Norms for the International Outcome Inventory for Hearing Aids

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Abstract
The International Outcome Inventory for Hearing Aids (IOI-HA) is a seven-item survey that was developed for use in research settings to facilitate comparison of data across diverse investigations. The inventory also has potential applications in clinical evaluation of hearing aid fitting outcomes. This article reports the development of norms for the inventory that are suitable for use with group data in research applications, and individual data in a clinical setting. The normative group was defined as adults fitted bilaterally with analog, single-channel, single-memory, compression processing, in-the-ear hearing aids. There were 154 subjects. Associations between outcomes and demographic variables (e.g., gender, hearing loss, etc.) were explored, and several relationships were seen. Based on these data, two sets of norms were derived. The appropriate set will depend on the individual's reported subjective hearing problems without amplification.

Key Words: Hearing aid, hearing loss, older adult, outcomes assessment

Abbreviations: IOI-HA = The International Outcome Inventory for Hearing Aids; ITE = In-the-ear; SD = standard deviation; MANOVA = multivariate analysis of variance; PTA1 = average of thresholds at 250, 500, and 1000 Hz; PTA2 = average of thresholds at 500, 1000, and 2000 Hz; PTA3 = average of thresholds at 1000, 2000, and 4000 Hz

Sumario
El Inventario Internacional de Resultados para Auxiliares Auditivos (IOI-HA) es una evaluación de siete elementos que se desarrolló para ser utilizado en situaciones de investigación, y así facilitar la comparación de datos entre diferentes estudios investigativos. El inventario también tiene aplicaciones potenciales en evaluaciones clínicas de resultados de adaptaciones de auxiliares auditivos. Este artículo reporta el desarrollo de normas para dicho inventario, que son útiles en el manejo de datos grupales en aplicaciones de investigación y en datos individuales en situaciones clínicas. El grupo normativo se definió como aquel de adultos adaptados bilateralmente con auxiliares auditivos intra-auriculares, analógicos, de un canal, de memoria única y con procesamiento de compresión. Se utilizaron 154 sujetos. Se exploró la asociación entre resultados y variables demográficas (p.e. género, hipoacusia, etc.), y se observaron varias relaciones. Basados en esta información, se derivaron dos grupos de normas. El grupo apropiado dependerá del reporte subjetivo del individuo sobre sus problemas auditivos sin amplificación.

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Palabras Clave: Auxiliar auditivo, hipoacusia, adulto mayor, evaluación de resultados

Abreviaturas: IOI-HA = Inventario Internacional de Resultados para Auxiliares Auditivos; ITE = intra-auricular; SD = desviación estándar; MANOVA = análisis multivariado de variancia; PTA1 = promedio de umbrales a 250, 500 y 1000 Hz; PTA2 = promedio de umbrales a 500, 1000 y 2000 Hz; PTA3 = promedio de umbrales a 1000, 2000, 3000 Hz

The International Outcome Inventory for Hearing Aids (IOI-HA) emerged from a consensus workshop that was held to explore and evaluate the state of the art in outcomes evaluation for audiological rehabilitation (Cox et al, 2000). The workshop participants identified a need to be able to combine and compare data from diverse sources such as investigations that used different methodologies. Thus, the inventory was developed with the goal of facilitating cooperation among researchers without limiting their responsibility and prerogative to plan studies as they see fit. By design, the IOI-HA is brief enough to be appended to a research protocol without significant cost in time or other resources. Further, it is general enough to be appropriate in many different studies.

If it is used in this way, the IOI-HA items can then provide directly comparable data that will allow combination or comparison across otherwise incompatible investigations. To facilitate use of the IOI-HA in research applications, a large set of translations has been prepared and made available to interested individuals (Cox et al, 2002). The psychometric properties of the English and Dutch language versions have been reported (Cox and Alexander, 2002; Kramer et al, 2002; Stephens, 2002). Although the psychometric properties of the IOI-HA items have been reported, there are no published norms for a well-defined group of hearing aid wearers. Such norms could provide a useful baseline for evaluating the real-world effects of a variety of hearing aid features.

Because it is both brief and inclusive, the inventory has attracted attention from practitioners as well as researchers. Practitioners have recognized the potential for using it as a concise broad-brush assessment of hearing aid fitting outcome. To facilitate this application of the IOI-HA, it would be useful to have normative data. By comparing responses from a given individual to empirical norms, the clinician can determine the relative success of the hearing aid fitting.

This article reports the development of norms for the original American English language version of the IOI-HA.

METHOD

The IOI-HA

Items

The inventory comprises seven items, each one targeting a different outcome domain. The domains are, in order: daily use, benefit, residual activity limitations, satisfaction, residual participation restrictions, impact on others, and quality of life. More information on the outcome domains can be found in Cox (2003). The inventory is intended to be administered in paper and pencil mode. The wording and construction of items were chosen with the intention of minimizing literacy and cognitive demands. Each item has five response choices that are approximately semantically equidistant in English (Levine, 1981). The layout of response choices always proceeds from the worst outcome on the left to the best outcome on the

right. It is sufficiently self-explanatory that no formal instructions are needed. The items and response formatting are reproduced as items 1–7 in Appendix A.

Scoring

Each item is scored using the integers from 1 to 5 for the five response choices. The leftmost response, indicating the poorest outcome, is scored as 1. The rightmost response, indicating the best outcome, is scored as 5.

Rationale for the Normative Group

Existing hearing aids incorporate many different styles and processing methods. It is possible that different styles and processing approaches impact the real-world effectiveness of the devices. Because the extent of this impact, if any, is usually unknown, it was decided that the IOI-HA norms would be most useful if they were obtained from a group of hearing aid wearers who used a well-defined hearing aid style with a consistent type of processing. Consequently, it was determined that the experimental group would consist of adult men and women who fulfilled the following requirements:

- Hearing aids obtained in a private practice setting.
- In-the-ear (ITE) hearing aid style.
- Single-channel, single-memory instruments.
- Compression processing (any form: input or output, limiting or wide dynamic range).
- Bilateral fitting.
- Same make and model for both ears.
- Consistent fitting protocol compatible with accepted practice (see Appendix B).
- Hearing aids owned for a period of 6–12 months when data obtained.
- Non-institutionalized individuals.
- English reading skills sufficient to complete the survey without assistance.

Sampling Procedure

Potential participants were defined as all those who met the inclusion criteria above and who were fitted with their hearing aids using the standard fitting protocol at a HEARx Audiology clinic between August 1, 2000, and January 31, 2001. In August 2001, IOI-HA surveys were sent to 225 individuals who originated from one of 80 clinics spread across four states of the USA. Participants were told that their responses would be anonymous. The blank surveys emanated from a HEARx central office. However, to ensure participant anonymity, the completed surveys were returned to the University of Memphis Hearing Aid Research Laboratory.

Supplementary Data

In addition to their responses to the IOI-HA items, participants were queried about: (1) their subjective degree of hearing difficulty without amplification; (2) preference for wearing one or both devices, or whether the instruments had been returned for credit; and (3) previous hearing aid experience. Further data available for each participant were: audiogram, gender, age, hearing aid make and model, and information about third-party payment (if any).

RESULTS

Hearing Aids

All of the hearing aids were programmable analog instruments, and all except two participants had user-operated volume controls. Sixty-five percent of the hearing aids incorporated a switchable directional microphone that operated in omnidirectional mode by default. Six percent of the hearing aids incorporated conventional directional microphones (not switchable). The remainder were strictly omnidirectional devices.

Participant Demographics

Useable responses were received from 154 participants, yielding a 69% response rate. Mean participant age was 77 years (SD = 10 years). Fifty-five percent of the participants were men, 45% were women. Most of the participants (95%) had essentially symmetrical hearing bilaterally (defined as interaural pure-tone average threshold difference of 15 dB or less). Although complete data were not available on bone-conduction

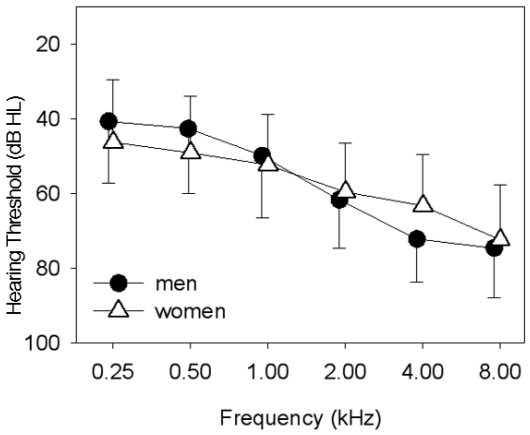

Figure 1 Composite audiograms of men and women subjects. Bars depict one SD.

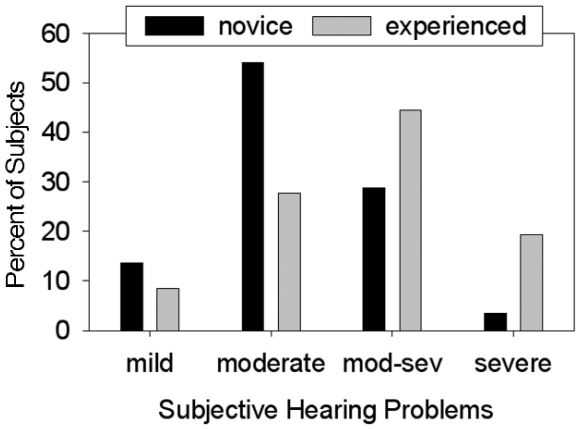

Figure 2 Subjective hearing difficulty (without amplification) reported by subjects with (experienced) and without (novice) previous hearing aid experience.

thresholds, it was estimated that more than 90% of the participants had essentially sensorineural impairments (defined as average air-bone gap less than 15 dB in both ears).

Composite audiograms for men and women are depicted in Figure 1. Multivariate analysis of variance (MANOVA) determined that there were significant differences between thresholds of men and women at 500 Hz ($p = .042$) and 4.0 kHz ($p = .001$). These configurations follow the typical pattern for older individuals with hearing loss; men have better low-frequency thresholds and poorer high-frequency thresholds than women (Jerger et al, 1993).

Table 1 depicts the data on previous hearing aid experience. Forty-one percent of the participants did not have significant previous experience with amplification. Fifty-six percent had varying amounts of experience. Three percent did not respond to this question.

Figure 2 depicts the distributions of subjective hearing difficulty (unaided) reported by participants with, and without, previous hearing aid experience. Most of the participants in both categories reported either moderate or moderately severe problems. New hearing aid users tended to report more moderate problems whereas experienced hearing aid users tended to report more severe problems. Despite having been fitted with two hearing aids, two participants reported that they have no hearing difficulty unaided. Their data are not shown in the figure. Five percent of participants did not respond to this item.

Table 2 describes the extent to which participants chose to wear both of the hearing aids they had purchased. Seventy-nine percent of them reported wearing both instruments all the time. Sixteen percent used only one device at least some of the time. Five percent either returned the devices or did not use them at all.

Table 1 Previous Hearing Aid Experience Reported by Subjects

Previous Experience	Percent of Subjects
None	36
Tried but didn't buy	5
Less than 5 years	18
More than 5 years	38
No response	3

Table 2 Reported Use of Two versus One Device

Use of Aids	Percent
Always one	5
Always two	79
Sometimes one, sometimes two	11
None or aids returned	5

Associations between Demographics and IOI-HA Responses

If participants with different demographic characteristics tend to yield different IOI-HA scores, this could have implications for the generation of norms for the inventory. Although it is convenient to produce one set of norms that can be used for a wide range of hearing aid wearers, it would not be appropriate to do this if we know, for example, that men tend to score systematically higher or lower than women on the items. Thus, before deriving norms from the data, we undertook several analyses to evaluate these types of concerns.

Gender

MANOVA was performed to explore any differences in item responses for men and women. None of the seven items yielded different mean scores for men and women. Thus, we determined that there was not a need for gender-specific norms.

Previous Hearing Aid Experience

Participants were divided into two groups: those with previous hearing aid experience and those without it. MANOVA was performed to explore any differences in item responses between the two groups. The item on hours of daily use (item 1) yielded a significant difference between novice and experienced users. Individuals with previous hearing aid experience reported more hours of daily use ($p < .001$). It seemed possible that this result might be mediated by a difference in hearing impairment between the two groups. That is, we speculated that persons with previous amplification experience might tend to have greater hearing impairment and therefore greater need to use amplification.

To explore this possibility, the analysis was repeated with hearing impairment added as a covariate. To quantify hearing impairment, three pure-tone averages were computed from each participant's composite (across both ears) audiogram. PTA1 was the average of thresholds at 250, 500, and 1000 Hz. PTA2 was the average of thresholds at 500, 1000, and 2000 Hz. PTA3 was the average of thresholds at 1000, 2000, and 4000 Hz. Three MANOVAs were performed, each using a different pure-tone average as the covariate. In all three analyses, the significant difference between experienced and novice users in daily hearing aid use was again observed ($p \leq .001$). In addition, when differences in low-frequency hearing loss were controlled (covariate = PTA1), a significant difference was also seen for item 3 (residual activity limitation). Experienced users reported greater residual activity limitations than novice users with the same low-frequency hearing loss ($p = .03$).

Subjective Hearing Difficulty

The distribution of scores for subjective hearing difficulty (depicted in Figure 2) was collapsed across the experience variable and divided into two groups: those with mild or moderate problems (better subjective hearing) and those with moderately severe and severe problems (poorer subjective hearing). MANOVA was performed to explore any differences in item responses yielded by individuals in the two groups. In this analysis, four of the seven items were seen to have significantly different mean scores for those with better versus poorer subjective hearing. The results are illustrated in Figure 3. Participants with more subjective hearing problems reported more hours of hearing aid use per day ($p < .001$), more overall

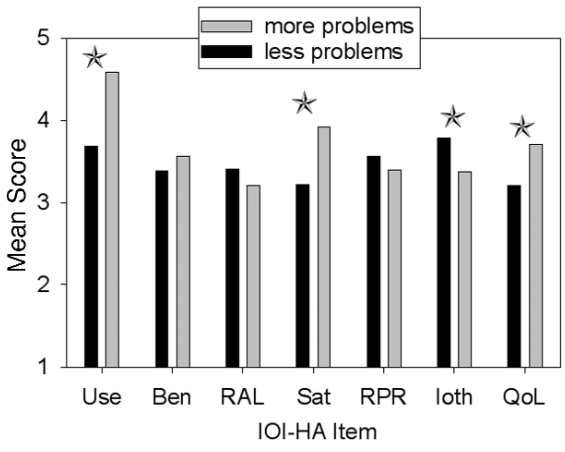

Figure 3 Mean score on each IOI-HA item for subjects with different amounts of subjective hearing problems without amplification. Stars indicate items with significantly different mean scores for the two groups. Use = hours of use per day; Ben = benefit; RAL = residual activity limitations; Sat = satisfaction; RPR = residual participation restrictions; Ioth = impact on others; QoL = quality of life.

satisfaction with the hearing aids (p = .001), and more improvement in quality of life as a result of the hearing aids (p = .004). On the other hand, participants with more subjective problems also reported being more of a bother to other people, even with the hearing aids (p = .03).

Objective Hearing Loss: Audiogram Thresholds

The three pure-tone averages described above were used to evaluate potential differences in IOI-HA responses from individuals with different degrees of objective hearing loss. PTA1 described low-frequency hearing loss, PTA2 described midfrequency hearing loss, and PTA3 described high-frequency hearing loss.

The distribution of PTA1 scores was arbitrarily divided into lower half (i.e., better average thresholds) and upper half (i.e., poorer average thresholds). MANOVA was performed to explore any differences in item responses yielded by individuals with better versus poorer objective hearing. The same procedure was followed for PTA2 and PTA3 data. These analyses yielded results that were consistent with those described above for subjective hearing problems. However, there were not as many significant effects when hearing loss was measured objectively. The results are summarized in Table 3. All three analyses yielded significant effects indicating that participants with poorer objective hearing report more hours of hearing aid use per day. In addition, analyses of groups based on PTA1 and PTA2 data both indicated that participants with poorer objective hearing realized more improvement in quality of life. Finally, the analysis of groups based on PTA1 data indicated that participants with poorer objective hearing were more satisfied with the hearing aids.

Unilateral versus Bilateral Use

As noted in Table 2, 16 percent of participants reported that they wear only one hearing aid some or all of the time, whereas 79 percent reported wearing both hearing aids all of the time they wear amplification. MANOVA was performed to compare mean responses on the IOI-HA items for unilateral and bilateral users. Only the item on hours of daily use (item 1) yielded a significant difference between these two groups. Individuals who reported using both hearing aids all the time also reported more hours of daily use (p = .005).

Who Paid for the Hearing Aids?

Most of the participants (65 percent) paid the entire cost of their hearing aids. However, several participant's hearing aids were partly (26.5 percent of participants) or completely (8.5 percent of participants) paid for by a third party such as private insurance. Figure 4 depicts the mean IOI-HA item scores for these three groups of individuals. MANOVA was performed to explore the significance of differences in mean scores within items. Again, the item on hours of daily use (item 1) yielded a significant difference among the three groups (p < .03). Individuals who paid the entire cost reported significantly more daily use than those who paid some of the cost. The use reported by participants who

Table 3 Probability Values Associated with Significant Results from Three MANOVAs Performed to Explore Associations between Objective Hearing Loss and Responses to IOI-HA Items

Item	PTA1	PTA2	PTA3
1. Use	p < .001	p < .001	p < .001
2. Benefit	---	---	---
3. Residual Activity Limitation	---	---	---
4. Satisfaction	p = .03	---	---
5. Residual Participation Restriction	---	---	---
6. Impact on Others	---	---	---
7. Quality of Life	p = .003	p = .027	---

Note: Hearing loss groups were based on low-frequency pure-tone thresholds (PTA1), midfrequency pure-tone thresholds (PTA2), and high-frequency pure-tone thresholds (PTA3) .

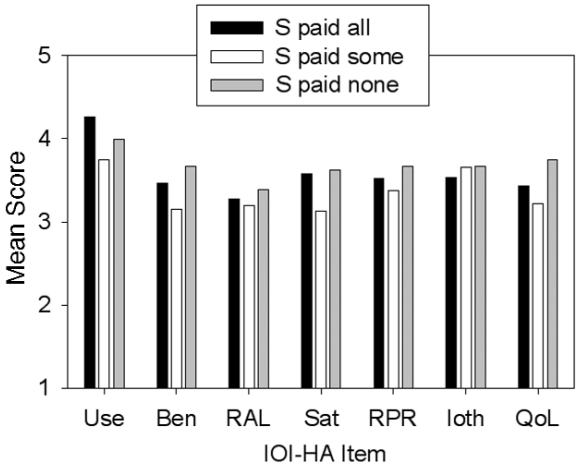

Figure 4 Mean score on each IOI-HA item for participants in three payment categories. Use = hours of use per day; Ben = benefit; RAL = residual activity limitations; Sat = satisfaction; RPR = residual participation restrictions; Ioth = impact on others; QoL = quality of life.

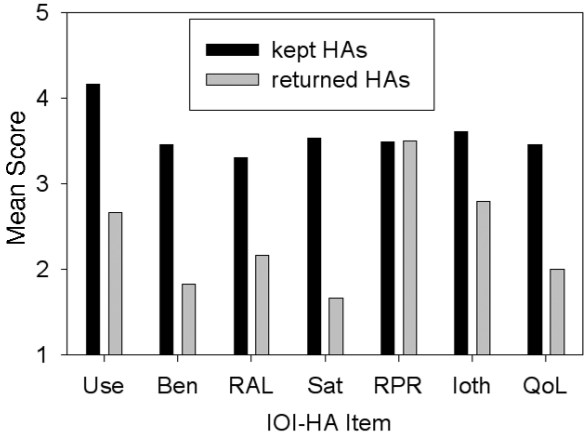

Figure 5 Mean score on each IOI-HA item for subjects who returned the hearing aids compared with those who kept the hearing aids. Use = hours of use per day; Ben = benefit; RAL = residual activity limitations; Sat = satisfaction; RPR = residual participation restrictions; Ioth = impact on others; QoL = quality of life.

received free hearing aids ("S paid none") was intermediate between these two groups and did not differ from either of them.

Hearing Aids Returned

In this participant group, only six individuals returned their hearing aids for credit. Figure 5 depicts the mean item scores for these six, compared with scores for participants who did not return the devices. Because there were so few participants in the group who returned the hearing aids, these data were not statistically tested.

IOI-HA Norms

Several of the variables explored were seen to have a significant association with responses on one or more IOI-HA items. The strongest associations were seen with subjective hearing problems unaided. Considering the results overall, it was

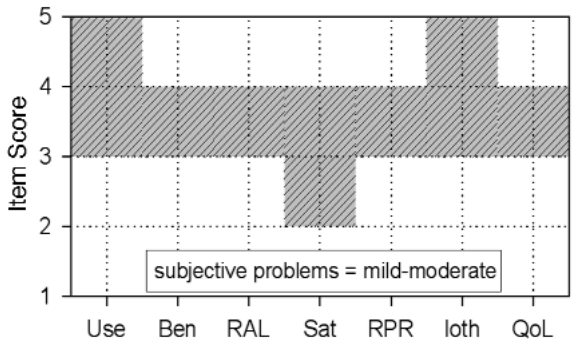

Figure 6 Template of norms to evaluate item scores for a person who reports subjective hearing problems (unaided) that are moderate or less. Use = hours of use per day; Ben = benefit; RAL = residual activity limitations; Sat = satisfaction; RPR = residual participation restrictions; Ioth = impact on others; QoL = quality of life.

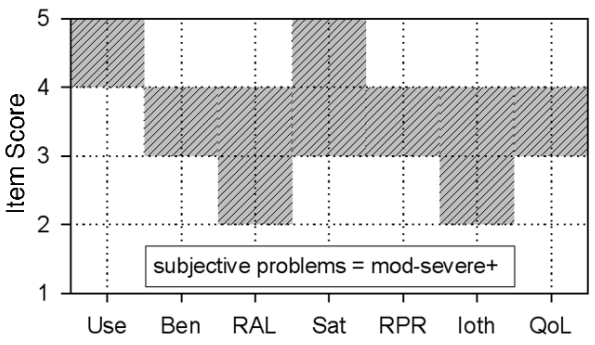

Figure 7 Template of norms to evaluate item scores for a person who reports subjective hearing problems (unaided) that are moderately severe or worse. Use = hours of use per day; Ben = benefit; RAL = residual activity limitations; Sat = satisfaction; RPR = residual participation restrictions; Ioth = impact on others; QoL = quality of life.

Table 4 Norms for Statistical Comparison with Group Data

Item	Mild–moderate (N = 71)		Mod–severe+ (N = 73)	
	Mean	**SD**	**Mean**	**SD**
1. Use	3.73	1.17	4.50	0.96
2. Benefit	3.39	0.98	3.52	1.08
3. Residual activity limitation	3.40	0.95	3.19	1.05
4. Satisfaction	3.20	1.21	3.84	1.17
5. Residual participation restriction	3.57	1.13	3.38	1.11
6. Impact on others	3.79	1.13	3.38	1.10
7. Quality of life	3.19	0.93	3.68	1.02

Note: Means and standard deviations (SD) are given for hearing aid wearers whose subjective hearing problems (unaided) are mild or moderate and for hearing aid wearers whose subjective hearing problems (unaided) are moderately severe or worse.

determined to produce two sets of IOI-HA norms: one for individuals who report moderately severe or severe subjective hearing problems without amplification, and another for those who report mild or moderate hearing problems without amplification (this latter category should also be used for the very small percentage of hearing aid purchasers who report no hearing problems without amplification). This implies that, to use the norms, it is necessary to add an eighth item to the inventory. This eighth item is used to determine the participant's category for subjective hearing problems unaided. The suggested format for the eighth item is shown in Appendix A.

Norms were developed for comparison with group data and for use with data from an individual. Norms for statistical comparison with group data, given in terms of means and standard deviations for each severity group, are shown in Table 4. Figures 6 and 7 depict suggested templates for evaluating responses from a single individual.

If the individual reports mild or moderate subjective hearing problems without amplification, the norms in Figure 6 should be used. If the individual reports moderately severe or severe subjective hearing problems without amplification, the norms in Figure 7 should be used. The shaded areas in Figures 6 and 7 illustrate the range of the middle 50 percent of the data for each item.

DISCUSSION

The norms developed in this study reflect the real-world effectiveness of basic, adequate, but not theoretically superior hearing aid technology. The fitting procedure relied on well-established principles (see Appendix B), but the fittings were performed in real clinical settings with all the attendant complications and pressures. As a result of this design, these norms should present a pragmatic clinical baseline against which individual performance or other technological or fitting approaches can be evaluated.

In research applications, the group data given in Table 4 could be useful for evaluating the real-world effectiveness of more advanced technology than that used by the participants in the norm group. For example, because the norms are based on data from persons wearing in-the-ear single-channel devices, comparison with data from a group of individuals wearing ITE multichannel devices could explicate the additional value of multichannel technology. Other comparisons could potentially examine all-digital processing, noise reduction algorithms, and so on. However, it must be stressed that an inventory comprising seven generally worded items cannot be expected to yield the refined and sensitive analysis that might be obtained from a longer questionnaire with more specifically targeted items.

The norms shown in Figures 6 and 7 can be used clinically to appraise the relative success of a hearing aid fitting for an individual hearing aid wearer. For example, Figure 6 would be used if the hearing aid wearer indicates that he or she has "moderate" hearing problems without amplification (item 8, Appendix A). Keep in mind that the shaded area depicts the range

of scores for the middle 50 percent of individuals. Thus, 25 percent of hearing aid wearers scored lower than the shaded area and 25 percent scored higher. Note that a score higher than the shaded area is not possible for the "use" and "impact on others" items. This indicates that the top 25 percent of individuals all score five (maximum) on these items. The norms in Figure 6 suggest that, for a person who has moderate hearing problems without amplification, a score less than three should generally be viewed as a relatively poor treatment outcome (except for the satisfaction item). On the other hand, the potential exists for an excellent relative outcome on items 2, 3, 5, and 7 (benefit, residual activity limitations, residual participation restrictions, and quality of life) because the norms do not encompass the maximum score.

The norms in Figure 7 are appropriate for individuals who report moderately severe (or worse) hearing problems unaided. The norms show that these individuals typically report high daily use (item 1) and relatively high satisfaction (item 4). These two items are mainly sensitive to poor outcomes. On the other hand, for items 2, 3, 5, 6, and 7, the shaded areas are in the middle of the response scale. Thus, all of these items are potentially sensitive to superior outcomes as well as poor outcomes.

Of the variables explored, participant's subjective hearing problems without amplification had the most pervasive association with responses on the IOI-HA. This was the basis for our decision to generate two sets of norms. However, it was interesting to note that several other variables also showed associations, especially with responses to the "daily use" item. Participants with previous hearing aid experience, those who reported wearing both hearing aids (rather than only one), and those who paid the full cost of the devices, all reported more hours of daily amplification use. Although we cannot provide precise guidelines, these data suggest that a report of relatively low daily use by an individual in one or more of these categories should be examined especially carefully by a practitioner seeking to optimize the fitting.

A variable that was not controlled in the inclusion/exclusion criteria for the study was microphone directionality. As a result, the norm group presented a mix of directional, nondirectional, and switchable directional devices. This could be a consideration in the future because design and development of directional microphones with advanced technological features has been a focus of attention in recent years. In the future, there could be interest in comparing these norms with IOI-HA data for persons using new microphones with advanced design. It is important, therefore, to be clear about the conditions represented in the norms. First, the directional microphones used by these participants were basic conventional designs. Second, only six percent of participants wore instruments with strictly directional microphones. The rest had either omnidirectional or switchable directional microphones that defaulted to the omnidirectional mode. Third, there is not an empirical basis to support a concern that the presence of directional microphones in some hearing aids significantly impacted these norms. A recent survey of a large number of individuals previously fitted with switchable directional devices determined that, on average, the directional mode was used less than one-quarter of the time and that patients were equally satisfied with both modes (Cord et al, 2002). Further, in other recent studies, study participants who were blinded could not notice significant performance differences between omni- and directional microphone modes in real-world settings (Walden et al, 2000; Surr et al, 2002).

It is noteworthy that the level of difficulty experienced by participants in their own lives (subjective hearing problems) was more useful than their objective impairment (audiogram) in predicting hearing aid fitting outcomes. This reinforces the view held by many practitioners that the real-world impact of a given hearing loss varies substantially across individuals and cannot be accurately predicted from sensitivity loss alone.

Finally, it is worth noting that these norms can only be used to determine how favorably a hearing aid wearer evaluates his or her hearing aids in a relative sense, that is, compared to other hearing aid wearers. Even if a person gives scores of "five" on all seven items, this does not guarantee that he or she is fully happy or fully contented with the fitting.

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Appendix A International Outcome Inventory for Hearing Aids (IOI-HA)

1. Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?

none	less than 1 hour a day	1 to 4 hours a day	4 to 8 hours a day	more than 8 8 hours a day
❑	❑	❑	❑	❑

2. Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in those situations?

helped not at all	helped slightly	helped moderately	helped quite a lot	helped very much
❑	❑	❑	❑	❑

3. Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?

very much difficulty	quite a lot of difficulty	moderate difficulty	slight difficulty	no difficulty
❑	❑	❑	❑	❑

4. Considering everything, do you think your present hearing aid(s) is worth the trouble?

not at all worth it	slightly worth it	moderately worth it	quite a lot worth it	very much worth it
❑	❑	❑	❑	❑

5. Over the past two weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?

affected very much	affected quite a lot	affected moderately	affected slightly	affected not at all
❑	❑	❑	❑	❑

6. Over the past two weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?

bothered very much	bothered quite a lot	bothered moderately	bothered slightly	bothered not at all
❑	❑	❑	❑	❑

7. Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?

worse	no change	slightly	quite a lot better	very much better
❑	❑	❑	❑	❑

8. How much hearing difficulty do you have when you are not wearing a hearing aid?

severe	moderately severe	moderate	mild	none
❑	❑	❑	❑	❑

Appendix B Outline of Hearing Aid Fitting Protocol

Initial Visit/ Evaluation	History Otoscopy Hearing evaluation
Hearing Aid Fitting	Check hearing aid (physical fit and comfort) Check hearing aid (acoustic/electroacoustic for soft, average, and loud inputs) Counseling (care, use, controls, etc.) Explain realistic expectations Explain hearing aid limitations Complete paperwork, discuss warranty Review printed materials Recommendations for adjustment Describe rehabilitation program (where counseling issues are reinforced and enhanced)
Follow-Up Phone Call 24–48 Hours after Fitting	Check use and effectiveness If patient has problems, schedule immediate follow-up
1–2 Week Postfit Follow-Up	Verify acoustic performance Inspect ear canals and hearing aids for irritation, wax, or improper function Check with patients for complaints/problems Troubleshoot/adjust hearing aid fitting as needed
6-Month Checkup	Repeat checks in last appointment Clean hearing aid and change BTE tubing (if applicable)
Annual Checkup	Review and document fitting outcomes Verify acoustic/electroacoustic performance Clean hearing aid, change BTE tubing, if applicable Explore changes in hearing. Make medical referrals, as needed