Clinical Application of the Satisfaction with Amplification in Daily Life Scale in Private Practice I: Statistical, Content, and Factorial Validity

Holly Hosford-Dunn*
Jerry Halpern

Abstract
Statistical, content, and factorial validity of the Satisfaction with Amplification in Daily Life (SADL) scale was assessed. SADL subscales closely correspond to four satisfaction domains. Subjective benefit is a key component of satisfaction, but other nonauditory factors contribute to wearer satisfaction, notably telephone use and appearance. Results confirm the SADL's psychometric properties and verify its use to validate hearing aid fitting satisfaction in private practice settings for a general patient population at 1-year postfitting. Interim SADL norms may be refined as more SADL data are obtained for different patient populations, hearing aid types, and fitting environments.

Key Words: Hearing aids, outcome measures, Satisfaction with Amplification in Daily Life

Abbreviations: PP-SADL = private practice SADL group, SADL = Satisfaction with Amplification in Daily Life

Subjective, self-report measures to validate hearing aid fittings address the needs of cost containment and quality control in the increasingly competitive hearing health care market. Interest in self-assessment measures also stems from the realization that objective assessment does not measure some elements that contribute to successful, long-term hearing aid fittings (Dillon et al, 1997; Cox and Alexander, 1999; Kochkin, 2000). The need to validate successful hearing aid fittings is of growing importance as we learn more about the positive impact of hearing aid use on quality of life measures (Kochkin, 2000).

Self-assessment procedures have inherent face validity because they measure patients' perceptions of pre- versus postfitting performance (i.e., benefit) and their perceptions of the relative success of their hearing aid fittings (i.e., satisfaction). Yet, the clinical utility of self-report measures appears low because most private practitioners do not use them to validate their fittings (Mueller, 1997; Medwetsky et al, 1999; Abrams and Hnath-Chisolm, 2000). Reasons for the underuse are varied (cf., Huch and Hosford-Dunn, 2000): some tools are lengthy or complex; others require pre- and postfitting administration. Many psychometrically sound assessment tools limit their scope to perceived communication benefit and/or handicap, without regard for consequential, nonauditory factors that contribute to patient satisfaction with hearing aid use (Resnick, 1998; Cox and Alexander, 1999; Hosford-Dunn and Huch, 2000). There may be insufficient justification for use of subjective measures of benefit and handicap in busy dispensing settings because these measures do not adequately predict which hearing aid fittings will succeed and which will not, nor do they shed light on problem areas beyond those associated with aided improvement in understanding speech (Hosford-Dunn and Huch, 2000).

Cox and Alexander (1999) comment, “Satisfaction is the outcome variable that appears to encompass the full constellation of factors needed
for a positive fitting result” (p. 307). However, measuring satisfaction is a formidable task because a large number of factors contribute to final outcome and because satisfaction depends solely on the patient’s perceptions and attitudes. Another difficulty is that satisfaction is not a static measure of outcome. Satisfaction declines in the first 3 months postfithing (Hosford-Dunn and Baxter, 1985) and is likely to show other fluctuations over time, depending on the patient’s circumstances and the performance of their instruments. The questions of when and how often to measure satisfaction remain unresolved.

Some investigations have used single-item indices of overall satisfaction and measured how their index correlated with other variables (cf., Oja and Schow, 1984; Hosford-Dunn and Baxter, 1985; Dillon et al, 1997). Results of these studies are not always in agreement, nor can they be compared directly. However, variables that have been linked to single indices of satisfaction include daily use, provider service, aided speech performance, self-assessed aided benefit, motivation, and age. Although undifferentiated measures of satisfaction may identify indiscriminate relationships between variables and satisfaction, they lack clinical utility because they cannot analyze reasons for dissatisfaction in problem fittings or help in formulating intervention strategies. Some studies have incorporated satisfaction items into larger surveys and analyzed the results for evidence of satisfaction-related domains or key variables that contribute to satisfaction in one or more areas. Based on 34 to 45 satisfaction items in Knowles Electronics’ MarkeTrak Satisfaction surveys, Kochkin (1993, 1997) identified four factors that were important to hearing aid owners (value and perceived benefit, sound quality, reliability, satisfaction in multiple listening situations). He also found that degree of satisfaction on some items was related to the patients’ history of hearing aid use, binaural/monaural status, and degree of hearing loss and to instrument attributes such as style and programmability. Humes (1999) identified multiple independent factors underlying hearing aid outcome, one of which was a factor encompassing user satisfaction, subjective benefit, and hearing aid use. Dillon et al (1997) found that satisfaction measures correlated highest with a factor representing aided benefit and communication ability. Each study suggests elements that contribute to user satisfaction, but none provides a mechanism for quantifying degrees of satisfaction in its component parts. For clinical utility, satisfaction needs to be measured independently and in a structured manner. As Abrams and Hnath-Chisolm (2000, p. 72) point out:

Satisfaction does not always correspond to significant or quantifiable changes in impairment, activity limitations, participation, or health-related quality of life. In addition to improvements in communication and real-world functioning, the domain of satisfaction involves the patient’s relationship with service providers, the ease of access to services, as well as the influence of factors such as cosmetics, comfort, expectations and perceived value. It is a construct that needs independent assessment [italics added].

The Satisfaction with Amplification in Daily Life (SADL) scale is a self-report questionnaire developed by Cox and Alexander (1999) to address the clinical need for a brief, independent assessment of satisfaction in its component parts. The authors used interviews, surveys, and focus groups to identify and categorize variables according to their importance to hearing aid users. Results of these “importance” studies were used to construct 25 satisfaction items, which were administered to a large group of hearing aid wearers. Responses to the satisfaction items were subjected to psychometric and factor analyses. From those analyses, Cox and Alexander constructed the SADL, which consists of 15 items from four domains that accounted for the majority of variance in their satisfaction item data. In the SADL, the average of the 15 items yields a “Global satisfaction” score. Four subscale scores, based on averages of three to six items, profile satisfaction according to Positive Effect (measures of acoustic and psychological benefit), Negative Features (e.g., background noise, feedback, telephone use), Service/Cost, and Personal Image (cosmetics and hearing aid stigma). Because the subscales are modeled on satisfaction domains that were identified by hearing aid users during SADL development, the SADL has good construct validity as an outcome measure of satisfaction in hearing aid users.

The SADL is designed for clinical utility. It is a one-page paper and pencil form, requiring less than an eighth-grade reading level, which most patients can complete in less than 10 minutes at home or in the office. It is easily scored with inexpensive software that can be downloaded from the Internet. Preliminary psychometric
Validation of the SADL in a Private Practice Setting/Hosford-Dunn and Halpern

analysis by Cox and Alexander (1999) shows reasonably good content validity of items and sub-scales and good test–retest reliability at about 5 months. Suggested applications for the SADL are for hearing fitting verification and validation, patient counseling, and program evaluation.

Interim norms for the SADL are based on several elderly, predominantly male populations culled from Veterans Affairs and community clinics. Many subjects received amplification at no cost, and some had been using their instruments for some time. There is a need to test the SADL in different patient populations and clinical environments in order to understand the extent to which the clinical and statistical utility of the SADL are maintained in different service delivery contexts and to document the discriminatory power of the SADL in these environments and for different postfitting intervals.

The present article examines the validity of the SADL in a private practice setting. Study goals addressed three types of validity:

- **Statistical Validity.** Develop 1-year postfitting SADL scores for a routine private practice cohort using self-pay patients with a wide range of ages who were evenly distributed by gender. Compare private practice scores to interim SADL norms to see whether the latter generalize to different patient populations, clinical settings, and administration time frames.

- **Item and Content Validity.** Assess the stability of psychometric properties of the SADL by comparing item and subscale correlations to those reported by Cox and Alexander (1999).

- **Factorial Validity.** Evaluate the extent to which SADL subscales correspond to separate satisfaction domains by isolating factors that explain the variance in the data and compare the item loadings on those factors to item assignments in the SADL subscales.

### METHOD

#### Subjects

As in other questionnaire-based studies of hearing aid outcome (e.g., Dillon et al, 1999), participants were patients who received standard audiometric and hearing aid services and were not subjects in the usual experimental sense. The cohort sample consists of all patients seen in the first author’s private practice in 1996 and 1997 (N = 375) who were evaluated and fitted with amplification and kept amplification beyond the trial period. All participants were English speaking and all were asked to complete the SADL at their 1-year follow-up. Those who complied within the time frame of the study are referred to as the Private Practice SADL group (N = 282), abbreviated as “PP-SADL,” to distinguish their data from the entire cohort and from the data of Cox and Alexander (1999). The PP-SADL group is described in the Results section.

Characteristics of the cohort are similar to those described elsewhere for a large private practice cohort of hearing aid purchasers (Northern and Beyer, 1999). Age and gender of the total cohort are describe in Table 1 and Figure 1. Forty-seven percent were male and 53 percent were female. Most adults were older than 60 (only 22 were younger than 60). Females were slightly older than males (p < .05). With very few exceptions (e.g., a 6-year-old boy), subjects lived independently in homes or active retirement centers. No subjects lived in nursing homes at the time of hearing aid delivery.

Forty-five percent of the subjects were new users, 22 percent were experienced users who were replacing their old aids with amplification of the same circuit type, and 33 percent were experienced users who were upgrading to analog programmable or digital signal processing instruments. Sixty-four percent of the fittings

| Table 1 Age and Gender of the Cohort (Ages Unknown for 3 Patients) |
|----------------------|------------------|------------------|
| Overall (n = 371)    | Male (n = 175)   | Female (n = 175) |
| Average age          | 76.0             | 74.5             | 77.3             |
| SD                   | 12.8             | 13.6             | 12.1             |
| Median               | 77               | 76               | 79               |
| Range                | 61–101           | 6–101            | 21–95            |

**Figure 1** Age distribution for all patients fitted with amplification.
were binaural. Binaural fits were slightly more common for males than for females ($p < .05$). The remaining fittings were categorized as monaural, including some experienced binaural users who were replacing only one instrument. Additional information regarding the patients' hearing aid fittings is contained in Part II of this study (Hosford-Dunn and Halpern, 2000).

**Materials**

Audiometric tests, acoustic immittance in some cases, and soundfield verification were conducted using standard audiometric and soundfield equipment in sound-treated booths. Soundfield stimuli were presented in quiet through one speaker positioned at 0° azimuth.

**SADL Scale**

A prepublication version of the SADL was obtained from the Hearing Aid Research Laboratory (HARL), University of Memphis. The form contained instructions for answering 15 satisfaction items on a 7-point equal-interval-appearing semantic scale ranging from “not at all” to “tremendously.” For 11 items, “tremendously” indicates satisfaction and is scored as a 7, whereas “not at all” indicates dissatisfaction and is scored as a 1. The remaining four items are reversed so that “tremendously” indicates complete dissatisfaction and is scored as a 1, whereas “not at all” receives a 7. The uniform scores and staggered response pattern of a satisfied patient are shown graphically in Figure 2 using the automated SADL scoring program.

**Procedures**

Procedures were incorporated into the patients' regular office visits to encourage participation. Hearing aids and counseling were provided in a series of appointments in which individual participants received services from one or more of three audiologists employed in the private practice (including the first author).

---

The 15 questionnaire items of the prepublication version were the same as in the SADL published in Cox and Alexander (1999). The form itself differed in one minor way: it offered four response categories for the multiple-choice question on perceived disability. The published version added a “moderately severe” category.

**Initial Appointment (90 Minutes).** The patient brought in a completed two-page history form that was mailed prior to the appointment. Following review and discussion of the history form, the audiologist performed pure-tone audiometry and speech audiometry (PI/PB function for new patients or return patients if word recognition scores were poorer than the previous year’s tests), as well as acoustic immittance testing and threshold tone decay, if indicated.

The hearing aid recommendation procedure has been described elsewhere (Iskowitz, 1999; Hosford-Dunn and Huch, 2000). In the procedure, hearing aid candidacy was established based on audiometric results and by a needs assessment that was completed after testing. The needs assessment was based on informal counseling, often in conjunction with the Client Oriented Scale of Improvement (Dillon et al, 1997).

**Fitting Appointment (90 Minutes).** Amplification was fitted 2 weeks later. Prior to this appointment, programmable and digital signal processing instruments were preset according to recommended algorithms. The audiologist...
Validation of the SADL in a Private Practice Setting/Hosford-Dunn and Halpern

followed a checklist that ensured that a number of fitting and orientation variables were addressed (Hosford-Dunn and Huch, 2000). The audiologist also checked ear canal status and goodness of fit. Counseling and aid adjustments were performed until the patient expressed initial satisfaction with amplification. In most cases, verification was performed at follow-up appointments.

**Follow-up Appointments (30 Minutes Each).**

Patients were scheduled to return for initial checks at 2 to 7 days postfitting. The main purposes of the first follow-up visit were to ensure that patients were (1) able to manipulate their instruments; (2) experiencing no pain or discomfort with insertion, removal, or use; and (3) noting improved intelligibility of conversational level speech without loudness discomfort in their everyday life. Problems in these areas were addressed by the audiologist at this appointment and served to dictate subsequent intervention timing and strategy.

Follow-up appointments continued at weekly intervals until patients expressed satisfaction with their amplification. Regardless of when this occurred, all patients were scheduled for follow-up at 1-month and 6-months postfitting. Patients with no previous hearing aid experience were scheduled also for follow-up at 3-months and 9-months postfitting. All patients were scheduled for repeat audiometry and hearing aid follow-up at 12-months postfitting.

**Soundfield verification by functional gain (500-4000 kHz) at the patient's preferred gain/volume settings was performed when the patient expressed satisfaction with amplification. Audiologists fit the instruments according to their overall judgment of test results and the patients' reported preferences, rather than by a specific prescription formula.**

**SADL Measures.** SADL scales were mailed to patients prior to their 12-month follow-up appointments, accompanied by a self-addressed, stamped return envelope. Patients either mailed back the SADL or completed a SADL at their annual appointment. A second mailing was made to patients who did not mail in the SADL or keep their annual appointments.

**Data Analysis**

Data were stored and analyzed on the Stanford University Sun Sparc Ultra II computer, Solaris 2.6 Operating System, using programs from the Statistical Analysis System. Qualifying data were subjected to statistical measures of central tendency, principal-components analysis with varimax rotation, correlation analyses, analysis of variance, and logistic and multiple regression analyses.

Returned SADL scales were screened for missing items. Questionnaires were excluded from global score computations if they had more than two missing items (<13 responses) or more than one missing item in any subscale. Subscale scores were computed if a subscale contained no more than one missing item, that is, at least 5 of 6 responses in the Positive Effect subscale or 2 of 3 responses in the Service/Cost, Negative Features, or Personal Image subscales.

**RESULTS**

**PP-SADL Group Characteristics**

Two hundred and eighty-two SADL scales were returned (75.4% response rate). Of the 92 nonrespondents, 8 were deceased, 5 were no longer able to conduct their own affairs (e.g., Alzheimer's disease, dementia, illness), 6 had moved, and 73 were either lost to follow-up or did not complete the questionnaire within the time frame of the study.

Characteristics of the PP-SADL group are shown in Figure 3 and Table 2. According to t-tests, PP-SADL and cohort samples were statistically similar in age, gender, previous hearing aid history (new vs previous users; years of experience), and hearing aid style selections. However, SADL respondents were significantly different (p < .005) in the following ways: they were more likely to have binaural fittings, they returned for more hearing aid follow-up checks, and they purchased higher level hearing aid technologies with higher invoice costs. Effects of these variables on SADL measures are explored in Part II of this study (Hosford-Dunn and Halpern, 2000).

Composite left and right air-conduction audiograms are shown in Figure 4 for males and females. Within genders, t-tests showed...
that average left and right ear thresholds were not significantly different at any test frequency for males or for females. Between genders, auditory sensitivity was poorer for females at 250 and 500 Hz (p < .005) and poorer for males at 3000 to 6000 Hz (p < .005), consistent with prior observations in the literature (Jerger et al, 1993). Average functional gain measures (Table 3) indicate an inherent fitting philosophy that fell between a one-third gain rule and National Acoustics Laboratory-Revised formula (Byrne and Dillon, 1986).

The 282 completed questionnaires were screened for missing items according to the criteria described in the Analysis section. Two hundred and fifty-seven were acceptable for Global score analyses. Usable response rates were higher for internal analyses of specific subscales: 275 for the Positive Effect subscale, 274 for Service/Cost, 271 for Negative Features, and 270 for Positive Effect.
Table 3  Average Hearing Level and Functional Gain Values at 500–4000 Hz for PP-SADL Group, Compared to Two Prescription Targets (n = 258)

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average HL (dB HL)</td>
<td>35</td>
<td>42</td>
<td>53.5</td>
<td>61.5</td>
<td>66</td>
</tr>
<tr>
<td>Average functional gain (dB)</td>
<td>11</td>
<td>18</td>
<td>23</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>One-third-gain rule (dB)</td>
<td>11.7</td>
<td>14</td>
<td>17.8</td>
<td>20.5</td>
<td>22</td>
</tr>
<tr>
<td>NAL-R predicted gain (dB)</td>
<td>9.5</td>
<td>20.5</td>
<td>22.1</td>
<td>23.6</td>
<td>25.0</td>
</tr>
</tbody>
</table>

NAL-R = National Acoustic Laboratories-Revised.

Frequency response histograms for each of the 15 items are contained in the Appendix. Response rates exceeded 90 percent for all but items 4 (89%) and 7 (77%). Most items had a wide range of scores, but items 4, 12, and 13 had ceiling effects and few responses below 4 on the scale.

Statistical and Content Validity

Global, Service/Cost, Positive Effect, and Personal Image means were statistically similar to interim norms. Item means from both studies did not differ significantly by t-tests (p > .001) for 12 of the 15 items, as shown in Figure 5. Items 2, 7, and 12 differed significantly (p < .001) as follows: patients in the PP-SADL group were less frustrated by background noise (item 2, t = -3.54) and feedback (item 7, t = -3.93) and were more satisfied with provider services (item 12, t = -3.46). High satisfaction on items 2 and 7 produced a Negative Features subscale mean that was significantly higher for the PP-SADL group, as shown in Table 4.

Item Validity: Internal Consistency

Means and standard deviations for item scores are given in Table 5, together with the corrected item-total correlation and Cronbach’s alpha for global, subscale, and item scores. Overall, the results paralleled those of Cox and Alexander (1999) but with lower correlations and alpha values. Cronbach’s alpha for the global score was high (.77 compared to .85 in Cox and Alexander), indicating that many of the items in the scale behaved similarly and positively predicted one another. That similarity was concentrated in the six items comprising the Positive Effect subscale. Those items had similar means and variances and relatively high corrected item-total correlations, resulting in a high Cronbach’s alpha (α = .84, compared to .88 in Cox and Alexander). This suggests that items in this subscale were fairly equal in importance to patients and were important components of the satisfaction construct (Cronbach, 1951).

In both studies, the other subscales were distinguished from the Positive Effect subscale by fewer items, wider ranges of item means, lower interitem correlations, and lower Cronbach’s alpha values. Cronbach’s alpha values for the Personal Image subscale were similar between studies (.48 vs .52 for Cox and Alexander). The higher means in the PP-SADL data for items 2 and 7 in Negative Features and item 12 in Service/Cost reduced the interitem correlations in those subscales. As a result, Cronbach’s alpha values were lowest for the Negative Features and Service/Cost subscales and also lower than the values reported by Cox and Alexander (Negative Features α = .43 vs .54 in Cox and Alexander; Service and Cost α = .45 vs .61 for Cox and Alexander).

*Data in Table 5 were calculated using only SADL questionnaires in which every item in a subscale was completed (N ranged from 196 to 252).
Table 4  Global and Subscale Statistics of the PP-SADL Group Compared to Interim SADL Norms (Cox and Alexander, 1999)

<table>
<thead>
<tr>
<th>Score</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>20th</th>
<th>80th</th>
<th>T-test Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>257</td>
<td>5.0</td>
<td>0.8</td>
<td>4.3</td>
<td>5.6</td>
<td>0.58</td>
</tr>
<tr>
<td>Interim Global</td>
<td>53</td>
<td>4.9</td>
<td>0.8</td>
<td>4.3</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>Positive Effect</td>
<td>275</td>
<td>4.9</td>
<td>1.2</td>
<td>3.8</td>
<td>6.0</td>
<td>-0.18</td>
</tr>
<tr>
<td>Interim Positive Effect</td>
<td>257</td>
<td>4.9</td>
<td>1.3</td>
<td>3.8</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>Service/Cost</td>
<td>274</td>
<td>5.0</td>
<td>1.0</td>
<td>4.0</td>
<td>5.7</td>
<td>2.29</td>
</tr>
<tr>
<td>Interim Service/Cost</td>
<td>142</td>
<td>4.7</td>
<td>1.2</td>
<td>4.0</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Negative Features</td>
<td>271</td>
<td>4.0</td>
<td>1.5</td>
<td>3.0</td>
<td>5.3</td>
<td>3.54*</td>
</tr>
<tr>
<td>Interim Negative Features</td>
<td>256</td>
<td>3.6</td>
<td>1.4</td>
<td>2.3</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Personal Image</td>
<td>270</td>
<td>5.8</td>
<td>1.0</td>
<td>5.0</td>
<td>6.7</td>
<td>1.36</td>
</tr>
<tr>
<td>Interim Personal Image</td>
<td>103</td>
<td>5.6</td>
<td>1.1</td>
<td>5.0</td>
<td>6.7</td>
<td></td>
</tr>
</tbody>
</table>

*p < .001.

Content Validity: Subscale Correlations

Subscale correlations, at least weakly, predicted scores in other subscales (Table 6). In general, Cox and Alexander (1999) found similar correlations with weaker significance, due to their smaller sample size. The best agreement between studies and highest subscale correlations were between Positive Effect and Service/Cost (r = .58) and between Negative Features and Personal Image (r = .34). To a lesser extent in both studies, the Positive Effect and Service/Cost subscales correlated with Negative Features.

The poorest agreement between studies was with the Personal Image subscale, which correlated higher with Service/Cost and lower with Positive Effect in our data. The former may be due to the wider range of instrument types offered. The very low but highly significant correlation between the Positive Effect and Personal Image subscales requires discussion. The relative

Table 5  Mean and SD for PP-SADL Global, Subscale, and Item Scores, Corrected Item-Total Correlations, and Cronbach's Alpha for Each Subscale

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Item Correlation</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Score (n = 153)</td>
<td>4.9</td>
<td>.76</td>
<td></td>
<td>.77</td>
</tr>
<tr>
<td>Positive Effect (n = 252)</td>
<td>5.1</td>
<td>1.25</td>
<td></td>
<td>.71</td>
</tr>
<tr>
<td>Help you understand people</td>
<td>5.6</td>
<td>1.53</td>
<td></td>
<td>.71</td>
</tr>
<tr>
<td>Was in your best interests</td>
<td>4.8</td>
<td>1.50</td>
<td></td>
<td>.60</td>
</tr>
<tr>
<td>Reduce asking for repetition</td>
<td>5.4</td>
<td>1.52</td>
<td></td>
<td>.71</td>
</tr>
<tr>
<td>Worth the trouble</td>
<td>3.9</td>
<td>2.00</td>
<td></td>
<td>.50</td>
</tr>
<tr>
<td>Improve your self-confidence</td>
<td>4.5</td>
<td>1.38</td>
<td></td>
<td>.53</td>
</tr>
<tr>
<td>How natural is the sound</td>
<td>6.4</td>
<td>0.83</td>
<td></td>
<td>.27</td>
</tr>
<tr>
<td>Competent hearing aid provider</td>
<td>3.5</td>
<td>1.55</td>
<td></td>
<td>.27</td>
</tr>
<tr>
<td>Cost seems reasonable</td>
<td>5.0</td>
<td>1.60</td>
<td></td>
<td>.33</td>
</tr>
<tr>
<td>Personal Image (n = 232)</td>
<td>4.0</td>
<td>1.92</td>
<td></td>
<td>.40</td>
</tr>
<tr>
<td>Frustrated with background</td>
<td>4.8</td>
<td>2.09</td>
<td></td>
<td>.33</td>
</tr>
<tr>
<td>Bothered by feedback</td>
<td>3.3</td>
<td>1.93</td>
<td></td>
<td>.09</td>
</tr>
<tr>
<td>Helpful on the telephone</td>
<td>5.8</td>
<td>1.61</td>
<td></td>
<td>.32</td>
</tr>
<tr>
<td>Others notice less more</td>
<td>6.3</td>
<td>1.37</td>
<td></td>
<td>.41</td>
</tr>
<tr>
<td>Makes you seem less capable</td>
<td>5.2</td>
<td>1.37</td>
<td></td>
<td>.18</td>
</tr>
<tr>
<td>Content with the appearance</td>
<td>4.8</td>
<td>1.37</td>
<td></td>
<td>.48</td>
</tr>
</tbody>
</table>
Table 6  Correlation Coefficients Among the Four Subscales of the SADL, Computed for Data in the Present Study (1) and by Cox and Alexander (2)

<table>
<thead>
<tr>
<th></th>
<th>Positive Effect</th>
<th>Service and Cost</th>
<th>Negative Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service and Cost</td>
<td>.58**</td>
<td>.58*</td>
<td></td>
</tr>
<tr>
<td>Negative Features</td>
<td>.58**</td>
<td>.32**</td>
<td>.17</td>
</tr>
<tr>
<td>Personal Image</td>
<td>.12**</td>
<td>.29*</td>
<td>.25** .08</td>
</tr>
</tbody>
</table>

*p < .005, **p < .001.

The independence of the subscales was due to stigma items on the Personal Image subscale (items 4 and 13), which did not correlate with any items in the Positive Effect subscale, nor did not demonstrate a wide range of responses, and demonstrated ceiling effects (see Appendix). Figure 6A shows a graphic example of the independence of the Positive Effect and Personal Image subscales, with the patient reporting low benefit on the Positive Effect subscale but average or better satisfaction with Personal Image. The high Personal Image score was due to high scores on the stigma items 4 and 13 but not on item 8 (appearance). The disparity between appearance and stigma items in Personal Image is even more pronounced in Figure 6B. In both cases, dissatisfaction is reported for appearance and benefit items, but stigma items reflect satisfaction. In the PP-SADL data, appearance correlated with all Positive Effect items but not with its fellow items in the Personal Image subscale. Thus, in the present data, Personal Image subscale scores were inflated by the ceiling effect manifest by stigma items, so that appearance usually had to be scored very low to reduce the subscale score, as in Figure 6B. The stigma items' ceiling effects and low Cronbach's alpha for the subscale explain the low correlation between the Positive Effect and Personal Image subscales. The prevailing correlation of appearance with benefit items explains the high significance of the correlation between subscales.

Appearance was not always associated with benefit, however, nor did it always diverge from stigma scoring. A small group of patients expressed strong stigma concerns so that appearance and stigma were rated low in the presence or absence of benefit satisfaction. Figures 6C and 6D are examples of these SADL patterns.

Factorial Validity

When the SADL was developed, each subscale was modeled on one of four factors (eigenvalues > 1.0) extracted from principal-components analysis of 25 candidate items. The final 15 items were selected and assigned to subscales, based on their weightings on the four orthogonal factors. In the process, some items were dropped, and item 8 (hearing aid appearance) was reworded (Cox and Alexander, 1999).

In the present study, we were interested in how closely the final 15 items and the four SADL subscales aligned with factors extracted from the PP-SADL data. Accordingly, the SADL items in the present data were subjected to principal-components analysis with standard varimax rotation to determine how closely the results predicted SADL construction. The results are in general agreement with the subscale organization of the SADL (Table 7). Four factors were extracted (eigenvalues > 1.0), which accounted for 86.9 percent of the variance in the data. All 15 items distributed on the four factors when loadings < .50 were suppressed. All but two distributed without overlap (items 8 and 12 loaded on two factors).

The nine items in the Positive Effect and Service/Cost subscales loaded on Factors 1 and 2, emphasizing the importance of benefit and value manifest by these two subscales to satisfaction measures on the SADL. Along with the relatively high correlation in Table 6, the loadings suggest an integral relationship between Positive Effect and Service/Cost (cf., Figure 6D).

Factor 3 contained two of the three items in Negative Features and Factor 4 contained the three items comprising the Positive Image subscale. These item loadings confirmed the Negative Features and Positive Image subscales as independent SADL domains that contribute less to Global satisfaction than the benefit/value domains of Factors 1 and 2.

The loadings of three items did not correspond to their subscale assignments in the SADL. Item 8 (appearance) loaded on Factor 4, as predicted, but loaded equally on Factor 1.

---

3All case examples were scored with the automatic scoring program provided by HARL, using interim SADL norms from Cox and Alexander (1999). Negative Features norms are therefore conservative for the PP-SADL data.

4See Humes (1999) for a discussion of this procedure.
Likewise, item 12 (competent provider) loaded equally on Factors 2 and 4. Item 11 in the Negative Features subscale (helpful on the telephone) was unique because it did not load on Factor 3, as predicted by the SADL. Instead, it was the highest loading item in Factor 1.

Based on the clustering of SADL items in the principal-components analysis, the following interpretations were made of the extracted factors and their relations to SADL subscales.

**Factor 1**

Factor 1 (29.6% of the variance) included six items, one each for acoustic benefit, psychological benefit, sound quality, telephone use, hearing aid cost, and hearing aid appearance. All but the last two address aspects of perceived benefit. The strong loading of item 11 (telephone use) on Factor 1 emphasized the importance of this item to perceived benefit. Despite its low mean score, denoting general dissatisfaction with telephone use, item 11 correlated with all items loading on Factors 1 and 2 (r ranged from .26 to .36; p < .0001). Its highest correlation was with item 8 (appearance). It did not correlate with items in Factor 3 or the stigma items in Factor 4.

The loading of item 14 (cost) in Factor 1 and its correlations with other items in that factor indicate that the PP-SADL group felt that cost was important and equated it with performance, underscoring the complementary relationship of the Positive Effect and Service/Cost subscales. Cost correlated with all items in Factors 1 and 2 (r ranged from .26 to .40; p < .0001) except item 12 (provider competence). It correlated highest with item 6 (worth the effort). Cost did not correlate with any items that loaded exclusively on Factors 3 and 4.

Equal loading of item 8 (appearance) on Factors 1 and 4 indicates the importance of cos-
Table 7  Loadings of the 15 SADL Items on Four Factors Extracted by Principal-Components Analysis with Varimax Rotation

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helps you understand people</td>
<td>.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was in your best interests</td>
<td>.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce asking for repetition</td>
<td>.61</td>
<td>.50</td>
<td>.59</td>
<td>.74</td>
</tr>
<tr>
<td>Worth the trouble</td>
<td>.63</td>
<td>.51</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Improve your self-confidence</td>
<td>.63</td>
<td>.51</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>How natural is the sound</td>
<td>.58</td>
<td>.50</td>
<td>.59</td>
<td>.74</td>
</tr>
<tr>
<td>Competent hearing aid provider</td>
<td>.50</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Cost seems reasonable</td>
<td>.54</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Please with dependability</td>
<td>.70</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Frustrated with background sounds</td>
<td>.79</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Bothered by feedback</td>
<td>.79</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Helpful on the telephone</td>
<td>.75</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Others notice loss more</td>
<td>.75</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Content with the appearance</td>
<td>.75</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
<tr>
<td>Makes you seem less capable</td>
<td>.75</td>
<td>.49</td>
<td>.57</td>
<td>.74</td>
</tr>
</tbody>
</table>

Loadings less than 0.50 are not shown.

metrics to the benefit/cost analysis of Factor 1 (see Figs. 6A and 6B) but also its importance as a separate domain (see Figs. 6C and 6D and Factor 4 below). Appearance correlated with all Factor 1 items (r ranged from .24 to .36; p < .0001) and was highest with telephone use (item 11). Appearance did not correlate with the other items in Factor 4.

Factor 1 accounts for the most variance in the SADL data. This factor combines the Positive Effect subscale with the cost portion of the Service/Cost subscale, encompassing improved performance, function, and the value patients attach to these perceived benefits, along with some aspects of appearance. The gist of Factor 1 is that the more restorative (positive) the effects of hearing aid use are on daily function, the greater the perceived benefit, acceptance of cost and appearance (for most patients), and overall satisfaction expressed by the patient (or vice versa in Fig. 6D).

Factor 2

Factor 2 (22.9% of variance) complements Factor 1 because it is loaded by the remaining Positive Effect and Service items. Together, Factors 1 and 2 completely encompass those two SADL subscales, include 11 of the 15 SADL items, and account for over 50 percent of the variance in the SADL results. Factor 2 includes one acoustic benefit item, two psychological benefit items, and two service items. Factor 2 items are distinguished by high loadings with the exception of item 12 (provider competence), which contributes little to satisfaction measures because of its small range of scores and its obvious ceiling effect (see Appendix). Although Factor 2 is marginally less important to overall satisfaction scores than Factor 1, it includes item 6 (worth the trouble), which has the highest correlation with Global satisfaction (r = .66; p = .0001). The three benefit items (1, 3, and 6) in this factor have the highest interitem correlations in the SADL (r values of .63 to .75; p < .0001).

Factor 2 combines Positive Effect and the service portion of the Service/Cost subscales. Whereas Factor 1 casts a wide net on performance, function, appearance, and value issues, Factor 2 focuses more narrowly on practicality of benefit. The gist of Factor 2 is that if the instrument functions reliably to improve speech understanding, then it is worth the trouble to operate and is in the patient’s best interest.

Factor 3

Factor 3 (18.1% of variance) reflects two-thirds of the Negative Features subscale. It is a very specific factor that is completely defined by the two highest loading items in the analysis (2 and 7). PP-SADL patients scored these items according to their degree of irritation with environmental noise or instrument feedback, rather than according to benefit or performance. The variability in SADL satisfaction explained by Factor 3 is due to technological limitations (negative features) of amplification in the presence of challenging hearing losses or listening environments. The gist of Factor 3 is that dissatisfaction expressed in this factor reflects the degree of patient-technology mismatch present in the hearing aid fitting.

Factor 4

Factor 4 (16.5% of variance) parallels the Personal Image subscale, reflecting separate cosmetic and stigmatizing issues associated with wearing hearing aids. As previously discussed, the cosmetic issue is represented by item 8, a complex and important item that is pivotal in the Personal Image subscale and also loads on Factor 1. Stigma is represented by items 4 and 13.

Item 12 (provider competence) loads on Factors 4 and 2 but is of little value in interpreting these factors because of its narrow response range and ceiling effect.

533
Summary of Factors

Variations in PP-SADL data are explained largely by four orthogonal factors that correspond more or less to the four SADL subscales, alone or in combination. The majority of variance in satisfaction is due to the first two factors, which are complementary combinations of Positive Effect and Service/Cost subscales that describe benefit/value issues. Factor 1 also includes telephone use and appearance, both of which are important indicators of user satisfaction in this domain.

DISCUSSION

Psychometric Verification

Good agreement between our study and Cox and Alexander's (1999) confirms many of the psychometric properties of the SADL. The PP-SADL group differed from the developmental population of Cox and Alexander in a number of ways. Our group was larger and more homogeneous in that all patients were seen in a single private practice environment, almost all patients were private pay, all patients had new hearing aids, and all were evaluated with the SADL at 1-year postfitting. Psychometric corroborations by our data support the use of the SADL to validate the success of first-year hearing aid fittings for the wide range of patients encountered in typical private practice settings.

Global SADL scores were not significantly different in the two studies, nor were scores for the Positive Effect, Service/Cost, and Personal Image subscales or their component items (except item 12, as discussed below). Subscale correlation coefficients were similar in both studies except for Personal Image, which correlated lower with Positive Effect and higher with Service/Cost than reported by Cox and Alexander.

The psychometric performance of the Personal Image subscale and its components is of particular interest because that subscale received limited testing before the SADL was released. This was due to the necessity of rewriting item 8 (appearance) late in the development stage. The good agreement between studies for item 8 and Personal Image statistics (see Tables 4 and 5) provides verification for the preliminary findings included in the interim norms. The wider range of instrument styles used in the PP-SADL group may explain the subscale correlation differences shown in Table 6. Those differences, coupled with the factor loadings from principal-components analysis (see Table 7), suggest that item 8 (appearance) plays a dual role in determining satisfaction, primarily as a component of benefit/value assessment and secondarily as a cosmetic assessment that is sometimes coupled with stigmatic concerns.

The PP-SADL group scores on the Negative Features subscale were significantly higher than the norm, due to more satisfaction with two items that loaded on Factor 3 (but not due to the telephone item, which scored very low in both studies). The higher satisfaction (less difficulty) with background interference and feedback that was expressed by patients in the present study is likely due to the wide range of hearing aid technologies that were fit on these patients. This, as well as other effects of other variables on SADL scores, is reported in Part II of this study (Hosford-Dunn and Halpern, 2000).

PP-SADL patients expressed higher satisfaction with providers (item 12), which could be due to a number of reasons. It could reflect a statistical sampling error, due to the small sample size in the interim norms (n = 126). The fact that patients filled out the form prior to or at their annual appointment could have prompted an "acquiescence response" to please the audiologist (Walden et al, 1984) or a Hawthorne Effect (Carey, 1967) because the patients were pleased by the audiologist's attention. The timing may have prompted "no response" from patients who were displeased with the provider but did not want to jeopardize services (a likely example is shown in Fig. 6D). Higher satisfaction scores could be due to fewer variables in the dispensing process because all patients were fit and followed by one of three audiologists in a single private practice. It could also be due to the difference between a private practice setting, where patients select the location and provider, and institutional settings, where services and providers are assigned to patients. Any or all of these possibilities are supported by the reduced response variability in the present study (SD = 0.8 vs 1.03 for Cox and Alexander). Whatever the explanation, the well-known ceiling effect for provider satisfaction questions makes item 12 predictable but of limited use (cf., Dillon et al, 1997). That is not to say that it would be wise to drop it from the SADL.

Western Electric experiments conducted in the 1930s inadvertently demonstrated increases in workers' performance when work situations received attention, regardless of whether the attention was positive or negative.
In our opinion, it has clinical utility for three reasons: (1) it tells patients that the office and the provider want to give satisfactory service, (2) it is very useful on the rare occasions when a patient expresses dissatisfaction with a provider or leaves the question unanswered, and (3) it provides a quick cross-check of validity.\footnote{For example, when item 12 is marked “A” or “B,” denoting dissatisfaction, by patients who orally express overall satisfaction.}

**Satisfaction Domains and SADL Structure**

The SADL’s four subscales are intended to tap important and distinct dimensions of wearer satisfaction with amplification. Data from the present study can be interpreted as describing four domains, which are similar but not identical to the four SADL subscales. Principal-components analysis of the 15 SADL items showed that they grouped into four orthogonal factors that accounted for almost 90 percent of the variance. The distribution of individual item loadings on these factors closely paralleled the SADL subscales. The Positive Effect subscale was constructed to measure perceived psychological and acoustic benefit from hearing aid use. Because of its importance to overall satisfaction, Positive Effect was designed with twice as many items as other subscales, giving it twice the scoring weight. This design characteristic was borne out by our data, in which all items related to benefit (including telephone use), loaded on two orthogonal factors that accounted for the majority of the variance in the data and included 11 of the 15 SADL items. Although imperfectly aligned with the subscales, the first two factors in the principal-components analysis represent complementary Benefit/Value domains that encompassed all Positive Effect and Service/Cost items. Other studies also have found close alignment of benefit and service with satisfaction in factor analysis (Dillon et al, 1997; Humes, 1999). In the present data, Service/Cost appeared as a subset of Positive Effect, underscoring Cox and Alexander’s comment that “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” (p. 315). This relationship is seen to a greater or lesser extent in the item responses of Figures 6B and 6D. Figure 6A shows an exception to the rule.

Factor 3 was specific to two Negative Features items, background noise and feedback problems. In SADL construction, Negative Features items were grouped together not because of interitem similarity but because they reflected areas of frequent dissatisfaction. This construction is reflected in both studies by the low item means and interitem correlations of the items and the low Cronbach’s alpha of the group. A low Cronbach’s alpha indicates that the response to one item does not predict responses to other items in a subscale, but this is not a psychometric indictment of the SADL construction. The fact that items in a domain do not strongly predict each other underscores the important clinical observation that not every item within a domain has equal importance to every patient (Gatehouse, 1999). Factor 3 is not directly analogous to the Negative Features subscale because telephone use loaded on Factor 1 instead. Besides indicating that telephone use is a more universal concern than background noise or feedback, the narrow focus of Factor 3 may also reflect wording differences among items. Both Factor 3 items are couched in negative terms (i.e., “Are you frustrated when...” and “Are you bothered by...”). In contrast, the telephone item is phrased positively (i.e., “How helpful is...”). It seems likely that a telephone item with negative phrasing (i.e., “Are you frustrated when...”) might load on Factor 3 along with other negative features. Alternatively, the oddity of the telephone item may signal something unique about the private practice in which this study was conducted.

Factor 4 included all three items in the Personal Image subscale but was most affected by item 8 (appearance). Appearance was not one of the original 25 items in the Cox and Alexander study and therefore was not included in their principal-components analysis. It was inserted in the final set of items because “subjects revealed a wide range of attitudes about the importance of self-image and stigma” (p. 313). Frequency response histograms in the Appendix confirm this observation for item 8, which had a wide range of responses in our data, but not for stigma items 4 and 13, which had narrow response ranges and ceiling effects.

Due to post hoc rewriting of item 8, Cox and Alexander (1999) assigned appearance to the Personal Image subscale without testing its factor loading. In our analysis, appearance loaded equally on Factors 4 and 1. The fact that appearance clustered with other Personal Image items in Factor 4 lends support to the assumption that some hearing aid users put a premium on cosmetic concerns over and above hearing needs (see Fig. 6C). Loading on Factor 1 suggests that
those patients with fewer cosmetic concerns, or greater hearing concerns, will rate appearance as satisfactory so long as their instruments restore hearing to their satisfaction. For those patients, factor 4 had little effect on satisfaction outcome (see Fig. 2).

Telephone Use Is a Unique Item

Telephone use (item 11) is a unique and very important item that could be placed justifiably in the Positive Effect or Negative Features subscale or could serve as an independent, single-item subscale. It emerged as a negative feature in the present study, with the lowest satisfaction of any item in the scale. However, telephone satisfaction did not load on Factor 3, along with other Negative Features items, nor was telephone satisfaction correlated with satisfaction on these other items (r = .00-.04; p = .51-.99). Instead, telephone use was the heaviest weighted item on Factor 1. This finding is consistent with other studies in which telephone use was associated with lowest benefit by patients (Dillon et al, 1999).

The response distribution to this item (see Appendix) showed a wide range of satisfaction possible with telephone use, even though many patients reported little satisfaction and others did not use the aid with the telephone (manifest by marking “not at all” on the SADL form). The latter included monaurally aided patients who use the telephone on their other (better) ear, which may be a different strategy than that adopted by subjects in the Cox and Alexander (1999) study. The range also included patients fitted with completely-in-the-canal technologies, who consistently rank telephone use as one of the most satisfactory aspects of use in other studies (cf., Kochkin, 1995, 1997). Some patients answered this item not from the vantage of a negative feature but from the vantage of overall communication ability and strategy, perhaps explaining why this item did not weight on the same factor as other negative feature items. Another explanation, already discussed, is that the item is phrased as a performance, rather than negative, issue. Nevertheless, telephone use remains a negative feature for a number of older respondents, who report significantly less satisfaction with telephone use than younger wearers.

Clinical Utility

Timing and Test Stability

The good psychometric agreement between our data and that of Cox and Alexander suggests that the SADL is relatively unaffected by personnel and timing variables. Cox and Alexander standardized the SADL on 149 subjects who had used their instruments for varied lengths of time and who retook the SADL about 4 months after its first administration (range of 12-30 weeks) (Cox and Alexander, 1999). Timing and administration in our study differed in several ways: (1) subjects were actual patients who were fitted with new instruments at the beginning of the study; (2) fitting and follow-up followed routine clinical protocols, so the exact timing of SADL administration was not tightly controlled as in a typical experiment; (3) services and collection of SADL data were performed by several clinicians who functioned independently in the same office; and (4) patients completed the SADL at 1 year (range of 10-15 months) after their initial appointments.

The looseness of timing and the use of clinicians as de facto experimenters are not considered drawbacks in the present study because our intent was to evaluate the SADL's ability to perform as a useful clinical outcome measure for unselected patients in a busy dispensing environment. Indeed, the previously referenced Hawthorne Effect poses a strong argument for this approach in order to avoid changes in patients' behavior (and SADL scores) that could be induced by the artificiality of the experimental process. Similarly, the lengthy period between fitting and SADL administration extinguishes the “halo” effect associated with acquisition, especially of high-cost, high-expectation instruments.

Our study does not address the questions of when the SADL should first be administered, relative to a new hearing aid fitting, or at what intervals thereafter. Surr et al (1998) found no significant change between Profile of Hearing Aid Benefit scores obtained at 6 weeks and at least 1 year postfitting. Even though benefit has the heaviest weighting in the SADL, satisfaction seems to follow a longer time course to stabilization, at least in the first year. Other factors besides acclimatization tend to reduce overall satisfaction in the first 3 months of wearing (Hosford-Dunn and Baxter, 1985).

Administration

The SADL is usually easy to use and interpret in a private practice setting, but there are a few aspects that require consideration for routine implementation.

In our protocol, mailed-in SADL forms were not always usable without further discussion
with the patients. This was due to several features of the SADL. The SADL included directions for completion that instructed patients to skip questions that were inapplicable to their situations. In a few cases, SADL forms were mailed in with a majority of items marked inapplicable. In these cases, patients completed the SADL again at their annual appointment after receiving oral instruction.

There are four reverse-scoring items interspersed in SADL, which typically produce a scattered response pattern, such as the one shown in Figure 2. A more uniform response pattern, with responses aligned toward the left or the right, results if reverse-scoring items are misinterpreted or if the form is completed without reading instructions or definitions of response choices. When this pattern was noted in our protocol, the patients were re-instructed and completed another SADL.

The SADL instructions do not specifically direct patients to complete the four demographic multiple-choice questions in the shaded area on the right of the form, leaving it to the office or clinician to decide who will answer the questions. In our study, the patients were the respondents, but some patients left these questions for the provider to complete, especially the question regarding hearing difficulty. In those cases, patients simply were asked to complete that part of the SADL.

Monaural wearers who use their unaided ear for the telephone should be instructed to leave item 11 blank. Item 7 requires explanation for many patients who wear automatic instruments who may otherwise leave it blank (as did 23% in our sample). To the degree that patients are satisfied with gain and do not experience feedback, their answers will tend toward satisfaction (e.g., “medium” to “not at all”). To the degree that attempts to increase gain have been unsuccessful due to resulting feedback, their answer will tend toward dissatisfaction (e.g., “medium” to “tremendously”).

Concurrent and Operational Validity

By intention, the word “satisfaction” does not appear in the SADL, nor does any item ask patients to rate general satisfaction in the manner of satisfaction indices used in other investigations. Based on the construction validity of the SADL, the Global score is a comprehensive measure of satisfaction that should correspond to general indices of satisfaction, while containing analytic information in its subscales (Cox and Alexander, 1999). Future studies could test this assumption by prefacing the SADL with a satisfaction index question on a separate page. At present, it is worth noting that the PP-SADL group’s average Global score (5.0) is 71 percent, which is the same average value that Kochkin (1997) reported when he used a single-index measure of satisfaction in wearers of new instruments.

CONCLUSIONS

Results confirm the psychometric properties of the SADL, verifying its use to validate hearing aid fitting satisfaction in private practice settings at 1-year postfitting. It may be applicable to a general patient population and to elderly adults. Preliminary data in this study and in Cox and Alexander (1999) show no differences in results between adults over 60 years old and younger respondents. According to Cox and Alexander (1999), the SADL quickly and reliably measures outcomes in domains that are most important to hearing aid users. Implementing the SADL into a busy clinical schedule requires only a few precautions. Providers should scan completed SADL forms to ensure that the patient understood instructions correctly and did not leave a number of items blank. Depending on the patient’s amplification situation, a few items may require explanation. Instantaneous, computerized scoring with graphic snapshots of global, subscale, and item scores allows comparison to standardized scores and flexible structuring of intervention strategies in areas of dissatisfaction.

Principal-components analysis confirms that the SADL evaluates satisfaction in four domains, which correspond directly or in overlapping fashion to the four SADL subscales. Positive Effect and Service/Cost subscales comprise nine items on the SADL. These items combine in the two most important content domains, explaining 52 percent of the variance in satisfaction scores. In this context, it is reasonable to say that the majority of SADL satisfaction is due to Benefit/Value domains described mainly by the Positive Effect subscale, with Service/Cost as a subset. Most of the remaining variance in the data is explained by the third and fourth content domains, which correspond to the Negative Features and Positive Image subscales, respectively. These results reinforce previous data suggesting that subjective benefit is a key component of satisfaction but that other nonauditory factors also contribute to wearer
satisfaction (Hosford-Dunn and Baxter, 1985; Cox and Alexander, 1999).

Telephone use (item 11) is the most important item in explaining variance in the data and is also the item with the lowest satisfaction rating. Its overall importance suggests that it should weight the Positive Effect subscale, yet its low ratings identify it correctly as a Negative Feature. Appearance (item 8) is an influential item that loads in two satisfaction domains. In many cases, it is integrally tied to the benefit/value domain, but it also affects satisfaction independently for patients with strong cosmetic concerns. Clinically, a small group of patients exist for whom cosmetic concerns outweigh all others, regardless of education and counseling efforts on the part of providers (cf., Van Vliet, 2000). The weighting of appearance in the Personal Image subscale may be problematic in motivated populations where stigma plays a minor concern.

Data from private practice implementation support most interim SADL norms, although the PP-SADL group was more satisfied with Negative Features than the norm group of Cox and Alexander (1999). In their 1999 study, they suggested the possibility that different hearing aid types might specify different norms. If our observations are replicated in other settings, separate Negative Features norms for different hearing aid technologies and styles may be useful in practices using a high percentage of high-performance instruments. Part II of this study explores this topic and other variables that may affect SADL scores (Hosford-Dunn and Halpern, 2000).

Acknowledgments. Mary Gansheimer, MS, Nermana Hrustic, Judy Hueh, MS, Alicia Hutzel, MS, Michael Irby, MS, Julie Leonard, MS, and Sherri MacMillan, MS, participated in data collection. Robyn Cox, PhD, Director of the Hearing Aid Research Laboratory, Memphis State University, provided SADL forms and the SADL scoring program. Drs. Harvey Abrams, Robyn Cox, and Donald Schum reviewed the manuscript and offered helpful criticisms.

REFERENCES


Validation of the SADL in a Private Practice Setting/Hosford-Dunn and Halpern


APPENDIX

Distribution of Responses to Individual SADL Items

Frequency response histograms for the 15 SADL items. Numbers on the abscissa correspond to the seven-point equal-interval-appearing semantic scale used by respondents to answer SADL items.