Evaluation of the Hearing Performance Inventory – Short Form

Miriam A. Henoch
University of North Texas

The 90-item Hearing Performance Inventory (HPI: Lamb, Owens, & Schubert, 1983) was originally developed to assess the communication difficulty of persons with hearing impairment in a variety of everyday situations. A shortened version of the HPI, the HPI-S, was evaluated to examine its internal consistency and construct validity. Audiometric and HPI-S data from 305 subjects were evaluated. Results suggested that the HPI-S has sufficient internal consistency and construct validity to support its use for screening for hearing handicap. Because the HPI-S examines 6 handicap domains and because the response mode allows for determination of degree of hearing handicap (i.e., none-to-severe), it can serve as an alternative to hearing handicap screening instruments with Yes-No responses when more detailed information is warranted.

Self-assessment inventories can serve a variety of purposes. The developers and evaluators of self-assessment scales have described their usefulness in determining to what extent a hearing impairment has resulted in a hearing handicap (Erdman, 1993; Weinstein, 1984; Weinstein & Ventry, 1983), planning programs of rehabilitation and determining treatment outcomes (Abrams, Hnath-Chisolm, Guerreiro, & Ritterman, 1992; Erdman, 1993; Weinstein, Richards, & Montano, 1995), assessing hearing aid benefit (Dempsey, 1986; Harless & McConnell, 1982; Jerram & Purdy, 1997; Newman & Weinstein, 1988; Walden, Demorest, & Hepler, 1984), evaluating the effects of tinnitus (Kuk, Tyler, Russell, & Jordan, 1990), and screening adult hearing loss (Mulrow, Tuley, & Aguilar, 1990; Schow, Smedley, & Longhurst, 1990). Even so, there does not appear to be widespread

Correspondence concerning this article should be addressed to Miriam A. Henoch, Department of Speech and Hearing Sciences, University of North Texas, P.O. Box 305010, Denton, Texas 76203-5010. Electronic mail may be sent via Internet to mhenoch@unt.edu.

use of these inventories. One of the most common reasons given for non-use of self-assessment inventories is the time involved in their administration (Erdman, 1993). As a consequence, counseling of individuals with impaired hearing continues to be based largely upon audiometric findings (Erdman, 1993) even though it has been well established that the degree of handicap experienced by individuals with hearing impairment cannot be predicted from audiometric results alone (Brainerd & Frankel, 1985; Hawes & Niswander, 1985; Peters & Hardick, 1974; Weinstein & Ventry, 1983).

Self-assessment inventories that contain scales with response options ranging along a continuum from little difficulty to great difficulty, provide some level of insight into the seriousness of a situation. Handicap inventories such as the McCarthy-Alpiner Scale of Hearing Handicap (M-A Scale: McCarthy & Alpiner, 1983), the Self-Assessment of Communication (SAC: Schow & Nerbonne, 1982), the Hearing Performance Inventory (HPI: Lamb, Owens, & Schubert, 1983), and the Communication Profile for the Hearing Impaired (CPHI: Demorest & Erdman, 1987) are examples of this type of assessment. The CPHI also examines the importance of a given situation to an individual as one of the factors in the evaluation of hearing performance.

A self-assessment inventory that examines problems associated with hearing loss in sufficient depth, may be too time consuming (and thus not cost effective) to administer *routinely* in a clinic setting. Examples of such tests are the HPI (Lamb et al., 1983), and the CPHI (Demorest & Erdman, 1987). An alternative procedure is to include a screening inventory as an adjunct to the case history that is usually completed prior to audiometric testing. If the results of the screening suggest that the hearing impairment is having a detrimental influence on daily functioning in communication situations, then a more comprehensive scale might be administered.

The Hearing Handicap Inventory for the Elderly (HHIE: Ventry & Weinstein, 1982), Hearing Handicap Inventory for Adults (HHIA: Newman, Weinstein, Jacobson, & Hug, 1991), and Self-Assessment of Communication (SAC: Schow & Nerbonne, 1982), are examples of self-assessment scales that have been developed for use as screening inventories. The SAC and HHIE have been chosen for inclusion in the Guidelines for Hearing Screening (American Speech-Language-Hearing Association [ASHA] Panel on Audiologic Screening, 1997). The *Yes, No,* and *Sometimes* response choices of the HHIE and HHIA make them ideally suited for hearing screening programs or for estimating a hearing handicap in the social and emotional domains that the instruments address. Due to its brevity, simple response mode, reliability, and validity, the HHIE is probably the most widely used of all available self-assessment inventories (Lichenstein, Bess, & Logan, 1988; Newman & Weinstein, 1988; Newman, Weinstein, Jacobson, & Hug, 1990; Newman et al., 1991; Ventry & Weinstein, 1982). However, there might be occasions in which an evaluator wishes to have some indication of the

degree to which a hearing loss has become handicapping. If a response choice to a question on a self-assessment inventory is Yes, that response does not define how often that particular situation occurs or the importance of the Yes answer to the person's life experience.

The HPI was developed to assess the degree of communication difficulty experienced by individuals with impaired hearing in a variety of everyday listening situations (Lamb et al., 1983). The 90-item version of the HPI has six scales: (a) understanding speech (US), (b) intensity (I), (c) social (S), (d) personal (P), (e) response to auditory failure (RAF), and (f) occupational (O). The US category addresses the ability to understand speech with (USV) and without (USNV) visual cues. The I scale deals with the detectability of communication and environmental signals, the P items contain questions regarding personal adjustment to hearing loss, and the RAF section relates to compensatory behaviors. The S section comprises items selected from the US and RAF sections that address issues that pertain to group interactions. The psychometric characteristics of the original 90-item HPI have been described elsewhere (Demorest & Walden, 1984; Lamb et al., 1983).

The shortened version of the HPI, the HPI-S, was developed by Lamb (personal communication, 1988). The HPI-S has 31 items retained from the revised version. These items were chosen based upon item analysis and factor analytic data (Demorest & Walden, 1984; Lamb et al., 1983). The HPI-S retains a representative sample of items from the first five scales of the HPI; the occupational scale, was not retained from the longer version (see Appendix for HPI-S questionnaire). For the HPI-S, the US scale is divided into two subscales, USV and USNV, making a total of six subscales for the HPI-S. Of the 12 items comprising the S scale of the HPI-S, one item is from the USV scale, three items are from

Table 1

Number of Items per Scale on the HPI and HPI-S

	Number of items	
Scale	**HPI**	**HPI-S**
USV	26	6
USNV	12	4
Intensity (I)	9	4
Personal (P)	8	5
Social (S)	27	12
RAF	20	12

Note. USV = understanding speech with visual cues; USNV = understanding speech without visual cues; RAF = response to auditory failure. Twelve questions taken from the USV, USNV, and RAF scales were also used to create the S scale. Thus the total number of items on the HPI-S as shown on Table 1 does not equal 31.

USNV, and eight items are from the RAF scale. The number of items retained in each scale was based upon the findings of Demorest and Walden (1984) who reported that the items within the I, P, and S sections of the HPI were highly correlated, which suggested that high internal consistency could be obtained with relatively few items. Item correlations within the RAF section were lower, so more items are needed to achieve a given degree of reliability. Table 1 compares the number of items on each scale of the HPI and the HPI-S.

According to Giolas, Owens, Lamb, and Schubert (1979), the HPI was developed to assess hearing performance in everyday listening situations. The 90-item version of the HPI is too long to be considered a screening inventory. However, if the reliability and validity of the HPI can be maintained in the shortened version, the HPI-S might provide an alternative hearing handicap screening instrument. The purpose of the present study was to determine the internal consistency and construct validity of the 31-item HPI-S.

METHOD

Subjects

The present investigation was an evaluation of HPI-S information obtained from patients seen at the Callier Center for Communication Disorders at University of Texas at Dallas (UTD) and the Speech and Hearing Center at the University of North Texas (UNT). Both Centers utilized similar test protocols therefore subjects from both UNT and UTD were selected to maximize the sample size. Subject files were selected for inclusion in the analysis if all necessary data were present in the file, that is, completed case history, HPI-S, and audiometric data. A total of 305 questionnaires was completed, 212 from UTD and 93 from UNT. The gender and age group characteristics are summarized in Table 2. Although no attempt was made to have an equal number of males and females in the study, the sample was divided almost equally across gender with 152 females and 153 males. The mean age of the sample was 56.2 years and ranged from 18 to 95 years.

Procedure

The HPI-S was a routine part of the intake information sent or given to all new patients scheduled for initial audiological evaluations at both centers. Each patient completed their own HPI-S. Instructions for completing the HPI-S were presented on a cover page which served as the first page of the questionnaire. Individual HPI-S scale scores and overall HPI-S scores were determined for each subject whose file was examined for the present study. For scoring purposes the response options of the HPI were assigned the following values, *practically always* 1 (least degree of difficulty), *frequently* 2, *about half the time* 3, *occasionally* 4, and *almost never* 5 (greatest degree of difficulty). Seven of the items on the HPI-S are semantically reversed, for example, the questions are negatively

Table 2
Sample Characteristics

Characteristic	*N* = 305
Gender	
Female	152
Male	153
Age group[a]	
< 26	36
26 to 35	30
36 to 45	24
46 to 55	41
56 to 65	48
66 to 75	57
76 to 85	52
> 85	13

[a]Sample size is reduced due to missing age data.

based rather than positively based. Therefore, those items were reversed for scoring prior to analyzing the data. The category of *not applicable* was not included in the data analysis.

Because all of the individuals completing the HPI-S had been seen for audiometric evaluation, complete audiometric data were available for each subject. All audiometric testing was completed in IAC test rooms which met ANSI standards (1991). Pure-tone and speech testing were performed using GSI 10 or GSI 16 audiometers. The instrumentation at both centers was calibrated annually. Clinical data included pure-tone, air-conduction thresholds, speech-reception thresholds, and word-recognition scores. Word-recognition scores were obtained using standardized, recorded materials. Testing was performed by ASHA certified audiologists or audiology graduate students who were being supervised by ASHA certified audiologists.

Audiometric results were based on better ear scores and included speech reception thresholds (BSRT); pure-tone average of 500, 1000, 2000 Hz (BPTA1); a high-frequency pure-tone average of 1000, 2000, and 4000 Hz (BPTA2); and word recognition (BWR). Audiological variables are shown in Table 3. Data were analyzed using the Statistical Package for the Social Sciences (SPSS ver. 7.5).

RESULTS

HPI-S Analysis

Correlations were obtained to compare selected audiometric measures with the six scales of the HPI-S as shown in Table 4. The highest significant positive cor-

Table 3

Summary of Audiological Variables for the Better Ear

Variable	Combined $N = 305$
Better Pure-tone Average 1[a]	28.9 dB HL
Better Pure-tone Average 2[b]	36.5 dB HL
Better Speech Threshold	27.3 dB HL
Better Word Recognition	85.0%

[a]Average of 500, 1000, and 2000 Hz. [b]Average of 1000, 2000, and 4000 Hz.

relations occurred among USV, USNV, and I with BSRT, PTA1, and PTA2 (r = .47 - .59). Significant correlations were also obtained among word recognition and the USV, USNV, and I scales, but the correlations were not as strong as those for the other audiometric measures (r = .27 - .36). The correlations of audiometric measures with the RAF scale were very weak and nonsignificant.

Means, standard deviations, and alpha coefficients for all 305 subjects were determined for each of the HPI-S scales. Table 5 summarizes these data. The RAF scale had the highest overall mean difficulty rating; similar findings have been described in other studies (Demorest & Walden, 1984; Hawes & Niswander, 1985).

HPI-S scale scores were compared as a function of degree of hearing loss defined by the BSRT. Figure 1 illustrates these findings; means and standard deviations are shown in Table 6. For the USV, USNV, I, and P scales, scores increased for each increase in severity of hearing loss ranging from a mean BSRT of less than 26 dB HL to greater than 55 dB HL. There is no similar identifiable trend for the S and RAF scales.

Table 4

Pearson Product-Moment Correlations of HPI-S Scales With Selected Audiometric Measures

Scale	BSRT	PTA1	PTA2	WR
USV	.57*	.58*	.59*	-.36*
USNV	.47*	.53*	.56*	-.37*
Intensity	.52*	.50*	.51*	-.27*
Personal	.48*	.48*	.46*	-.28*
Social	.33*	.38*	.42*	-.21*
RAF	-.004	.06	.10	.009

Note. BSRT = Better ear speech reception threshold; PTA1 = pure-tone average of 500, 1000, 2000 Hz; PTA2 = pure-tone average of 1000, 2000, and 4000 Hz; WR = word recognition.
*p = .001.

Table 5

Descriptive Statistics and Internal Consistency Reliability for the HPI-S

	USV	USNV	I	P	S	RAF	HPI-S
n^a	305	305	305	298	305	305	305
Items	6	4	4	5	12	12	31
M	2.28	2.81	2.64	2.31	2.88	3.16	2.85
SD	1.01	.95	.98	.98	.67	.82	.88
α	.90	.88	.78	.86	.80	.77	.88
S_e	.33	.42	.54	.42	.34	.35	.22

Note. USV = understanding speech with visual cues; USNV = understanding speech without visual cues; I = intensity; P = personal; S = social; RAF = response to auditory failure.
[a]Sample size varies because of missing data for some items.

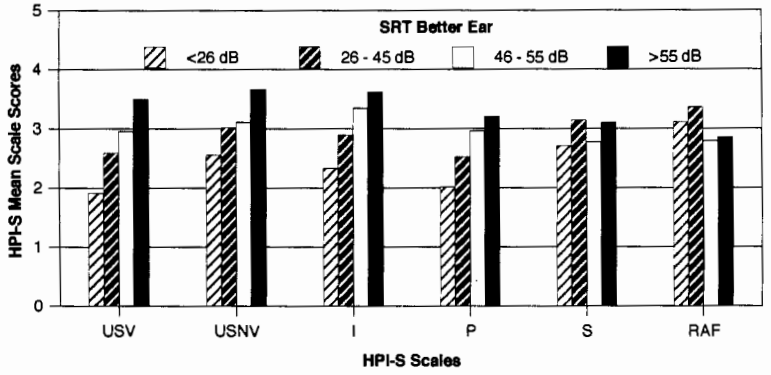

Figure 1. HPI-S scale scores as a function Better-Ear SRT.

Table 6

Descriptive Statistics for HPI-S Scale Scores as a Function of Better-Ear SRT

	< 26 dB		26 to 45 dB		46 to 55 dB		> 55 dB	
Scale	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
USV	1.90	.80	2.59	.96	2.92	1.07	3.13	.87
USNV	2.55	.90	3.02	.79	3.11	.99	3.65	1.03
Intensity	2.33	.91	2.90	.89	3.35	.82	3.63	.80
Personal	2.02	.88	2.53	.89	2.97	1.00	3.21	1.04
Social	2.72	.63	3.15	.69	2.79	.55	3.11	.73
RAF	3.12	.80	3.36	.82	2.81	.84	2.87	.92

Note. USV = understanding speech with visual cues; USNV = understanding speech without visual cues; RAF = response to auditory failure.

DISCUSSION

The common procedure for evaluating internal consistency of a measure is coefficient alpha. Coefficient alpha examines the intercorrelation of test items relative to overall performance on a scale. Internal consistency for the HPI scales has been shown to be relatively high ranging from .86 to .96 in the Lamb et al. (1983) report to .86 and .99 in the Demorest and Walden (1984) study. In the present investigation, coefficient alpha ranged from a low of .77 for RAF to a high of .90 for the USV scale. Relative to scale length, the assumption is that as scale length increases, reliability will increase. Demorest and Walden (1984) describe a special case of the Spearman-Brown prophecy formula that allows for prediction of the reliability coefficient when scale length is shortened. This formula was used in the present study to determine if the alpha coefficients obtained for the HPI scales in the reference study (Demorest & Walden, 1984, Table 3, p. 235), which evaluated the 156-item version of the HPI (Giolas et al., 1979), and hence had a greater number of test items for each scale, could predict the alpha coefficients obtained on the HPI-S. The formula is

$$\frac{kr}{1 + (k - 1)r}$$

where k is equal to the number of items in the HPI-S divided by the number of items in the original HPI and r is equal to the alpha coefficient obtained in the reference study. Although alpha coefficients in the present study are lower (see Table 6) than those of the Lamb et al. (1984) and Demorest and Walden (1984) studies, they are completely consistent with the shortening of the scale. Differences between the actual and predicted values of alpha ranged from .01 to .03. The reliability coefficients for each of the scales and the S_e obtained for each of the HPI-S scales support the reliability of the HPI-S.

Correlations between communication scales and pure-tone thresholds, speech-reception thresholds, or word-recognition scores can be "... considered evidence of construct validity because they confirm theoretically predicted relationships between the construct(s) measured by the inventory and other variables" (Demorest & Walden, 1984, p. 237). In the present investigation, significant correlations were obtained between the BSRT, PTA1, and PTA2 and all of the HPI-S scales except the RAF scale. Significant correlations were also obtained between WR and the USV, USNV, and I scales. The highest significant correlations for a single audiometric variable occurred between the PTA2 and the USV and USNV scales and that may reflect the influence of high-frequency hearing loss on the understanding of speech. The significant relationships observed in the present study lend support to the construct validity of the HPI-S. The weak relationships between the audiometric variables and the RAF scale suggest that the items on that scale, which reflect compensatory behaviors, do not covary with degree of hearing impairment.

The analysis of the data in the present study support the use of the HPI-S as an instrument to screen for hearing handicap. The HPI-S examines six different domains of handicap, understanding speech with visual cues, understanding speech without visual cues, auditory detectability, adjustment to hearing loss, group interactions, and response to auditory failure, in a screening format. It is also sufficiently easy for respondents to complete, is relatively easy to score, and has apparent internal consistency and construct validity. These attributes make the HPI-S a viable instrument for screening hearing handicap in a clinical setting.

ACKNOWLEDGEMENTS

The author wishes to thank Stanford Lamb who provided the shortened version of the HPI, Marilyn Demorest who gave advice and counsel on the statistical analysis, and Karrie Surber and Spencer Daily who did the data entry.

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APPENDIX

HEARING PERFORMANCE INVENTORY – SHORT FORM

1. Can you hear an airplane in the sky when others around you can hear it?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

2. You are talking with five or six strangers. When you miss something important that was said, do you ask the person talking to repeat it?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

3. You are with a child (6 to 10 years old) in a fairly quiet room. Can you understand the child when his/her voice is loud enough for you and you can see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

4. You are at a small social gathering. If you have difficulty hearing what is being said, do you move to a place where you can hear better?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

5. When you have difficulty understanding a person because they are holding their hand in front of their mouth, do you ask them to lower their hand?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

6. Does your hearing problem discourage you from attending lectures or church services?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

7. Can you hear water running in another room when others around you can hear it?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

8. You are at a party or family gathering of less than ten people, the room is fairly quiet. Can you understand what a friend or family member is saying to you when their voice is loud enough for you, but you can not see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

9. Does your hearing problem lower your self confidence?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

10. You are in a fairly quiet room with five or six strangers. One person talks at a time. When you are aware of the subject, can you understand what is being said when the speaker's voice is loud enough for you, but you can not see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

11. You are at a fairly quiet restaurant. Can you understand the waitperson when their voice is loud enough for you and you can see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

12. You are seated with five or six strangers around a table or in a living room. Often two persons are talking at once and one person frequently interrupts another. When you miss something important that was said, do you pretend you understand?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

13. Does your hearing problem tend to make you impatient?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

14. You are with a stranger and there is background noise such as music or a crowd of people. Can you understand the person when their voice is loud enough for you, but you can not see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

15. You are having dinner with five or six friends and you hear only a portion of what was said. Do

you repeat that portion when asking the speaker for a repetition?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

16. You are talking with five or six strangers. When you miss something important that was said, do you let the person talking know – at least one time – that you have a hearing problem?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

17. You are having dinner with five or six friends. When you miss something important that was said, do you ask the person talking to repeat it?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

18. When others are listening to speech on the television or radio, is it loud enough for you?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

19. Does your hearing problem discourage you from going to the movies?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

20. You are in a fairly quiet room talking with five or six strangers. One person talks at a time and the subject of conversation changes from time to time. Can you understand what is being said when the speaker's voice is loud enough for you and you can see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

21. You are seated with five or six friends or family members around a table or in a living room. Often two persons are talking at once and one person frequently interrupts another. When you miss something important that was said, do you remind the person talking, at least once, that you have a hearing problem?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

22. You are at a restaurant and there is background noise such as music or a crowd of people. Can you understand the waitperson when their voice is loud enough for you and you can see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

23. You are with a child (6 to 10 years old) and several people are talking nearby. Can you understand the child when their voice is loud enough for you and you can see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

24. A person is talking to you from a distance of no more than six feet. There is music or noise in the background. Would you be aware that they are talking if you did not see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

25. When you have difficulty understanding a person with a pipe, toothpick, or similar object in their mouth, do you ask them to remove the object?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

26. You are at a restaurant and you hear only a portion of something the waitperson said. Do you repeat the portion when asking them for a repetition?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

27. You are with five or six friends or family members. One person talks at a time. When you miss something important that was said, do you pretend you understand?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

28. You are with five or six friends or family members and there is background noise such as music or a crowd of people. One person talks at a time. When you are aware of the subject, can you understand what is being said when the speaker's voice is loud enough for you, but you can not see their face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

29. You are at a lecture or church service. If you have difficulty hearing what is being said, do you move to a place where you can hear better?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

30. Does your hearing problem tend to make you feel nervous or tense?

Practically[a] Always	Frequently	About half the time	Occasionally	Almost Never	N/A

31. You are with a female stranger and there is background noise such as traffic, music, or a crowd of people. Can you understand her when her voice is loud enough for you and you can see her face?

Practically Always	Frequently	About half the time	Occasionally	Almost Never	N/A

[a]Items are reversed for scoring.

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