The Abbreviated Profile of Hearing Aid Benefit

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Objective: **To develop and evaluate a shortened version of the Profile of Hearing Aid Benefit, to be called the Abbreviated Profile of Hearing Aid Benefit, or APHAB.**

Design: **The Profile of Hearing Aid Benefit (PHAB) is a 66-item self-assessment, disability-based inventory that can be used to document the outcome of a hearing aid fitting, to compare several fittings, or to evaluate the same fitting over time. Data from 128 completed PHABs were used to select items for the Abbreviated PHAB. All subjects were elderly hearing-impaired who wore conventional analog hearing aids. Statistics of score distributions and psychometric properties of each of the APHAB subscales were determined. Data from 27 similar subjects were used to examine the test-retest properties of the instrument. Finally, equal-percentile profiles were generated for unaided, aided and benefit scores obtained from successful wearers of linear hearing aids.**

Results: **The APHAB uses a subset of 24 of the 66 items from the PHAB, scored in four 6-item subscales. Three of the subscales, Ease of Communication, Reverberation, and Background Noise address speech understanding in various everyday environments. The fourth subscale, Aversiveness of Sounds, quantifies negative reactions to environmental sounds. The APHAB typically requires 10 minutes or less to complete, and it produces scores for unaided and aided performance as well as hearing aid benefit. Test-retest correlation coefficients were found to be moderate to high and similar to those reported in the literature for other scales of similar content and length. Critical differences for each subscale taken individually were judged to be fairly large, however, smaller differences between two tests from the same individual can be significant if the three speech communication subscales are considered jointly.**

Conclusions: **The APHAB is a potentially valuable clinical instrument. It can be useful for quantifying the disability associated with a hearing loss and the reduction of disability that is achieved with a hearing aid.**

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In previous articles, we have reported the development of the Profile of Hearing Aid Performance (PHAP) and the Profile of Hearing Aid Benefit (PHAB) (Cox, Alexander, & Gilmore, 1991a; Cox & Gilmore, 1990; Cox, Gilmore, & Alexander, 1991b; Cox & Rivera, 1992). Both the PHAP and the PHAB are 66-item inventories that are completed by a hearing aid wearer. All of the items are statements about communication abilities or perception of sound in daily life situations, and the respondents' task is to indicate how frequently each statement is true. They are provided with a seven-point response scale as follows: always (99%), almost always (87%), generally (75%), half-the-time (50%), occasionally (25%), seldom (12%), never (1%). To complete the PHAB, each item is given two responses, one for "without my hearing aid" and one for "with my hearing aid." Thus, the PHAB measures both unaided and aided performance. In addition, a measure of benefit from the hearing aid is computed by subtracting the results for "with my hearing aid" from those for "without my hearing aid." In contrast, when the PHAP is used, all of the items relate to the situation when the hearing aid is worn. As a result, the PHAP measures aided performance only, not unaided experiences or hearing aid benefit. In effect, the PHAP is equivalent to the "with my hearing aid" portion of the PHAB.

The 66 items used in the PHAB and the PHAP are divided into four scales and three of the scales are further divided into two subscales each. Scale SA (speech communication under relatively favorable conditions) is composed of subscales FT (Familiar Talkers) and EC (Ease of Communication). Scale SB (speech communication under unfavorable conditions that are not primarily due to background noise) comprises subscales RV (Reverberation) and RC (Reduced Cues). Scale SC (speech communication under unfavorable noisy conditions) is not further subdivided but is referred to as subscale BN (Background Noise) when discussed in the context of subscales. Scale ES (perception of Environmental Sounds) is composed of subscales AV (Aversiveness) and DS (Distortion). The subscales are briefly described below.

Familiar Talkers (FT). Seven items describing communication under relatively easy listening conditions with persons whose voices are known.

Ease of Communication (EC). Seven items describing the effort involved in communication under relatively easy listening conditions.

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Reverberation (RV). Nine items describing speech understanding in moderately reverberant rooms.

Reduced Cues (RC). Nine items describing communication without visual speech cues or when intensity is low.

Background Noise (BN). Sixteen items describing speech understanding in the presence of multitalker babble or other environmental competing noise.

Aversiveness of Sounds (AV). Twelve items describing negative reactions to environmental sounds.

Distortion of Sounds (DS). Six items describing the quality of voices and other sounds.

These two inventories, the PHAB and the PHAP, have been useful in research settings as measures of the outcome of hearing aid fittings. However, their value is limited in clinical applications because the 20 to 30 minutes required to complete the 66 items often is not readily available. In this paper, we report the development of an Abbreviated Profile of Hearing Aid Benefit (APHAB), which is intended to be used as a clinical instrument. The APHAB uses a subset of 24 items from the PHAB and typically requires 10 minutes or less to complete. It produces scores for unaided and aided performance as well as hearing aid benefit.

METHOD

Clinical applications of an APHAB might include: (a) prediction of likely success with amplification based on prefitting responses to the unaided portion; (b) comparison of aided performance of an individual with that of a reference group such as successful hearing aid wearers; or (c) documentation of benefit in various environments either for accountability purposes, to troubleshoot an unsuccessful fitting, or to compare the profit derived from different instruments or different programs in the same instrument. Based on these considerations, the APHAB was constructed with the following objectives in mind:

1. It should have an overall structure of four content domains corresponding to the four scales in the parent inventory.
2. Each domain should be represented by six test items.
3. The items should be chosen based on consideration of scores obtained in each of the three response modes (aided performance, unaided performance, and benefit).
4. Each six-item set should be chosen to maximize internal consistency reliability without making the items too similar in wording.

TABLE 1. Distribution of audiometric data for the better ear (binaural fittings) or the aided ear (monaural fittings), reported in percentages.

	Slope			
SRT	<6	6–14	>14	Total
<40	13	24	31	68
40–60	13	8	5	26
>60	5	0	1	6
Total	32	32	36	100

SRT = speech reception threshold for spondee words (dB HL); Slope = slope of audiogram from 500 to 4000 Hz in dB/octave.

It was determined at the outset that for the purposes of a clinical instrument three of the seven PHAB subscales (Familiar Talkers [FT], Reduced Cues [RC], and Distortion of Sounds [DS]) would be eliminated entirely. It was felt that due to the relatively easy listening situations assessed, aided and benefit scores for FT might sometimes be limited by a ceiling effect. Also, subscales RC and DS have been shown to have low internal consistency as well as lower test-retest correlations than the other subscales (Cox & Rivera, 1992). Items for the APHAB were selected based on an analysis of responses to the items of the remaining four PHAB subscales: Ease of Communication (EC), Reverberation (RV), Background Noise (BN), and Aversiveness (AV). The resulting abbreviated inventory comprises four subscales with each subscale named according to the subscale in the parent inventory from which the items were drawn. Thus, the APHAB subscales are also called Ease of Communication (EC), Reverberation (RV), Background Noise (BN), and Aversiveness (AV). The APHAB inventory yields scores for speech communication in favorable, reverberant, and noisy environments as well as a measure of the aversiveness of loud sounds.

Subjects

File data for hearing aid wearers who had completed the PHAB were used to select the items for the APHAB. All available first administrations of the PHAB were used. There were 128 records: 90 men and 38 women. Their mean age was 68 and the age range was 30 to 87 yr.

Audiometric and hearing aid fitting data were available for 88% of the subjects and these were thought to be representative of the entire group. Table 1 summarizes the extent of their hearing losses and the audiogram slopes. All subjects wore conventional, analog hearing aids. The fittings were: 42% binaural, 58% monaural, and 71% in-the-ear, 29% behind-the-ear instruments. Data on reported daily hearing aid use and duration of experience

TABLE 2. Distribution of hearing aid experience and hours of daily hearing aid use for 106 of 128 subjects, reported in percentages.

Hearing Aid Experience	Daily Use (hr)				
	<1	1–4	4–8	8–16	Total
6 wk–11 mos	4	6	7	15	32
1–10 yr	4	9	6	28	47
>10 yr	0	3	6	12	21
Total	8	18	19	55	100

with amplification were available for a representative sample of 83% of the subjects. Table 2 reports these data.

Overall, subject demographics indicate that individuals were typically elderly with mild-to-moderate sloping or flat hearing losses. The majority had at least 1 yr of hearing aid experience and wore their instrument(s) more than 4 hr per day.

Procedure

To select six items for the APHAB Background Noise subscale, item analyses were performed for responses to the 16 items in the PHAB Background Noise subscale. Separate analyses were generated for unaided, aided, and benefit scores. Corrected item-total correlations were examined for each item in each analysis. Items with the highest item-total correlations across all three analyses were selected for the APHAB provided that they were not too similar in wording to other selected items. The same procedure was followed to select the items for the three other APHAB subscales: Ease of Communication, Reverberation, and Aversiveness. Distributions and descriptive statistics were generated for each of the 24 selected items and for the four APHAB subscales that resulted.

Next, test-retest reliability and critical differences for the APHAB were determined using the data from 27 of 28 subjects described by Cox and Rivera (1992), who completed the PHAB on three separate occasions. One subject was eliminated due to a change in selection criteria. The demographic characteristics of these subjects were reported in the previous article and were similar to those of the group used for item selection, described above.

Finally, all of the known successful hearing aid users (defined as daily use of amplification for more than 4 hr for more than 1 yr) were culled from the subject group. This yielded 55 subjects. (Note that the term "successful hearing aid user" as applied here should not be interpreted as suggesting that the hearing aid user was satisfied with his/her amplification system. Rather, it means that the individual was judged to have made a successful adjustment to the use of amplification, whether or not he or she was satisfied with the help it provided.) Using the data from these subjects, equal-percentile profiles were determined for unaided, aided, and benefit scores on each APHAB subscale. Seven profiles were generated, representing the 5th, 20th, 35th, 50th, 65th, 80th, and 95th percentiles.

TABLE 3. Statistics of score distributions and psychometric properties of each of the four APHAB subscales.

Ssc(Cond)	Mn	SD	skew	kurt	Corr_{it}	α
EC(unaided)	55	23	n	–	0.66	0.87
RV(unaided)	72	19	–	n	0.60	0.83
BN(unaided)	70	19	–	n	0.58	0.82
AV(unaided)	26	22	+	n	0.66	0.86
EC(aided)	24	19	+	+	0.62	0.84
RV(aided)	37	21	+	n	0.63	0.85
BN(aided)	40	20	n	n	0.63	0.85
AV(aided)	55	25	n	–	0.64	0.85
EC(benefit)	31	21	n	n	0.55	0.79
RV(benefit)	35	20	n	n	0.54	0.78
BN(benefit)	30	20	n	n	0.56	0.80
AV(benefit)	−30	23	n	n	0.56	0.82

Ssc(cond) = subscale and response condition; Mn = mean score (frequency of problems); SD = standard deviation; skew = skewness; kurt = kurtosis; Corr_{it} *= mean corrected item-total correlation;* α *= Cronbach's alpha; + = significantly positive; – = significantly negative, n = normal.*

RESULTS AND DISCUSSION

Two random orders of the 24 APHAB items were generated. These comprise Form A and Form B. Form A is reproduced in Appendix A and Appendix B gives statistics describing the items in each subscale. (Copies of APHAB inventories, forms A and B, and/or a DOS-based program for administering and scoring the inventory are available from the first author.) Table 3 displays the statistics and distribution characteristics for the four subscales. This table shows that none of the subscales has a mean score very near the extremes of the response range in any of the three response conditions (unaided, aided, and benefit). This reduces the likelihood of limitations due to ceiling effects. Also, all of the standard deviations of subscale scores are relatively large, indicating that subjects tend to use a wide range of responses. Thus, it is reasonable to expect the subscales to be sensitive to individual differences in scores. For each subscale the mean corrected item-total correlation was determined by averaging the corrected item-total correlations for the six items of the subscale. These are fairly high, ranging from 0.54 to 0.66, indicating that within each subscale the items are rather homogenous. Finally, the internal consistency reliability values denoted by Cronbach's alpha are also fairly high, ranging from 0.78 to 0.87. It should be noted that, because the items were chosen based on item-total correlations for this particular sample of subjects, it would not be surprising if results from a different sample reveal some decrease in the internal reliability statistics.

In the unaided response mode, three of the subscale distributions were significantly skewed. The negative skewness for subscales reflecting communication in unfavorable situations (Reverberation [RV] and Background Noise [BN]) shows that these subscales received mostly high scores (indicative of a high proportion of problems) but a few substantially lower scores. Similarly, the positive skewness in the subscale reflecting the aversiveness of sounds (AV) reveals that most individuals reported low sound aversiveness in unaided conditions but a few subjects reported relatively high aversiveness. It would be of interest to determine whether individuals who score in the tails of these skewed distributions are less likely to make a successful adjustment to hearing aid use. Some preliminary data on this question are reported below.

Test-retest reliability is an important consideration for any instrument that might be used to determine rehabilitation strategies. As noted earlier, these types of data were available for a subset of 27 subjects who had responded to the 66 items of the PHAB on three separate occasions. These data were rescored using only the items chosen for the APHAB. To evaluate any systematic changes in response tendencies over time, a repeated-measures analysis of variance (ANOVA) was performed on the data for the unaided response mode. Variables were subscale (Ease of Communication, Reverberation, Background Noise, and Aversiveness) and test occasion (first, second, and third). Mean overall scores for the first, second, and third tests were 56.2, 52.6, and 52.9, respectively. Thus, the result for the first test was about 3.5% higher than that for the two later tests. A difference of this size is probably too small to be of practical significance, and it did not quite achieve statistical significance at the 0.05 level ($F[2, 52] = 3.04, p = 0.06$). The interaction between subscale and test occasion was also nonsignificant. Similar ANOVAs were performed for the aided response mode and the benefit data. In both analyses, the main effect for test occasion and the two-way interaction were nonsignificant. Overall, these analyses did not provide evidence that there is any systematic tendency for APHAB scores to change across test occasions.

Retest reliability for APHAB subscale scores was explored in two ways: via test-retest correlation coefficients for each subscale, and by constructing 90% and 95% critical difference values. Test-retest correlation coefficients can be viewed as providing information about the reliability of intersubject differences. Such correlations will be high if the ordering of individuals tends to remain constant across tests (e.g., the higher-scoring individuals on the first test also score relatively highly on subsequent tests). In clinical settings, this feature might be of limited interest. Critical difference values reflect the reliability of repeated scores from the same individual. The difference between two scores from the same person will exceed the 95% critical difference by chance alone (i.e., when the real difference in scores is zero) on only 5% of comparisons. Thus, critical differences are important in clinical practice because they can be used to evaluate differences between scores obtained under putatively different conditions (e.g., two different hearing aids). If the two scores differ by more than the 95% critical difference, it can be concluded with reasonable certainty that the difference was not due to chance and probably depicts real differences between the tested hearing aids. In view of the variability of individual data, a 90% critical difference might be considered sufficiently stringent in clinical applications since it yields a likelihood of drawing correct conclusions 9 times out of 10.

TABLE 4. Mean test-retest correlation coefficients for APHAB subscales and for comparable PHAP and PHAB subscales from previous studies.

Ssc(cond)	APHAB	PHAP	PHAB
EC(unaided)	0.80		
RV(unaided)	0.65		
BN(unaided)	0.71		
AV(unaided)	0.89		
EC(aided)	0.76	0.77	
RV(aided)	0.81	0.84	
BN(aided)	0.67	0.88	
AV(aided)	0.70	0.84	
EC(benefit)	0.54		0.54
RV(benefit)	0.50		0.55
BN(benefit)	0.48		0.57
AV(benefit)	0.71		0.72

Ssc(cond) = subscale and response condition.

Table 4 gives the APHAB test-retest correlations for unaided, aided, and benefit scores. For each type of score, correlations were computed between the first and second test administrations and between the second and third administrations. The two correlations for each score were then averaged. These are compared with previously published analogous correlations for the PHAP (Cox & Gilmore, 1990) and for the PHAB (Cox & Rivera, 1992).

Correlations for the unaided response condition, which have no counterpart in previous publications, range from a low of 0.65 for the Reverberation (RV) subscale to a high of 0.89 for the Aversiveness (AV) subscale. These moderate to high values compare

TABLE 5. Ninety and 95% critical differences (in %) for APHAB subscales and for comparable PHAP and PHAB subscales from previous studies.

	90%			95%		
Ssc(cond)	APHAB	PHAB	PHAP	APHAB	PHAB	PHAP
EC(unaided)	22			26		
RV(unaided)	24			28		
BN(unaided)	23			27		
AV(unaided)	17			21		
EC(aided)	22		23	26		28
RV(aided)	18		20	22		24
BN(aided)	22		15	27		18
AV(aided)	31		23	36		28
EC(benefit)	26	27		31	32	
RV(benefit)	28	25		33	29	
BN(benefit)	27	21		33	25	
AV(benefit)	31	27		37	32	

Ssc(cond) = subscale and response condition.

quite favorably with statistics reported for other scales of similar content and length, such as the Communication Performance subscales of the Communication Profile for the Hearing Impaired (Demorest & Erdman, 1988). Correlations for the aided response condition range from 0.67 for the Background Noise (BN) subscale to 0.81 for the Reverberation (RV) subscale. Comparison of these values with those for the PHAP reported by Cox and Gilmore (1990) reveals that, for the Background Noise (BN) and Aversiveness (AV) subscales, retest correlations for the APHAB were less than those for the PHAP. While this result was probably partly due to sample differences, it was also expected because both of these subscales were markedly shortened for the APHAB and fewer items usually produce lower reliability. Correlations for the APHAB benefit subscales were also slightly lower overall than those computed for the longer PHAB subscales for the same subjects. The largest decrease was seen for the Background Noise (BN) subscale. In general, it appears that shortening the subscales resulted in a modest decrease in the reliability of intersubject differences.

Table 5 depicts 90% and 95% critical differences for each APHAB subscale and response mode. Comparable critical differences from PHAP and PHAB subscales are also shown. There are several noteworthy aspects of these data. First, let us consider only the aided and unaided response modes. The three subscales that reflect speech communication in various environments (Ease of Communication, Reverberation, and Background Noise) have rather similar critical differences in both modes. This indicates that hearing aid wearers judge the intelligibility of amplified speech just as consistently as they do unamplified speech. In addition, the consistency of judgments is not affected by the acoustic environment under consideration. For the sake of simplicity in clinical applications, it would be reasonable to adopt a single value for interpretation of aided or unaided score differences for the Ease of Communication, Reverberation, and Background Noise subscales (EC, RV, and BN). In addition, these same critical differences can be used to judge the significance of differences between aided and unaided scores. Values of 22% and 26% would approximate the 90% and 95% critical differences, respectively.

In contrast to the results for the speech communication subscales, the critical differences for the subscale reflecting perceptions of environmental sounds (AV) are much smaller for the unaided response mode (17% and 21%) than for the aided response mode (31% and 36%). This suggests that although individuals can consistently estimate the aversiveness of unamplified environmental sounds, they are much less certain from time to time about the aversiveness of amplified sounds.

The critical differences for the benefit subscales are larger than those for the aided and unaided response modes. This is not surprising because each benefit score is a difference between an aided and an unaided score and incorporates an element of measurement error from both of them. However, aided and unaided responses from the same individual are correlated to some extent, and this acts to reduce slightly the measurement errors associated with their differences. As noted for the unaided and aided response modes, the three speech communication benefit subscales have similar critical differences. Values of 27% and 33% are reasonable estimates of the 90% and 95% critical differences, respectively.

Comparison of the critical differences for APHAB subscales with those for corresponding PHAP and PHAB subscales reveals that the two APHAB subscales that were significantly shortened (Background Noise [BN] and Aversiveness [AV]) tend to have larger critical differences, as we would expect. For the two subscales that were only slightly shortened (Ease of Communication [EC] and Reverberation [RV]), the critical differences are much the same across the various versions of the inventory.

The critical differences for each subscale, especially for benefit scores, are relatively large. This means that a sizable interscore difference is necessary before we can conclude with reasonable certainty that two scores for a single subscale are not equal. In our experience, differences of this magnitude are often seen when aided scores are compared with unaided scores. In this case, it is sometimes possible to determine that a hearing aid provides significant benefit in some types of situations but not in others. However, when one hearing aid is compared with another hearing aid, differences as large as 25% to 30% on a single subscale are seldom seen. Furthermore, it seems likely that real differences smaller than this would have practical significance for the success of the fitting. Thus, it is relatively difficult to detect potentially important differences between hearing aids when scores for APHAB subscales are considered separately.

However, if results for the three speech communication subscales are evaluated jointly, smaller differences in subscale scores are required to justify a conclusion that there is an overall difference between two fittings. By considering the joint probability of observing a difference favoring the same instrument in all three speech communication subscales (Ease of Communication [EC], Reverberation [RV], and Background Noise [BN]), we can arrive at the likelihood that this pattern of results would be observed by chance if each pair of subscale scores was really equal. Assuming a two-way test on the first subscale (EC) followed by one-way tests of the two remaining subscales (RV and BN), we can determine the following:

1) When aided scores are compared for two hearing aids, a difference of 10% or more favoring the same instrument for all three subscales will occur by chance alone on fewer than 2% of observations.

2) When aided scores are compared for two hearing aids, a difference of 5% or more favoring the same instrument for all three subscales will occur by chance alone on fewer than 9% of observations.

3) When benefit scores are compared for two hearing aids, a difference of 10% or more favoring the same instrument for all three subscales will occur by chance alone on fewer than 4% of observations.

4) When benefit scores are compared for two hearing aids, a difference of 5% or more favoring the same instrument for all three subscales will occur by chance alone on fewer than 11% of observations.

Thus, it is possible to conclude with reasonable certainty that there is an overall difference in speech communication performance between two hearing aid fittings even when there are no significant interscore differences for any individual subscale. A difference of 10% or more favoring the same hearing aid for the Ease of Communication, Reverberation, and Background Noise subscales can be interpreted with a high level of certainty as indicative of superiority for the favored instrument. A difference of 5% or more for all three subscales approaches the 90% level of certainty. It should be noted that determination of the joint probability associated with any pattern of subscale score differences requires that we assume that the differences between the two scores for each subscale are mutually independent, that is, the difference on one subscale does not affect the difference observed on the other subscales. This is equivalent to assuming that the hearing aid wearer considers each item in the inventory on its own merits and is not influenced by his or her responses to other items.

TABLE 6. Equal-percentile profiles for APHAB subscale scores for successful hearing aid users. Data are given for each response mode.

		Subscale			
	%ile	EC	RV	BN	AV
Unaided	95	95	99	99	78
	80	86	93	89	39
	65	74	89	83	24
	50	65	81	81	17
	35	58	75	74	12
	20	42	60	63	4
	5	24	45	37	1
Aided	95	75	84	82	90
	80	39	58	56	81
	65	26	39	49	73
	50	16	33	37	60
	35	14	31	31	38
	20	12	21	21	25
	5	1	9	13	10
Benefit	95	73	72	65	5
	80	57	57	56	−7
	65	50	49	43	−15
	50	41	39	35	−25
	35	26	32	29	−44
	20	15	21	18	−57
	5	6	−2	0	−74

%ile = percentile.

Table 6 gives families of equal-percentile profiles for each response mode of the APHAB. These data are based on the responses of 55 successful wearers of linear hearing aids. The percentile level indicates the percentage of successful hearing aid wearers who reported a smaller proportion of problems (unaided and aided scores) or a smaller amount of benefit (benefit scores). For example, 65% of successful hearing aid wearers yielded scores of 26 or less for the Ease of Communication (EC) subscale in the aided response mode. Alternatively, we may say that 35% of these subjects reported scores of more than 26 in this condition. These kinds of data provide one approach to evaluation of APHAB scores for an individual (see Cox and Rivera [1992] for some examples using equal-percentile benefit profiles).

It might be possible to use the unaided APHAB profile as a predictor of the likely adjustment to amplification. As noted earlier, some of the subscales provided significantly skewed distributions in the unaided response mode and we postulated that an individual who scores in the tails of these distributions might be less likely to adjust successfully to amplification. To explore this idea in a preliminary way, the data base was searched for individuals who were judged to be unsuccessful hearing aid users (defined as reported use of the hearing aid less than 1 hr/day). Eight were identified. Unaided profiles for these eight subjects were compared with the unaided profiles for successful users. It was determined that 50% of the unsuccessful users yielded an unaided profile with scores below the 50th percentile for Ease of Communication (EC), Reverberation (RV), and Background Noise (BN) and above the 65th percentile for Aversiveness (AV). In other words, these subjects were reporting relatively few speech communication problems in daily life combined with relatively high aversiveness for everyday environmental sounds. In contrast, only 16% of the successful users yielded an unaided profile showing this pattern. Because of the small number of unsuccessful users involved in this evaluation, it would not be appropriate to draw firm conclusions from these observations. However, this result is consistent with our hypothesis that the unaided profile might be predictive of likely adjustment to linear amplification. It is also possible that this pattern in the unaided profile might be indicative of a need for nonlinear amplification. The predictive value of prefitting unaided APHAB patterns is a potentially fruitful avenue of future research.

Finally, we derived an estimate of the extent to which normal-hearing listeners report problems in the situations described by the APHAB items. Such data can provide a useful reference point for evaluating the residual problems reported by hearing aid wearers. Data reported by Cox et al. (1991a) on the responses of normal hearing subjects to the 66 PHAP items (modified to remove the reference to hearing aids) were rescored using only the APHAB items. This produced scores equivalent to the unaided portion of the APHAB. Cox et al. (1991a) reported that, for the 66-item inventory, even successful hearing aid wearers routinely reported a much greater frequency of problems in daily life than did normal hearers. The same conclusion was reached when we considered only the APHAB items. The 95th percentile values for normal-hearing subjects were 21, 29, 34, and 55, for the Ease of Communication (EC), Reverberation (RV), Background Noise (BN), and Aversiveness (AV) subscales, respectively. In other words, only five percent of persons with normal hearing reported a frequency of problems greater than these values. Comparison with the aided condition scores in Table 6 reveals that successful hearing aid wearers generally report a much greater frequency of problems than normal hearers on each of the speech communication subscales. Clearly, these data show us that even "successful" hearing aid fittings tend to fall far short of the ideal of restoring hearing to near-normal performance.

CONCLUSIONS

The APHAB seems to have potential as a useful clinical tool for measuring the outcome of hearing aid fittings, comparing alternative fittings, and tracking the success of a fitting over time. The time required to complete the inventory is within the reach of most practices and both administration and scoring can be accomplished by computer if desired, for additional time conservation. Evaluation of the significance of differences between two administrations of the inventory to the same individual (a likely clinical application) can be accomplished through a consideration of critical differences for each subscale alone or by noting the differences for the three speech communication subscales considered jointly. In addition, results for an individual hearing aid wearer can be compared with those of successful wearers of linear hearing aids, and with those for normal-hearing individuals. Of the three types of scores provided, aided performance and benefit have clear applications. More research is necessary to determine whether the profile seen for prefitting unaided responses is predictive of probable success with amplification or indicative of the type of amplification that might be most beneficial.

Last but not least, it is important to note that the APHAB is an inventory that quantifies the disability associated with a hearing loss and the reduction of disability that is achieved with a hearing aid. It is worth taking a moment to consider what this means and what it does not mean. According to a widely recognized set of definitions (see Stephens & Hétu, 1991), the effects of a hearing loss can be described in terms of three distinct domains: impairment, disability, and handicap. Impairment is the measurable loss of function that is documented with, for example, an audiogram. Disability is the effect of the impairment on the specific individual's auditory functioning in daily life (this will be influenced by the person's lifestyle and other variables). Handicap is the effects of impairment and disability on non-auditory aspects of the individual's functioning including, for example, emotional, social, and occupational issues. The development of a comprehensive rehabilitation program requires a full exploration of all three domains and a management plan that addresses all areas of concern.

The treatment of choice for auditory disability is usually a hearing aid. For this reason, the APHAB and its parent inventories were specifically designed to quantify this domain so that the success of the fitting in reducing disability could be examined. It is likely that the reduction of disability will be accompanied by some alleviation of handicap and this can also be explored with the help of an appropriate inventory to measure handicap. However, despite the clinician's best efforts, it is likely that residual disability and handicap will be seen even after a "successful" hearing aid fitting. It is probable that the satisfaction of the hearing aid wearer with the amplification device is related to the residual disability and handicap but the relationship is not a simple one. Satisfaction is clearly a complex variable (Kochkin, 1992) and includes elements that are often not addressed explicitly in hearing rehabilitation programs. We hope that systematic documentation of disability reduction using the APHAB will promote optimization of hearing aid fittings. However, the practitioner should keep in mind that reduction of disability is only one part of a complete rehabilitation program.

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APPENDIX A: Abbreviated Profile of Hearing Aid Benefit, Form A.

INSTRUCTIONS: Please circle the answer that comes closest to your everyday experience. Notice that each choice includes a percentage. You can use this to help you decide on your answer. For example, if a statement is true about 75% of the time, circle "C" for that item. If you have not experienced the situation we describe, try to think of a similar situation that you have been in and respond for that situation. If you have no idea, leave that item blank.

A Always (99%)
B Almost Always (87%)
C Generally (75%)
D Half-the-time (50%)
E Occasionally (25%)
F Seldom (12%)
G Never (1%)

	Without My Hearing Aid	With My Hearing Aid
1. When I am in a crowded grocery store, talking with the cashier, I can follow the conversation..	A B C D E F G	A B C D E F G
2. I miss a lot of information when I'm listening to a lecture.................	A B C D E F G	A B C D E F G
3. Unexpected sounds, like a smoke detector or alarm bell are uncomfortable..	A B C D E F G	A B C D E F G
4. I have difficulty hearing a conversation when I'm with one of my family at home..	A B C D E F G	A B C D E F G
5. I have trouble understanding dialogue in a movie or at the theater..	A B C D E F G	A B C D E F G
6. When I am listening to the news on the car radio, and family members are talking, I have trouble hearing the news	A B C D E F G	A B C D E F G
7. When I am at the dinner table with several people, and am trying to have a conversation with one person, understanding speech is difficult..	A B C D E F G	A B C D E F G

8. Traffic noises are too loud .... A B C D E F G A B C D E F G

9. When I am talking with someone across a large empty room, I understand the words .... A B C D E F G A B C D E F G

10. When I am in a small office, interviewing or answering questions, I have difficulty following the conversation .... A B C D E F G A B C D E F G

11. When I am in a theater watching a movie or play, and the people around me are whispering and rustling paper wrappers, I can still make out the dialogue .... A B C D E F G A B C D E F G

12. When I am having a quiet conversation with a friend, I have difficulty understanding .... A B C D E F G A B C D E F G

13. The sounds of running water, such as a toilet or shower, are uncomfortably loud .... A B C D E F G A B C D E F G

14. When a speaker is addressing a small group, and everyone is listening quietly, I have to strain to understand .... A B C D E F G A B C D E F G

15. When I'm in a quiet conversation with my doctor in an examination room, it is hard to follow the conversation .... A B C D E F G A B C D E F G

16. I can understand conversations even when several people are talking .... A B C D E F G A B C D E F G

17. The sounds of construction work are uncomfortably loud .... A B C D E F G A B C D E F G

18. It's hard for me to understand what is being said at lectures or church services .... A B C D E F G A B C D E F G

19. I can communicate with others when we are in a crowd .... A B C D E F G A B C D E F G

20. The sound of a fire engine siren close by is so loud that I need to cover my ears .... A B C D E F G   A B C D E F G

21. I can follow the words of a sermon when listening to a religious service .... A B C D E F G   A B C D E F G

22. The sound of screeching tires is uncomfortably loud .... A B C D E F G   A B C D E F G

23. I have to ask people to repeat themselves in one-on-one conversation in a quiet room .... A B C D E F G   A B C D E F G

24. I have trouble understanding others when an air conditioner or fan is on .... A B C D E F G   A B C D E F G

APPENDIX B
Descriptive statistics and distribution characteristics for each item in the APHAB.

	Unaided				Aided				Benefit			
ssc(#)	Mn	SD	skew	kurt	Mn	SD	skew	kurt	Mn	SD	skew	kurt
EC(4)	49	29	n	−	19	19	+	+	30	28	n	−
EC(10)	52	29	n	−	24	25	+	+	28	30	n	n
EC(12)	53	31	n	−	23	24	+	+	29	31	n	n
EC(14)	68	29	−	−	29	26	+	n	39	33	−	+
EC(15)	54	32	n	−	25	27	+	+	28	27	n	n
EC(23)	54	29	n	−	23	24	+	+	31	30	n	−
RV(2)	77	26	−	n	38	27	+	−	39	26	n	−
RV(5)	72	28	−	n	40	29	+	−	33	27	n	n
RV(9)*	79	22	−	n	43	29	+	−	36	25	n	n
RV(11)*	74	25	−	n	44	28	+	−	30	28	n	n
RV(18)	72	27	−	n	39	29	+	−	33	34	−	n
RV(21)*	60	28	n	−	23	20	+	+	38	29	−	+
BN(1)*	59	27	n	−	26	21	+	+	33	28	n	n
BN(6)	77	25	−	+	51	29	n	−	27	31	−	+
BN(7)	73	27	−	n	44	29	n	−	28	25	n	n
BN(16)*	78	21	−	+	46	26	n	−	32	26	n	n
BN(19)*	68	27	−	−	33	24	+	n	32	26	n	n
BN(24)	70	28	−	n	42	29	+	−	28	29	n	n
AV(3)	34	35	+	−	60	35	n	−	−26	31	−	n
AV(8)	21	26	+	+	51	33	n	−	−30	30	−	−
AV(13)	11	19	+	+	43	33	n	−	−31	32	−	−
AV(17)	33	29	+	n	68	28	−	n	−35	29	n	n
AV(20)	24	29	+	n	54	37	n	−	−30	31	n	n
AV(22)	31	32	+	n	58	34	n	−	−28	34	n	n

*ssc(#) = subscale and item number (Form A); skew = skewness; kurt = kurtosis; + = significantly positive; − = significantly negative; n = normal; * = reversed for scoring.*