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Measuring Hearing Aid Benefit Using a Willingness-To-Pay Approach

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Abstract

The value associated with self-perceived hearing aid benefit was assessed using a "willingness-to-pay" (WTP) approach. Abbreviated Profile of Hearing Aid Benefit (APHAB) data were obtained from 79 veterans who also indicated how much they were willing to pay for each hearing aid. The results of a multiple regression analysis revealed that veterans were willing to pay $22.06 more for a hearing aid for each 1-point increase in APHAB global benefit. A second multiple regression analysis revealed that the APHAB subscale scores for Ease of Communication (EC) benefit and understanding speech in Background Noise (BN) benefit, as well as income level, were all significant predictors of WTP. In addition, each 1-point increase in EC, BN, and Reverberation benefit increased the value associated with amplification by $16.32, $16.88, and $13.78, respectively. Each 1-point increase in the Aversiveness of Sounds subscale decreased the value associated with amplification by $7.63. The mean WTP across all income groups was $981.71 per hearing aid. These data are interpreted to support the use of WTP as a valid measure of hearing aid benefit.

Key Words: Abbreviated Profile of Hearing Aid Benefit, benefit, hearing aids, outcome, willingness to pay

Abbreviations: APHAB = Abbreviated Profile of Hearing Aid Benefit, AV = Aversiveness of Sounds, BN = Background Noise, COSI = Client Oriented Scale of Improvement, EC = Ease of Communication, RV = Reverberant Environments, VA = Department of Veterans Affairs, WTP = willingness to pay

This past generation has seen a dramatic shift in the health care environment. We have moved from a provider-oriented system where the health care professional functioned in a paternalistic role, controlling the information available to the patient, to a consumer-oriented focus, where the physician often performs as an employee of a managed health care organization and the patient demands information from his or her health care provider to make health care decisions. As part of this growth in health care consumerism, we have seen increasing use of outcome data to demonstrate the efficacy of audiologic intervention (Abrams and Chisolm, 2000). Speech recognition testing, insertion gain, and the speech intelligibility index provide the clinician with objective measures of hearing aid benefit, whereas self-report measures of benefit such as the Hearing Handicap Inventory for the Elderly (HHIE; Ventry and Weinstein, 1982), the Abbreviated Profile of Hearing Aid Benefit (APHAB; Cox and Alexander, 1995), and the Client Oriented Scale of Improvement (COSI; Dillon et al, 1997) enable us to determine the patient's perception of the success of treatment.

Although laboratory and self-report outcome measures provide important information about hearing aid treatment efficacy, little attention has been paid to quantifying benefit in economic terms. Although clinical outcome measures provide the genesis of economic analyses of audiologic outcomes, they do not directly address the issue of "value," that is, from the patient's perspective, are the benefits worth the cost? One such measure is termed "willingness to pay" (WTP) and is widely used among health economists as a subset of a cost-effectiveness

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analysis (Drummond et al, 1997). WTP analyses are often performed to determine a community's preference for adding a service to their insurance policy. For example, how much would a community of subscribers be willing to pay in increased premiums or copayments to add hearing aid and eyeglass coverage to their health insurance policies? If the insurer determines that the WTP is not sufficient to cover anticipated expenses, the service will not likely be included. A WTP analysis may also be performed retroactively to determine if a patient or group of patients perceives that the benefits associated with an intervention are worth the costs. In fact, it can be argued that consumer regulations and vendor policies that allow for a 30-day return privilege amount to a de facto WTP measure. The patient makes a decision sometime during the 30-day period regarding the "value" of the instruments—whether they have improved the communication problems to the extent that the patient is willing to pay for the instruments. The hearing aid industry maintains such information through its "return for credit" data. Unfortunately, return for credit rates are not a meaningful measure of WTP for several reasons. First, specific information is not always required concerning the reasons for the return; thus, we do not know if the patient would have been willing to pay for the instrument had the cost been less. Second, the fact that an individual purchases the instrument does not necessarily mean that the patient felt that the clinical benefits were worth the cost. Finally, nonclinical factors such as acquiescing to family pressure often play a part in deciding to "keep" the hearing aids despite the lack of perceived benefit.

One of the few studies to systematically address the monetary value associated with hearing aids was conduced by Newman and Sandridge (1998). As part of their cost-effectiveness study, they determined that more than 75 percent of their participants preferred fully digital instruments to conventional hearing aids. One-third of those participants changed their preference, however, when informed of the cost of the digital technology. Apparently, they were not willing to pay the additional cost for the benefit achieved.

The monetary value associated with an aspect of hearing aid benefit was also examined by Palmer et al (1995). First, participants were to make sound quality judgments while listening to class A and D amplifiers. Given a range of hearing aid cost between $0.00 and $700.00, participants were then asked how much they would pay for a hearing aid with the associated sound quality. The results indicated that the participants would be willing to pay, on average, $21.00 for each additional point in improved quality.

Although sound quality is an important attribute associated with patient acceptance of hearing aids, it does not address those variables specifically associated with outcome or how the instruments impact on the patient's impairment, activity limitations, or participation restrictions (World Health Organization, 2000). One could imagine a situation, for example, when a pair of hearing aids is perceived as having excellent sound quality but ineffective in resolving the patient's primary complaint: difficulty understanding conversational speech in the presence of competing messages.

Perhaps a more meaningful relationship to explore is that between post hoc WTP and outcome as measured by a self-report measure of hearing aid benefit. WTP analyses in health economics are not necessarily conducted to determine "product pricing" but rather as a means of determining patient preferences or health "utility" (Drummond et al, 1997). Given a choice of health care interventions and options, and given finite resources to pay for those services, what are the relative "values" of those services as measured by their WTP? The need to determine the value of audiologic intervention within the larger health care arena is becoming increasingly more important. It was the purpose of this investigation to determine the value of hearing aid intervention by examining the relationship between WTP and clinical outcome as measured by a standardized instrument.

METHOD

Participants

A total of 300 patients who were successively fit with hearing aids at the Veterans Affairs (VA) Medical Center, Bay Pines, Florida, between the months of September 1998 and February 1999 were surveyed in this study. In selecting patients to survey, no consideration was paid to hearing aid experience, type of instrument, severity or type of impairment, or number of instruments fit. Most hearing aids fit during this period were custom, nonprogrammable analog, nonlinear instruments.

Table 1 Summary of Multiple Regression Analysis for Predicting Willingness to Pay for a Hearing Aid from the Global APHAB Score and Income Category (N = 79)

Variable	*B*	*SE B*	*β*
Global benefit**	.719	.076	21.94
Income category*	.184	.076	933.31

*p = .05; **p < .01.

Outcome Measure

Abbreviated Profile of Hearing Aid Benefit

The APHAB is a pre- versus postintervention, 24 situational-specific item questionnaire categorized into four subscales of 6 items each: Ease of Communication (EC), Background Noise (BN), Reverberant Environments (RV), and Aversiveness of Sounds (AV). The EC, RV, and BN subscales are known as the "communication" subscales and can be combined to yield a global measure of benefit. The patient responds on a 7-point Likert scale from "always" (99% of the time) to "never" (1% of the time) as to how often the particular situation occurs. An example of an item in the BN subscale is "When I am in a crowded grocery store talking to the cashier, I can follow the conversation. . ." Commercially available software permits automated scoring of the responses that can either be entered directly by the patient into the program or transferred to the program from paper and pencil administration.

Procedure

All patients fit with hearing aids during the period of the investigation were sent a mailing that included a letter explaining the nature of the study and the APHAB. The APHAB form was modified to include two additional questions. The first question asked the participant to check a box to indicate annual household income. The categories of income were (a) under $10,000; (b) $11,000 to $25,000; (c) $26,000 to $50,000; (d) $51,000 to $75,000; (e) $76,000 to $100,000; and (f) over $100,000. The second question addressed the individual's WTP for each hearing instrument. The specific wording was as follows:

> The average cost of one hearing aid ranges from $680 to $2500 depending on the size of the hearing aid and the type of circuit. How much would you be willing to pay given the benefits experienced with your hearing aids? $_____, per hearing aid.

No reminder letters or second mailings of the questionnaires were sent to the patients if they failed to respond to the initial mailing.

RESULTS AND DISCUSSION

A total of 103 questionnaires (34.3%) were returned. Of that number, 34 questionnaires could not be used because either the APHAB was incorrectly completed or the WTP question was left blank. Using the 79 remaining questionnaires (26.3% of the total number of questionnaires mailed), the relationships between the amount of money each respondent was willing to pay for each hearing aid and hearing aid benefit as measured by the global APHAB score, as well as the four subscale scores, were examined using separate multiple regression analyses. Two predictor variables were input into the first regression model. These were income category, coded as a set of continuous dummy data (Cohen and Cohen, 1983), and the global benefit score. Five predictor variables were input into the second regression model. These were income category and the four subscale scores (i.e., EC, RV, BN, and AV).

The results of the first regression analysis are summarized in Table 1 and indicate that the amount of money individuals were willing to pay for each of their hearing aids could be significantly predicted by the global benefit score, with income category contributing significantly to model. Together, these two variables accounted for approximately half of the variance in the WTP values (i.e., $r^2 = .547$).

Since the APHAB global score is a composite of three of the subscale scores (i.e., EC, RV, and BN), it was also of interest to examine the predictive value of each of these subscale measures and that of the AV measure. The results of the multiple regression analysis, shown in Table 2, revealed that income category remained a significant predictor of WTP but that only two subscales (EC and BN) were significant predictors. The amount of variance accounted for by the inclusion of all five variables in the regres-

Table 2 Summary of Multiple Regression Analysis for Predicting Willingness to Pay for a Hearing Aid from the 4 APHAB Subscale Scores and Income Category (N = 79)

Variable	*B*	*SE B*	*β*
EC**	.441	.091	10.83
RV	−.008	.106	−.20
BN**	.411	.104	10.86
AV	−.041	.079	−1.07
Income category*	.188	.075	951.92

*p = .05; **p < .01.
EC = Ease of Communication; RV = Reverberant Environments; BN = Background Noise; AV = Aversiveness of Sounds.

sion model was 57.6%, a value similar to that obtained by considering the global score alone.

It is also of interest to note that of the subscale measures, EC was found to exhibit the strongest relationship with WTP, accounting for 44.3% of the variance. This suggests that ease of listening is a highly valued benefit. This finding should be of particular interest to clinicians and engineers who are placing increasing emphasis on technology designed to improve understanding in noise. In addition to that goal, these results suggest that the ability to communicate with minimal effort in relatively quiet environments appears to be on or near the top of patient preferences for hearing aid use.

Based on the data presented here, minimizing the effects of background noise would also appear to be highly valued, as the relationship between BN scores and WTP indicates. When considering BN benefit alone, we can account for 40.3 percent of the variance. Improving listening in reverberant environments and minimizing the aversiveness of amplified sounds, although important, only account for 27.3 and 6.5 percent of the variance in WTP, respectively. Further, the relationship between AV scores and WTP was a negative rather than a positive one. That is, as AV scores increased, the amount that individuals were willing to pay decreased. This finding is not completely surprising. Clinical experience indicates that many individuals report an increase in AV-related problems following initiation of hearing aid use. The spread of the data suggests large individual differences regarding perceived AV of amplified sound. Furthermore, clinical experience strongly indicates that this subscale is not strongly related to overall hearing aid satisfaction.

To further examine these data, the relationship between the benefit measures and the WTP values are illustrated in Figures 1 to 5 for the global, EC, RV, BN, and AV scores, respectively. It can be seen that for all of the benefit measures, except AV, as benefit increased, so did the amount of money that individuals were willing to pay. The dollar value associated with a 1-point increase in global benefit equaled $22.06. For EC benefit, the dollar value associated with a 1-point increase was $16.32; for RV benefit, $13.78; and for BN benefit, $16.88. Finally, in terms of the AV subscale, the data indicate that for each additional negative point, individuals would subtract approximately $7.63 from the amount they were willing to pay for a hearing aid.

The finding that household income category added to the strength of each regression model was not surprising. In fact, we requested income information since it could reasonably be assumed that an individual who earns less than $10,000 per year and is willing to pay $1000 for his or her hearing aid (10% of household income) values the

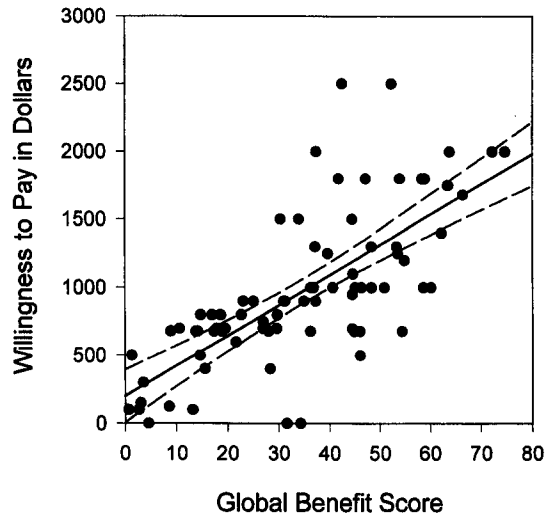

Figure 1 Relationship between participants' APHAB global benefit score and the amount of money they were willing to pay for one hearing aid.

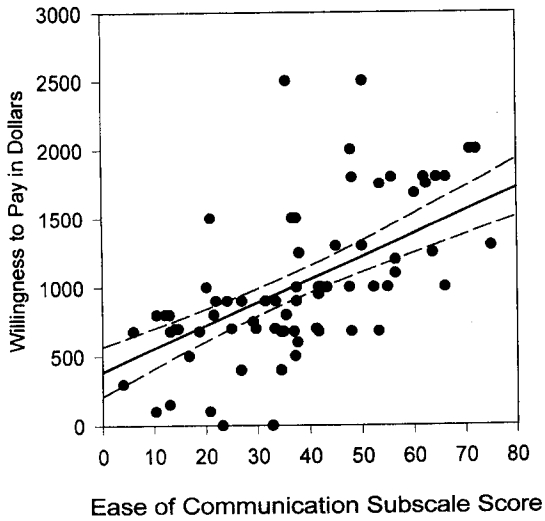

Figure 2 Relationship between participants' APHAB Ease of Communication subscale score and the amount of money they were willing to pay for one hearing aid.

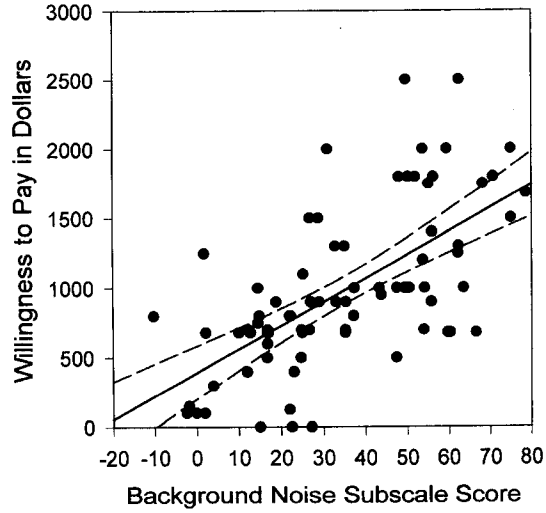

Figure 4 Relationship between participants' APHAB Background Noise subscale score and the amount of money they were willing to pay for one hearing aid.

hearing aid more than an individual who earns more than $100,000 and is willing to pay the same $1000 (1% of household income). In each analysis, as the income category increased, an individual was willing to pay slightly more money for a hearing aid. However, as can be seen in Figure 6, the influence of income category on WTP was not very large. Although the results of a one-way analysis of variance, with income group as the between-subjects variable and WTP as the dependent variable, failed to reach significance ($F = 1.38$, $df = 6, 69$, $p = .29$, $MSE = 314, 022$), caution should be taken in interpreting this result. Although it can be seen that the number of participants in some income categories was probably sufficient to detect reliable group differences, in others (e.g., the highest income group), the participant numbers were very small. It is of interest, however, that the mean WTP across all groups was $981.71 per hearing aid, with a range of $0.00 to $2500.00. Three respondents gave a value of $0.00. Two of the three were in the lowest income group, and one was in the $75,000 to $100,000 income group. Of the respon-

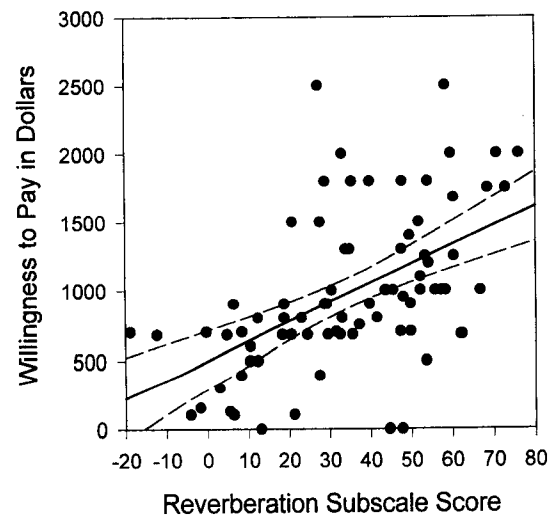

Figure 3 Relationship between participants' APHAB Reverberation subscale score and the amount of money they were willing to pay for one hearing aid.

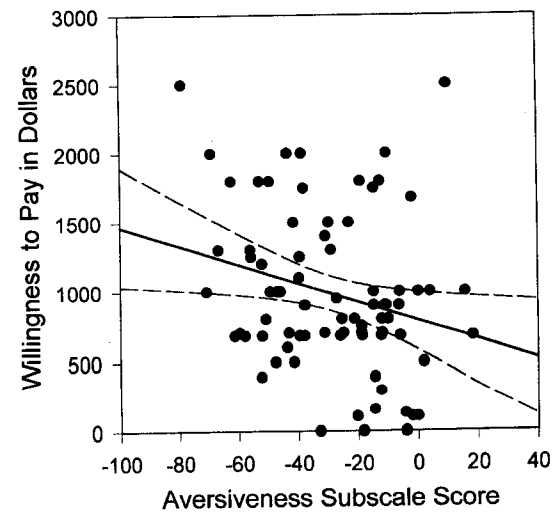

Figure 5 Relationship between participants' APHAB Aversiveness subscale score and the amount of money they were willing to pay for one hearing aid.

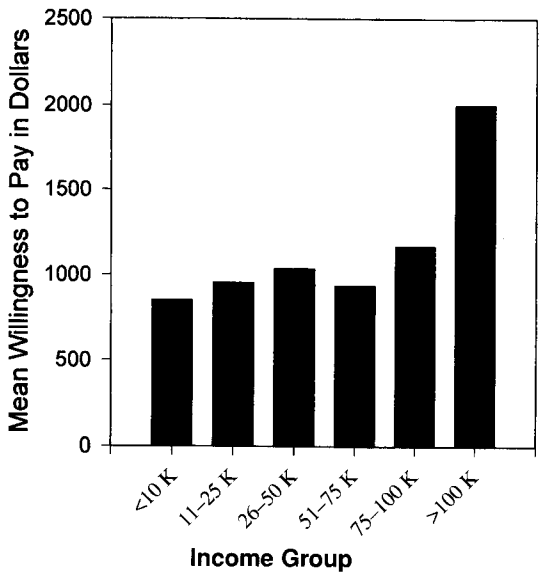

Figure 6 Mean amount of money participants in each of the income categories (with n = 14, 31, 24, 6, 3, and 1 from the lowest to highest income groups, respectively) were willing to pay for one hearing aid.

dents who were willing to spend $2000 or more for a hearing aid, one was also in the $76,000 to $100,00 category, and another was in the over $100,000. Perhaps somewhat surprisingly, however, the third individual was in the lowest income group (i.e., < $10,000). Thus, although household income seems to be a factor in the value placed on hearing aids, there was a great deal of variability within each income group.

A potentially interesting implication of these results is that in each analysis, the intercept between the benefit measure and the WTP value indicated that individuals would be willing to pay a certain amount of money per hearing aid even if the measured benefit equaled zero. For example, the WTP intercept for the global benefit score was $192.09 rather than $0.00. One possible reason for such findings is that the 24 set items on the APHAB may not necessarily represent those situations that are critically important to an individual patient. Recently developed outcome measures, specifically the COSI (Dillon et al, 1997) and Glasgow Hearing Aid Benefit Profile (Gatehouse, 1999), address this limitation by permitting the patient to identify specific communication situations that present the most difficulties. Despite this potential shortcoming of the APHAB, the results of this study help to demonstrate its construct validity as the APHAB benefit measures were significantly related to an alternative definition of benefit, that is, "value" (Nunnally and Bernstein, 1994).

Some caution should be exercised in the generalization of these findings to the non-VA population for several reasons. First, only 34 percent of 300 questionnaires were returned. Of particular interest was the fact that many of the respondents did not, or would not, answer the specific WTP question. Some of the respondents wrote that as combat veterans, they had "already paid" for their hearing aids. Other comments suggested that they felt the question was an attempt to change the policy concerning free medical care for eligible veterans. There was a level of suspicion that we did not anticipate at the time of the initial mailing. Given this apparent reluctance to place a value on a device that had been provided at no cost, it is also possible that some veterans may have purposely "undervalued" their WTP. Perhaps our return rate may have been larger if we had addressed this issue in our cover letter.

The fact that the participant population used in this investigation does not "pay" for the hearing instruments might also limit extending the interpretation of the results to the general population. It could be argued, however, that the absence of payment might have encouraged a "purer" judgment of value unbiased by retail pricing.

Another concern is that one-third of the returned questionnaires could not be used because of failure to properly complete the APHAB (e.g., unanswered items, "straight-line" responses). This illustrates the problems associated with mailing out the APHAB. With only six items per subscale, it is very important for all items to be completed for the results to be considered valid. Individuals often leave out items (despite written instructions) because they rarely or never encounter the situations described. In a face-to-face situation, this problem can be resolved by asking the patient how he or she would respond in that situation or by suggesting situations with similar communication challenges.

The WTP method used in this study (i.e., providing a range of hearing aid prices as anchors) is not the only approach to conducting WTP analyses. Alternative methods include providing no price references at all, providing consumer pricing references such as the cost of an automobile, refrigerator, or personal computer, or providing medically related cost references such as eyeglasses, pacemaker, and hip replacement. Using this last approach establishes a comparative health-related quality of life question, "How much are you willing to pay for your improved quality of life now that you can hear better?," compared with how much people are willing to pay

for other medical devices and procedures. This is a very compelling question and deserves serious investigation. An alternative approach to determining WTP among paying patients is to ask how much they would be willing to pay for their hearing aids if they lost them.

Even with the concerns discussed above and the differences in the range of cost of hearing aids between this and the Palmer et al (1995) study, it is of interest to note the remarkable similarity between the results. In their study of hearing aid sound quality, the subjects were willing to pay $21.00 for each additional point in sound quality. The participants in the current study were willing to pay an additional $22.06 for each additional point in global benefit. To paraphrase Palmer and her colleagues, we can now say what "global" hearing aid benefit costs: approximately $22.06 a point.

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