve your self-confidence?	A	B	C	D	E	F	G
10.	How natural is the sound from your hearing aid?	A	B	C	D	E	F	G
11.	How helpful is your hearing aid(s) on MOST telephones with NO amplifier or loudspeaker?	A	B	C	D	E	F	G
12.	How competent was the person who provided you with your hearing aid(s)?	A	B	C	D	E	F	G
13.	Do you think wearing your hearing aid(s) makes you seem less capable?	A	B	C	D	E	F	G
14.	Does the cost of your hearing aid(s) seem reasonable to you?	A	B	C	D	E	F	G
15.	How pleased are you with the dependability (how often it needs repairs) of your hearing aid(s)?	A	B	C	D	E	F	G