

# Quantifying the Obvious: The Impact of Hearing Instruments on Quality of Life

*NCOA survey of nearly 4000 people finds significant quality-of-life differences between users and non-users of hearing instruments*

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**A**t a press conference in May 1999, James Firman, PhD, president and CEO of the National Council on the Aging (NCOA), released some of the findings from what is perhaps the largest study ever conducted on the effects of untreated hearing loss on adults as well as their families. The study, commissioned by the NCOA, was funded by the Hearing Industries Association (HIA). The actual field work and analysis was conducted by the Seniors Research Group utilizing the National Family Opinion Panel (NFO).

The report<sup>1</sup>, which is voluminous, was first made available to key researchers in the industry in draft form in December 1998. Because of its size, it is considered inaccessible to the typical hearing health care stakeholder. To make the results more widely known, the senior author of this paper conducted an "executive" level analysis of the HIA-NCOA database and reported on the findings at the European Hearing Industries Manufacturers Assn. (EHIMA) World Hearing Conference held in Brussels in May 1999 and to the Hearing Industries Association (HIA) in June 1999 in Minneapolis.<sup>2</sup> A summary of this presentation as well as the draft findings of the

A survey of 2069 hearing-impaired individuals and 1710 of their family members reveals that hearing instrument users are likely to report improvements in their physical, emotional, mental and social well-being. Users of hearing instruments on average are more socially active and avoid extended periods of depression, worry, paranoia and insecurity compared to non-users with hearing loss. Additionally, family members and friends are more likely to notice these benefits than the actual users themselves.



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## Key to Graphs & Tables

The 2069 hearing-impaired respondents (and, where noted, the responses of 1710 of their family/friends) were separated into five even quintiles by the severity of their hearing losses (i.e., Quintile 1 represents the 20% of those with the mildest hearing losses while Quintile 5 represents the 20% of those with the most severe losses) as measured by the AAO-HNS's Five Minute Hearing Test (FMHT). In the following graphs and tables, these five quintiles are further separated into two groups: users and non-users of hearing instruments. Asterisks (\*) next to the quintile number in the figures denote levels of statistical significance: \*\* = 95% or higher; \* = 85-90% (suggestive of trends only). For a complete description of the survey methodology and statistical reporting, please see the section, "Study Methods, Survey Parameters & Quintiles, and Statistical Reporting."

NCOA study were published by the industry journals in July 1999.<sup>3,4</sup>

The purpose of this article, which reports on the responses of 2069 hearing-impaired individuals and 1710 of their family members or friends, is to present the executive-level findings of the final study with the expectations that hearing health care providers and manufacturers will use this information as a springboard for repositioning the hearing care industry for the new millennium.

## Activity Level

Respondents were asked to indicate the extent (times per month) to which they engaged in 13 activities. Six of the activities were solitary in nature while seven involved other people. Total solitary and social activity scores were also calculated. As shown in Table 2, hearing instrument users are shown to have the same level of solitary activity as non-users. However, hearing instrument users are *more likely* to engage in activities involving

## Study Methods, Survey Parameters & Quintiles and Statistical Reporting

► **Sampling:** In November 1997, a short screening survey was mailed to 80,000 members of the National Family Opinion (NFO) panel. The NFO panel consists of households that are balanced to the latest U.S. census with respect to market size, age of household, size of household and income within each of the nine census regions, as well as by family versus non-family households, state (with the exception of Hawaii and Alaska) and the nation's top-25 metropolitan statistical areas.

The screening survey covered only three issues: 1) physician screening for hearing loss; 2) whether the household had a person "with a hearing difficulty in one or both ears without the use of a hearing aid", and 3) whether the household included a person who was the owner of a hearing instrument. This short survey helped identify nearly 15,000 hearing-impaired individuals and also provided detailed demographics on those individuals and their households. The response rate to the screening survey was 65%. In Dec. '97, an extensive survey was sent to 3300 hearing instrument owners with tabulation of the data occurring in Feb. '98.

The response rate for the hearing instrument owner survey was 83%. The achieved database served as input into Knowles Electronics MarkeTrak V studies.<sup>5,7</sup> The data presented in the MarkeTrak panel refer only to households as defined by the U.S. Bureau of Census (i.e., people living in a single-family home, duplex, apartment, condominium, mobile home, etc.). People living in institutions have not been surveyed; these would include residents of nursing homes, retirement homes, mental hospitals, prisons, college dormitories and the military. Given that a nationally representative sample of more than 15,000 hearing-impaired individuals had been identified by Knowles Electronics, it was decided to resurvey a sample of the MarkeTrak V panel and their spouse (or close friend). A sample of 3000 individuals with a self-admitted hearing loss ages 50 and over were randomly drawn from the MarkeTrak panel. Equal samples of 1500 hearing instrument owners and non-owners were drawn from the panel.

► **Survey Design and Response.** Utilizing information from previously developed industry surveys<sup>8,9</sup>, interviews with industry researchers and academia, and a review of the literature on the psychosocial and physical aspects of hearing loss<sup>10-23</sup>, Senior Research Group designed an eight-page questionnaire comprised of 300+ questions for the individual with hearing loss and a four-page questionnaire comprised of 150 questions for the spouse or family member of the identified respondent. The comprehensive survey covered a myriad of topics ranging from self and family perceptions of benefit of hearing aids to attitudes towards hearing health and hearing instruments. In addition, a number of personality scales<sup>24-27</sup> deemed relevant to this study were included in the survey.

The National Family Opinion Panel (NFO), which conducted the field work for this study in the spring and summer of 1998, sent respondents one questionnaire for themselves and one for their spouse, family

member or close friend to complete. The hearing-impaired respondent who received the survey packet was asked to give the survey to the family member or friend of their choice who was most familiar with them. While hearing instrument owner and non-owner samples were matched on important census demographics, NFO was unable to match them on severity of hearing loss, since hearing loss was not measured in the MarkeTrak screening survey. A \$1 cash incentive was mailed with each survey.

Response rates were high among both hearing-impaired individuals and their family or friends, 79% and 71% respectively (sample sizes of 2364 and 2132 respectively). After analyzing the returned surveys for useability (e.g., minimal missing information), in excluding the substantial number of hearing aid owners who rarely or never used their hearing aids, and in choosing family survey returns which also had a concurrent respondent survey, the final sample sizes for respondents and family members were reduced to 2069 and 1710 respectively.

► **Hearing Loss Assessment Measure and Use of Quintiles:** In addition to quality-of-life items, a paper and pencil assessment of hearing loss was administered with the anticipation that the results of this assessment would be used to control for hearing loss when comparing the quality of life of hearing instrument users and non-users. The key hearing assessment tool used was the American Academy of Otolaryngology-Head and Neck Surgery's Five Minute Hearing Test (FMHT).<sup>28</sup> The FMHT is a 15-question test measuring self-perceived hearing difficulty in a number of listening situations (e.g., telephone, multiple speakers, television, noisy situations, reverberant rooms), as well as self-assessments of some signs of hearing loss (e.g., people mumble, inappropriate responses, strain to hear, avoid social situations). Each item of the FMHT is traditionally scored on a four-point scale, using the values "never," "occasionally," "half the time" and "almost always." The developers of the NCOA survey utilized a five-point Likert attitude scale with end-point anchors of "strongly agree" and "strongly disagree." Koike et. al.<sup>28</sup> have shown that the FMHT is significantly correlated with standard audiologic measures, such as speech reception thresholds, speech discrimination scores, air conduction thresholds and pure tone measures.

A factor analysis (minimum eigenvalue = 1) of the 15-item FMHT demonstrated that it is a unidimensional test. Consequently, respondents' subjective hearing loss scores were simply calculated as the mean of the 15 items. Respondents were then grouped into one-of-five hearing loss quintiles based on their mean overall subjective hearing loss scores. Each quintile represents 20% of the total sample. Quintile 1 represents the 20% of respondents with the least severe hearing loss (per the FMHT) and Quintile 5 the 20% with the most severe loss.

The quintile system was utilized for all analysis as a means for controlling for differences in hearing loss between hearing instrument user and non-user samples. The use of

these quintiles allowed us to achieve more valid comparisons between the two samples. If we were to simply compare responses of all hearing instrument users with those of all non-users, without regard to degree of hearing loss, the findings would have been misleading and, in fact, erroneous. For example, it is widely known that *incidence* and *degree* of depression have been found to increase with *severity* of hearing loss. Thus, even if severely hearing-impaired people experience reduced depression after obtaining hearing instruments, they might still report more depression than non-users overall, since hearing instrument users tend to have more severe hearing loss than non-users. However, when hearing instrument users are matched with non-users in the same quintile (i.e., a cohort analysis) the differences between them reflect the potential impact of the hearing instruments rather than the *effect of their degree* of hearing loss.

While there is no audiological basis for labeling hearing loss associated with each quintile group, it is worthwhile to look at the respondents' self-perceived hearing loss compared to their resulting quintile classification based on the FMHT score. The modal self-perceived hearing loss is as follows: Quintile 1 (mild/moderate), Quintile 2 (moderate), Quintile 3 (moderate/severe), Quintile 4 (severe), Quintile 5 (severe/profound).

► **Statistical Analysis & Reporting:** As stated earlier, close to 500 data points were collected from respondent and family member surveys. It is beyond the scope of this paper to document all of the findings presented in the NCOA final report. This paper instead will focus on key benefit results with an emphasis on aided versus unaided results within hearing loss cohort (quintile). As an example, the final report provides detailed results for the six items making up the "anger & frustration" scale in the survey. With few exceptions, we will present only the total results for each scale. The majority of items in the NCOA survey were scored on a five-point Likert scale.

In general, mean scores are presented for both users and non-users by quintile on the majority of scales. For some items we will simply present the percent of respondents (e.g., was depressed within the preceding 12 months). All of the subscale findings for which there are mean results have been normalized (i.e., converted to z-scores with a mean of 5 and standard deviation of 2). This type of normalization is attractive, in that one can easily discern trends across a wide variety of factors and across groups (user versus non-user and by quintile). For instance, a score of 5 on each subscale indicates that the sample mean score is at the 50% percentile; a score of 3 is at the 16% while a score of 7 is at the 84%.

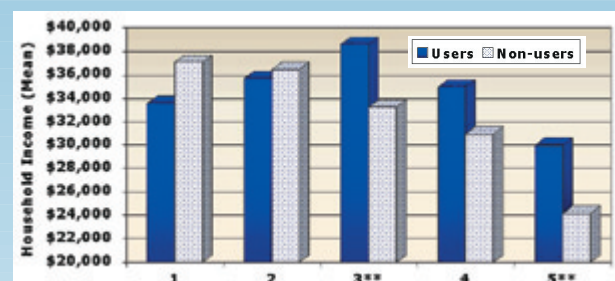
In discernment of trends, statistically significant differences in means (t-test) or percentages (z score for differences in proportions) at the 95% and 99% or higher confidence level have been documented. Given the smaller sample sizes in Quintiles 1 & 2

*continued on page 4*

## Demographics and Similarities/Dissimilarities of the Quintiles

In Table 1, selected demography is presented by quintile for users and non-users. Sample sizes for respondent and family member survey returns are also provided. The cohort groups with minor exceptions are well matched on gender, employment status and marital status. With respect to the age of respondents, Quintile 1 and Quintile 2 are shown to be significantly older on average by about five and two years respectively.

As shown in Fig. 1 and Table 2, household income is significantly related to both hearing loss and hearing instrument usage. The striking trend (income differential) in Quintiles 3-5 indicate that the more serious levels of hearing loss have less household income; this is despite the fact that the higher hearing loss non-user groups tend to be employed more often. Quintile 3 and 5 hearing instrument user groups are shown to have significantly more earning power than non-users and they are more educated. Thus, hearing instrument wearers also report that they have "plenty" of discretionary



**Fig. 1.** Household income by hearing loss quintile for hearing instrument users and non-users (same data as Table 1).

income more often than non-users. For example, 22% of Quintile 5 hearing instrument users report they have plenty of discretionary income compared to 8% for the non-users. The discretionary income differential for the more severely hearing-impaired samples is a likely cause of the lower earning power. Because of higher disability levels, communication is probably impacted, resulting in lower income and therefore less earning power. Finding a solution to their hearing loss is exacerbated for these groups, in that lower earning power means that the respondent is less likely to be able to afford a hearing instrument to correct his/her hearing loss.

In general, the demographics for users and non-users for Quintiles 1, 2 and 4 are well matched. However, the age differences should be taken into account, for instance, when evaluating the impact of hearing instrument usage on relevant variables such as likelihood of attending a senior center. For Quintile 3, we find hearing instrument users with greater discretionary income despite the fact that they are less likely to be in the work force. Finally, Quintile 5 shows significant differences in income and marginal differences (90% confidence) on most other demographics presented in Table 1. With the exception of age in two quintiles and income in two quintiles, there do not appear to be systemic differences between the users and non-users.

Differences in income and age could, of course, be related to important outcome measures such as functional health, anxiety, depression, emotional health and sociability. Similarly, the reader will notice later in this article that there are differences in reported physical health between users and non-users which is supportive of known experimental studies.<sup>14</sup> In turn differences in physical health could impact scores on depression, anxiety and self esteem. It is the authors' intent to first present univariate results on outcome measures followed by a total sample multivariate analysis to rule out spurious results due to confounding. ♦

**Table 1. Demographics of hearing aid users versus non-users in five hearing loss groups.**

Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
Useable surveys (respondent)	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Useable surveys (family)	74	336	147	247	208	184	281	136	327	86
	63	253	125	207	168	184	237	122	280	71
Age	75.2 ***	70.4	73.6 ***	71.3	72.9	71.7	72.6	72.5	74.3	72.9
Gender (Male %)	61	53	66	66	64	69	61	66	56	66 *
Marital Status (Married %)	61	64	68	67	65	66	65	65	61	70 *
Employed Status (Retired %)	71	69	72	70	75	63 **	72	66	72 *	64
Education (% some college or degree)	55	61	54	52	56	50	61 **	51	43 *	32
Financial situation										
Household income	\$33,602	\$37,107	\$35,681	\$36,474	\$38,582 **	\$33,241	\$34,961	\$30,907	\$29,966 ***	\$24,197
Discretionary income (%plenty)	35	27	33	29	32 ***	22	26	22	22 ***	8

Notes: \*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) - 85% confidence (suggestive of trends only)

other people. With the exception of Quintile 4, hearing instrument users are shown to have significantly higher participation in three to four of the seven activities listed. Four of the five quintile hearing instrument user groups indicate they

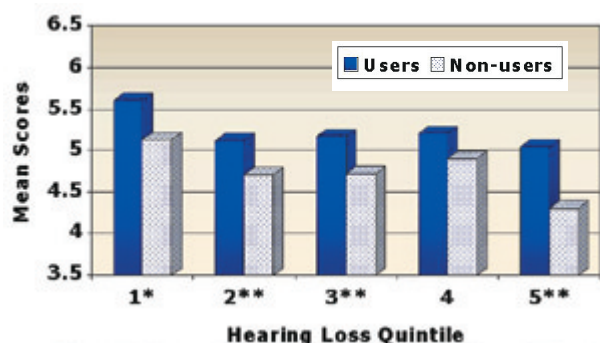
participate more in organized social activities (Fig. 2), while three of the five hearing loss groups report they are more likely to attend senior centers if they are hearing aid users. The most serious hearing loss group (Quintile 5) reports greater participation in four of the seven activities if they are hearing instrument users.

### Interpersonal Relations

The NCOA survey asked 12 questions concerning the respondent's quality of interpersonal relationships with their family. The questions used a four-point scale ranging from "a lot" to "not at all" (e.g., "How much can you relax and

be yourself around them?") and 12 questions concerning negativity (e.g., arguments, tenseness, criticism) in the relationship using a four-point scale ranging from "often" to "never." Interpersonal warmth and interpersonal negativity scores for family, friends and total are documented in Table 3. Due to the scale used, high scores on the interpersonal warmth variable are indicative of less interpersonal warmth while high scores on the interpersonal negativity denote more negativity in relationships.

In Fig. 3, it can be seen that interpersonal warmth in relationships declines as hearing loss gets worse. Hearing instrument users in Quintiles 1-3 (mild to moderate) are shown to have greater interpersonal warmth in their relationships than their non-user counterparts. Referring to Fig. 4, significant reductions in negativity in family relationships appears to be associated with hearing instrument usage in Quintiles



**Fig. 2. Activity Levels:** Hearing instrument users are more likely to participate in organized social events than non-users. Higher scores indicate greater monthly participation in activities.



1 and 2, the hearing loss groups with the mildest hearing disability.

Social Effects

Forty-seven items in the survey assessed the social impact of hearing loss and hearing instrument usage. The social effects indices are documented in Table 4 (on p. 18) with the more important significant findings graphed in Figs. 5-8. The majority of the items were scored on a five-point Likert scale taking the values “strongly agree” to “strongly disagree.” The scales on sociability assessed average monthly contact with family and friends by phone and in person.

In Fig. 5, the stigma of hearing loss is shown to increase as hearing loss increases. All five non-user groups report they would be embarrassed or self-conscious if they wore hearing instruments, while all five user groups reported lower stigmatization with hearing instruments. We are

not concluding, of course, that usage of hearing instruments would lead to reduced stigma; most likely hearing instrument users have resolved their concerns about the stigma associated with hearing instrument usage more so than their non-user counterparts. The high stigma scores for non-users is thus more an indicator of their personal barriers to hearing instrument adoption.

As hearing loss increases, respondents were more likely to overcompensate for hearing loss by pretending that they have heard what people say, by avoiding telling people to repeat themselves, by avoiding asking other people to help them with their hearing problem, by engaging in compensatory activities such as lip reading or by defensively talking too much to cover up the fact that they cannot hear well. Fig. 6 shows that all five hearing instrument user groups report significantly lower overcompensation scores. Family members were

Study Methodology

continued from page 2

for users and Quintiles 4 & 5 for non-users, we have also recorded differences significant at the 85% and 90% confidence level; however, in the latter case the differences should be analytically recognized only in the discernment of trends. Certainly, a result is much more important if there are significant differences across four or five of the groups than if the results are marginally significant, for instance, in only Quintile 1. Also, there are some quality-of-life issues which are highly significant (99%+) in Quintile 5 only, in that the issue appears to primarily impact people with a severe or profound hearing loss. In these cases, we note this single cohort finding. However, if a single cohort achieves significance only at the 85% or 90% level, while documented in the tables to follow, we will not report the difference as a finding in this report. ♦

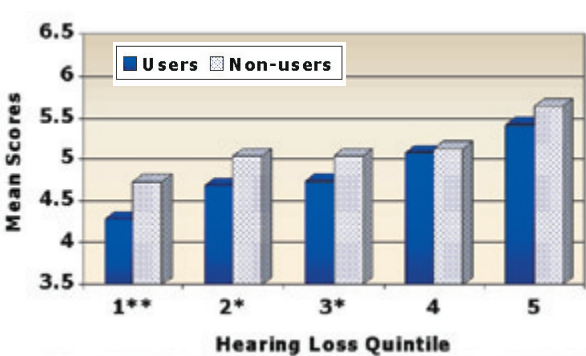


Fig. 3. Interpersonal Relationships: Interpersonal warmth in relationships. Higher scores denote less perceived interpersonal warmth.

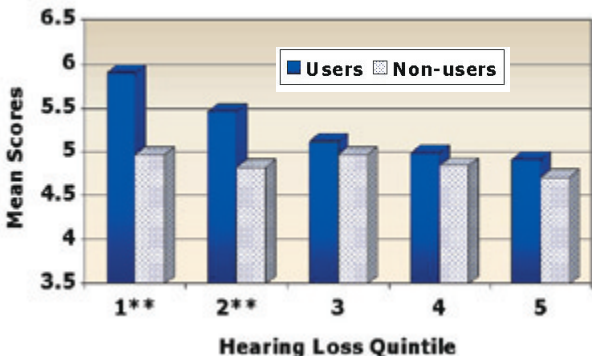


Fig. 4. Interpersonal Relationships: Negativity in family relationships. Higher scores indicate there is less tenseness, arguments, criticisms, etc.

Table 2. Solitary and social activities for hearing aid users and non-users.

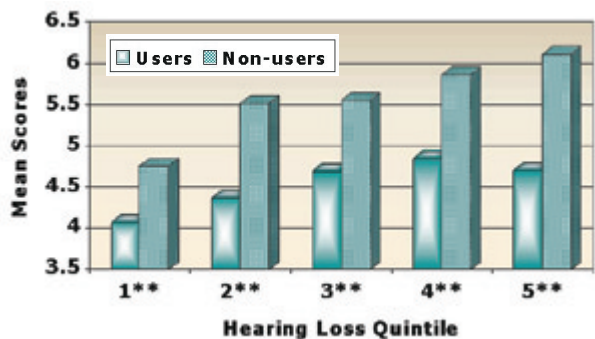
Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
<b>Solitary activities</b>										
Reading	5.28 ~	4.91	4.78	5.13 *	5.25 ***	4.88	5.13	5.02	5.01	4.31
Garden/yard	4.98	4.94	5.26	5.09	5.12	5.05	4.81	5.02	4.87	5.23
TV	5.24	5.13	4.99	4.98	4.98	5.15	4.74	5.26 ***	4.84	5.04
Aerobics	4.95	5.05	4.85	4.98	5.42	4.96	4.98	5.16	4.81	4.78
Hobby	4.85	5.03	5.00	4.81	4.62	5.17	4.81	5.37	5.21	5.22
Shop by self	5.56	5.30	4.80	5.04	5.05	4.90	4.95	4.97	4.75	4.87
Total	5.15	5.07	4.96	5.00	5.08	5.03	4.91	5.13 **	4.94	5.01
<b>Social Activities</b>										
Attend church	5.68 **	4.95	4.92	4.87	5.05	4.92	5.06	4.88	5.14 ***	4.57
Attend sports	5.75	5.18	5.02	5.06	5.13	4.90	4.93	5.05	4.74 ***	4.53
Organized social events	5.61 ~	5.13	5.11 **	4.70	5.17 ***	4.72	5.20	4.89	5.04 ***	4.30
Attend senior center	5.18	4.81	5.19 **	4.76	5.24 ~	4.93	4.97	5.03	5.23 ***	4.73
Theatre/Movie	5.43	4.98	5.11	5.19	5.12	4.92	4.84	4.98	4.83	5.11
Volunteer/civic clubs	5.14	5.13	5.43 **	4.88	5.32 ***	4.81	4.87	5.03	4.85	4.65
Shop with friends/family	5.76 ***	4.86	5.05	4.86	4.74	4.87	5.00	4.94	5.19	5.23
Total	5.52 ***	5.02	5.17 **	4.93	5.12	4.98	5.00	4.98	5.07	4.91

Notes:  
\*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) ~ 85% confidence (suggestive of trends only)

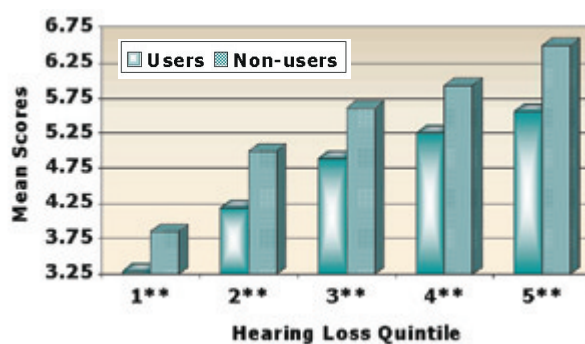
Table 3. Hearing aid users versus non-user self ratings of quality of interpersonal relationships

Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
<b>Lack of interpersonal warmth</b>										
Family in home	4.26	5.03 ***	4.58	5.01 **	4.72	5.18	4.83	5.02	5.32	5.53
Family/friends not in home	4.59	4.63	4.71	4.96	4.88	4.99	5.11	5.17	5.38	5.62
Total	4.28	4.73 **	4.68	5.04 **	4.73	5.03 ~	5.07	5.12	5.42	5.64
<b>Lack of negativity</b>										
Family in home	5.90 ***	4.97	5.47 ***	4.82	5.11	4.97	4.97	4.84	4.91	4.70
Family/friends not in home	5.45	5.29	5.42 ***	4.84	5.08	4.97	4.79	4.73	4.89	4.53
Total	5.12	5.00	5.29 *	4.96	4.98	4.89	4.99	4.89	5.05	4.84

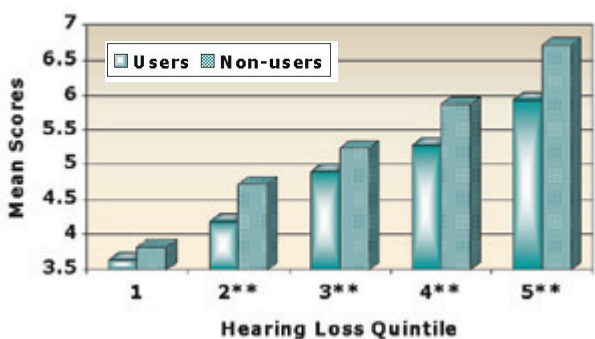
Notes:  
\*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) ~ 85% confidence (suggestive of trends only)



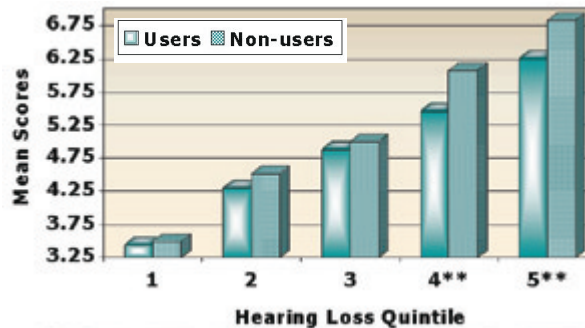
**Fig. 5. Social Effects: Stigma.** Higher scores indicate the subjects are embarrassed or self-conscious about wearing hearing instruments.



**Fig. 6. Social Effects: Overcompensation of hearing loss.** Higher scores indicate the subjects are more likely to hide or cover up their hearing loss.



**Fig. 7. Social Effects: Discrimination.** Higher scores are indicative of subjects who report, for instance, they are "accused of hearing only what they want to hear."

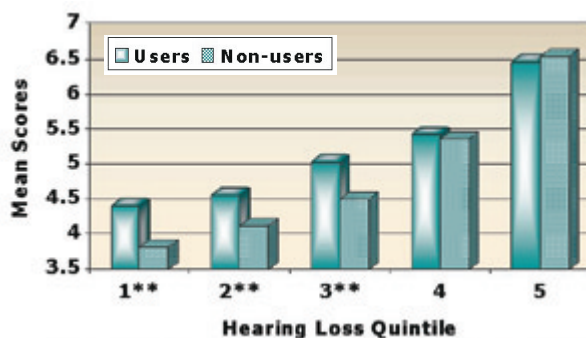


**Fig. 8. Social Effects: Difficulty in communication.** Higher scores are indicative of the effort it takes to communicate for the respondents.

less likely to observe the impact of hearing instruments on the reduction of hearing loss compensatory behaviors than were respondents.

The greater the hearing loss, the greater the likelihood that respondents will report they are the target of discrimination (Fig. 7). The greater the hearing loss, the greater the likelihood that respondents with more serious hearing losses were accused of hearing only what they want to hear, found themselves the subject of conversation behind their backs, were told to "forget it" when frustrated family members were not heard the first time, etc. All hearing loss groups except Quintile 1 (the mildest hearing loss) reported significant reductions in discriminatory behaviors if they were hearing instrument users. While family members observed greater incidences of discriminatory behavior as hearing loss increased, again they did not see reductions in discriminatory behavior associated with hearing aid usage.

Fig. 9 shows a strong relationship between hearing loss and family member concerns of safety ("cannot hear warning signs or instructions from doctor, made a serious mistake, not safe to be alone), as well as significant differences between



**Fig. 9. Social Effects: Safety concerns from family members.** Higher scores indicate that the respondent's family is concerned that the person's hearing loss could impact their safety or the safety of others.

hearing instrument users and non-users. Respondents also agreed that safety concerns increase as hearing loss increases. The data, however, indicates that safety concerns are significantly higher among hearing instrument users than non-users in Quintiles 1-3. Perhaps the realization that mistakes were being made or that unaided hearing loss could result in possible injury was what motivated the current hearing instrument owner to purchase his/her aids. This explanation is consistent with the findings from Marke-Trak research<sup>5</sup>, which indicates that the number-one motivation to purchase hearing instruments is "the realization that their hearing loss was getting worse" and

the number-two reason is "family members."

There were a number of social effects which were correlated with hearing loss but were not impacted by hearing instrument usage. These were negative effects on the family (e.g., "I find it exhausting to cope with their needs"), family accommodations to the individual with hearing loss (e.g., "I have to use signs and gestures a lot of the time"), rejection of the person with hearing loss (e.g., "Tending to get left out of social activities because of their hearing loss") and withdrawal (e.g., "They tend to withdraw from social activities where communication is difficult"). In addition, hearing instrument usage was not associated with increased phone or in-person contact with family or friends.

## Emotional Effects

Eighty items in the HIA-NCOA study dealt with the emotional aspects of hearing loss. Overall results within this category for respondent and family members are documented in Table 5. The more important significant findings are graphically presented in Figs. 10-15.

All five hearing instrument user groups scored significantly lower in their self-rat-



ings of emotional instability. In agreement with their family members, they were less likely to exhibit tenseness, insecurity, instability, nervousness, irritability, discontentment, being temperamental and other negative emotions or traits (Fig. 10). Four of the five hearing instrument user groups reported significantly lower tendencies to exhibit anger (e.g., “I sometimes get angry

when I think about my hearing”) and frustration (e.g., “I get discouraged because of my hearing loss”). As shown in Fig. 11, family members observed significantly lower anger and frustration in all five hearing instrument user groups.

In Figure 12a, all five hearing instrument user groups reported significantly lower depressive symptoms (e.g., weariness, insomnia, thoughts of death). Four of the five hearing instrument user groups (Quintiles 1-4) thus reported significantly lower incidences of depression within the last 12 months compared to their non-user counterparts (Fig. 12b). The reduction in the incidence of depression varied from a high of 49% reduction in Quintile 2 to a low of 18% in Quintile 5; the average reduction

ness, insomnia, thoughts of death). Four of the five hearing instrument user groups (Quintiles 1-4) thus reported significantly lower incidences of depression within the last 12 months compared to their non-user counterparts (Fig. 12b). The reduction in the incidence of depression varied from a high of 49% reduction in Quintile 2 to a low of 18% in Quintile 5; the average reduction

Table 4. The social effects of hearing loss. Hearing aid users versus nonusers.

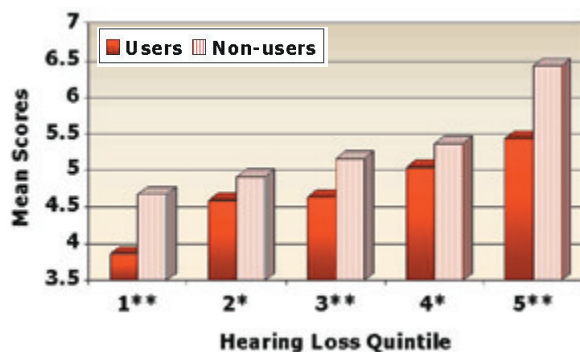
Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Communication difficulty (e.g. fatigue)										
Self	3.43	3.49	4.30	4.52	4.88	4.99	5.46	6.07***	6.25	6.83**
Family member	4.37	4.09			4.84	4.89	5.00	5.42*	6.14	6.31
Compensation for loss										
Self	3.29	3.85***	4.18	4.98***	4.88	5.61***	5.25	5.93***	5.55	6.49***
Family member	4.42	4.09	4.53	4.83	4.83	4.93	5.19	5.36	5.74	6.47***
Discrimination										
Self	3.63	3.82	4.18	4.72***	4.89	5.23**	5.27	5.87***	5.93	6.71***
Family member	4.25	4.26	4.56	4.91~			5.00	5.37*	5.62	5.91
Negative effects on family (family)	4.47*	4.02	4.33	4.63~	4.90	4.79	5.17	5.60*	5.89	6.28
Family accommodation (family)	4.47*	4.03	4.29	4.56~	4.93	4.94	5.18	5.37	6.07	6.39
Rejection										
Self	4.07	3.87	4.26	4.47	4.92	4.87	5.52	5.56	6.19	6.11
Family member	4.10	4.14	4.36	4.41	4.96*	4.62	5.23	5.32	6.28	6.44
Safety concerns										
Self	4.01***	3.53	4.36*	4.09	4.92	4.78	5.56	5.33	6.69	7.00
Family member	4.39***	3.81	4.55***	4.11	5.02***	4.49	5.41	5.35	6.46	6.54
Stigma										
Self	4.06	4.75***	4.36	5.52***	4.68	5.56***	4.83	5.87***	4.69	6.11***
Family member	4.74	4.60	4.39	4.83**	4.99	4.94	5.03	5.35~	5.48	5.84
Sociability										
Phone with family	5.23	5.39	5.00	4.77	4.98	5.11	4.85	4.97	4.83	4.87
Phone with friends	5.20	5.35	5.13	4.84	5.13	4.90	4.92	4.98	4.80	4.63
Phone with family/friends	5.23	5.44	5.08~	4.77	5.09	5.00	4.86	4.97	4.79	4.68
Meet with family	4.86	5.08	4.94	4.77	5.01	5.12	4.95	5.12	5.03	5.14
Meet with friends	5.33	5.14	5.02	4.96	5.14	4.87	4.89	5.05	4.89	4.98
Meet with family/friends	5.17	5.13	4.95	4.82	5.11	4.99	4.89	5.12	4.94	5.08
Withdrawal										
Self	3.57	3.57	4.28	4.24	4.93~	4.69	5.54	5.58*	6.65	6.38
Family member	4.28	4.23	4.29	4.53	4.78	4.68	5.11	5.49*	6.22	6.49

Notes:  
 \*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) ~ 85% confidence (suggestive of trends only)  
 (family) denotes family rating.

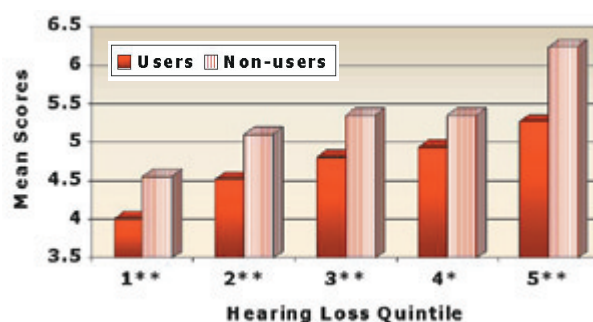
Table 5. The Emotional effects of hearing loss. Hearing aid users versus nonusers.

Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Anger & frustration										
Self	3.50	3.69	4.22	4.49*	4.70	5.11***	5.47	5.85**	6.16	7.15***
Family member	4.00	4.55**	4.51	5.09***	4.80	5.36***	4.93	5.36*	5.27	6.23***
Anxiety										
Self within last 12 months (%)	14.40	18.60	16.00	21.90	16.00	21.90*	21.00	25.00	24.10	33.30*
Family member (%)	4.76	16.21***	11.20	16.91~	11.90	16.85	16.88	22.95	23.21	29.58
Number of symptoms	4.59	4.87~	4.75	4.66	4.67	5.14***	5.06	5.29	5.29	5.93***
Denial										
Self	4.82	6.03**	4.98	5.85***	4.69	5.55	4.27	5.40***	3.63	4.98***
Family member	4.67	5.20*	4.61	5.29***	4.82	5.36***	4.70	5.41***	4.64	5.67***
Depression										
Within last 12 months (%)	10.10	19.80***	15.90	26.70***	15.97	26.67***	20.80	31.67***	27.70	33.70
Family member	12.70	21.74*	16.80	16.91	20.20	21.74	19.83	28.69*	27.50	32.39
Depression symptoms	4.48	4.87**	4.45	4.81**	4.64	5.24***	4.95	5.29~	5.37	5.99**
Emotional instability										
Self	3.86	4.67***	4.59	4.90~	4.63	5.15***	5.03	5.36~	5.43	6.43***
Family member	4.19	4.71*	4.68	4.94	4.66	5.07**	4.91	5.49**	5.35	6.27***
Independence										
Self	4.12	3.95	4.54	4.41	4.88	5.08	5.37	5.31	6.06	4.48*
Family member	4.51	4.19	4.27	4.40	4.88	4.92	5.05	5.45*	6.11	6.50
Paranoia	4.17	4.50	4.47	5.11***	4.68	5.14***	5.09	5.73***	5.33	5.98**
Personal confidence (low)										
Self	4.33	3.92*	4.58	4.63	4.94	4.91	5.27	5.24	6.13	6.2
Family member	4.06	4.22	4.69	4.66	4.88	4.94	5.06	5.27	5.80	6.38**
Social Phobia symptoms										
Self critical	4.33	4.68*	4.49	4.78*	4.80	5.00	5.02	5.29	5.50	6.36***
Self esteem (low)	4.02	4.47*	4.69	4.80	4.54	5.27***	5.21	5.41	5.54	6.00*
	4.12	4.66***	4.71	4.82	4.87	5.32**	5.20	5.25	5.25	5.59
Traumas experienced in:										
Last month	4.76	4.97	5.00	4.89	4.90	5.10	5.04	5.07	5.05	5.12
Last 6 months	4.57	5.00**	4.84	4.96	4.82	5.05	5.04	5.05	5.13	5.36
Past 12 months	4.40	4.85**	4.66	4.93	4.87	5.18	5.16	5.18	5.10	5.47~
Overall life satisfaction	5.68**	5.16	5.18	4.97	4.94	4.79	4.82	4.85	4.96	5.26

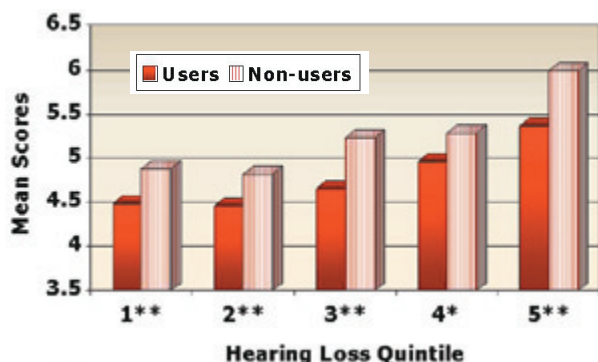
Notes:  
 \*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) ~ 85% confidence (suggestive of trends only)



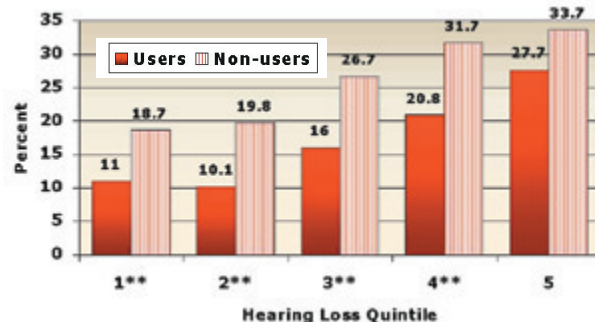
**Fig. 10. Emotional Effects: Emotional instability.** Higher scores indicate the respondent described themselves as more fearful, tense, insecure, unstable, nervous, etc.



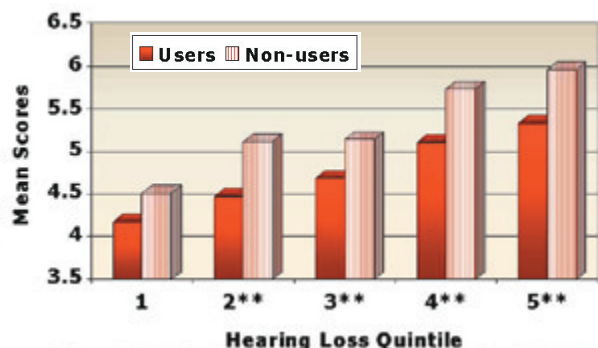
**Fig. 11. Emotional Effects: Anger/Frustration (Family/friend's assessment).** Higher scores indicate family members observed greater degrees of anger and frustration in the respondent.



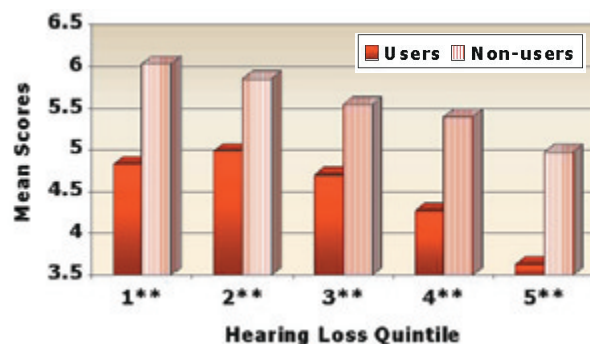
**Fig. 12a. Emotional Effects: Depression symptoms.** Higher scores indicate that respondents exhibited more symptoms of depression over the previous 12 months.



**Fig. 12b. Emotional Effects: Percent of respondents depressed in last 12 months.** High scores denote higher incidence of self-reported depression.



**Fig. 13. Emotional Effects: Paranoia.** Higher scores indicate the respondent has more feelings of paranoia.



**Fig. 14. Emotional Effects: Denial.** Higher scores indicate respondents were more likely to deny their hearing loss or the impact of their hearing loss on their life or the lives of others.

in depression associated with hearing instrument usage across all five groups is 36%.

Hearing instrument users in Quintiles 2-4 reported significantly lower paranoid feelings (Fig. 13, e.g., "I am often blamed for things that are just not my fault"). Not surprisingly, and in agreement with family members' responses, all five non-user groups (Fig. 14) scored higher on denial (e.g., "I don't think my hearing loss is as bad as people have told me"). As expected, denial is also inversely related to hearing loss.

Family members and respondents were asked to indicate if the person with the hearing loss exhibited anxiety, tenseness or if they worried for a continuous period of four weeks in the previous year.

In addition, the respondents were asked to indicate if they experienced anxiety symptoms (e.g., keyed up or on edge, heart pounding or racing, easily tired, trouble falling asleep). In general, there were no significant differences in the incidence of anxiety as rated by both the respondent and their family members. However, three of the five non-user groups (1,3,5) exhibited higher anxiety symptoms (Fig. 15). In addition, three of the five non-user groups (1,2,5) exhibited more social phobias than non-users of hearing instruments (Fig. 16). Clearly, the reduction in phobia and anxiety associated with hearing instrument usage is more pronounced in individuals with serious-to-profound hearing losses (Quintile 5).

Factors not appreciably impacted by hearing instrument usage in this study were: sense of independence (e.g., burden on family, answer for the person with hearing loss) and overall satisfaction with life. Although not as conclusive as some of the previous factors, non-users reported that they were more self-critical (e.g., "I dwell on my mistakes more than I should") and had lower self-esteem (e.g., "All in all, I am inclined to feel that I am a failure"). Hearing loss is highly correlated with self-criticism (Fig. 17). There is also some evidence, though not as strong, that non-users are more critical of themselves (Quintiles 1,3,5). Finally, as shown in Table 5, there were no significant differences between users and non-users in traumas experi-



enced in the past year.

## Personality Assessment

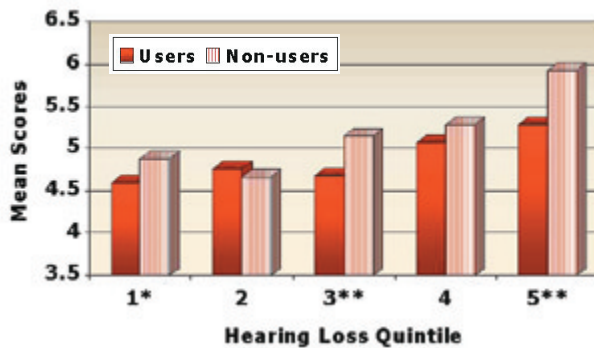
Seventy-nine items were devoted to miscellaneous personality scales in addition to the personality measures under emotional effects and social effects. All of the personality scales used in this study are published scales.

In viewing the list of personality traits measured in this study, the reader will recognize that there are literally thousands of personality scales which could have been used. The scales used here were chosen

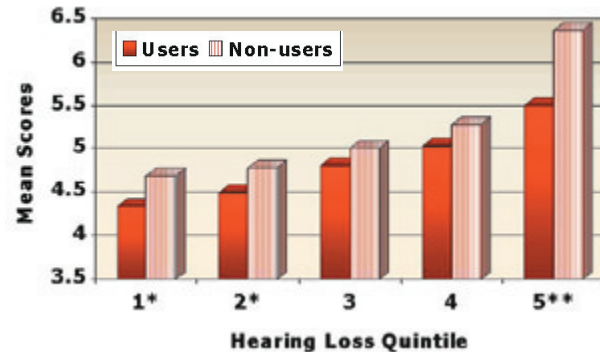
by the primary research company, Seniors Research Group, based on their research of the literature and their knowledge of personality correlates associated with the elderly and hearing loss. Many of the scales employed have a considerable research background, such as Levinson's Locus of Control.<sup>26</sup> While it would have been desirable to administer a comprehensive psychological battery to this population (e.g., California Psychological Inventory, Minnesota Multiphasic Personality Inventory, etc.), it was beyond the scope and budget of this study to do so. The per-

sonality measures are documented in Table 6 with the key findings in Figs. 18-20.

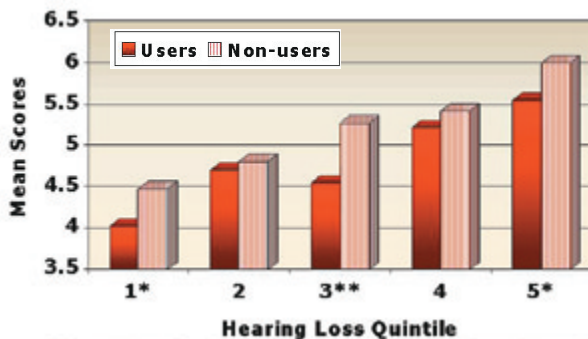
Family members indicated that the respondent's cognitive state is affected by their hearing loss, particularly if the hearing loss is "severe" to "profound." In Fig. 18, Quintiles 4 and 5 indicate that hearing instrument usage is associated with improvements in family perceptions of the person's mental and intellectual state. Non-users were more likely to be viewed as being confused, disoriented, non-caring and arrogant, inattentive and/or virtually "living in a world of their own."



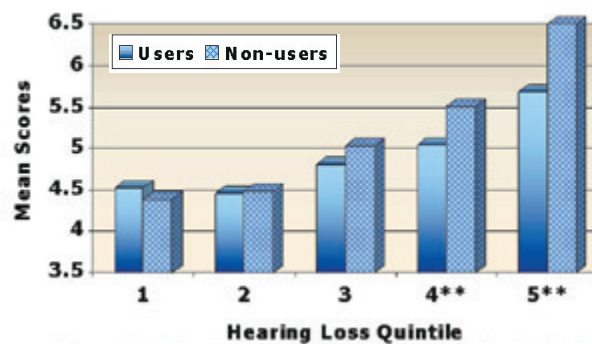
**Fig. 15. Emotional Effects: Anxiety symptoms.** Higher scores indicate respondents were more likely to exhibit more anxiety symptoms.



**Fig. 16. Emotional Effects: Social phobias.** Higher scores denote that respondents were more likely to exhibit social phobias.



**Fig. 17. Emotional Effects: Self-critical behavior.** Higher scores indicate respondents were more likely to report they "dwell on their mistakes" or "have an inferiority complex."



**Fig. 18. Personality Measures: Family member perception of respondent's cognitive state.** Higher scores indicate the respondent is viewed as confused, disoriented and unable to concentrate.

**Table 6. Personality measures. Hearing aid users versus nonusers.**

Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Active coping	4.69	5.05	4.63	4.93 ~	4.69	5.06	4.93	5.36 **	5.14	5.58 *
Autonomy	5.10	5.17	4.93	4.84	5.09	4.96	4.80	5.21	4.91	5.41 ***
Cognitive/personality (family)	4.51	4.38	4.45	4.48	4.80	5.02	5.03	5.51 **	5.69	6.58 ***
Emotional dependency	4.44	4.53	4.60	4.67	4.81	5.21 **	5.15	5.33	5.51	5.84
Extroverted										
Self	5.39	5.23	4.97	5.03	4.93	5.09	5.04	4.92	4.68	4.89
Family member	5.63 *	5.08	5.04	5.04	4.93	5.08	5.07	5.06	4.80 *	4.35
Fatalism	5.06	4.79	4.62	4.74	4.78	4.85	4.97	5.30 *	5.47	5.87 ~
Interpersonal conformity	5.16	5.26	5.26 ~	4.94	4.80	4.97	4.82	4.89	4.88	5.34 *
Intellectual openness										
Self	5.09	5.26	4.56	5.07	4.83	5.08	5.05	4.93	4.97	4.73
Family member	5.07	5.19	4.94	5.21	4.91	5.09	5.07	4.97	4.85 **	4.21
Introverted										
Self	4.57	4.94 ~	4.86	4.92	4.84	5.13 ~	4.93	4.97	5.23	5.44
Family member	4.14	4.84 ***	4.81	4.93	4.78	5.03	4.98	5.56 ***	5.18	5.75 **
Justice	4.60	4.90	4.82	4.90	4.96	4.98	5.02	5.35 *	5.13	5.38
Locus of control external	4.61	4.75	4.95	4.79	4.78	5.18 ***	4.89	5.30 **	5.27	5.85 **
Locus of control internal	5.30	5.24	4.76	4.92	4.73	4.99	4.84	5.06	5.06	5.28
Powerful others	4.27	4.64 ~	4.85	4.93	5.11	5.25	5.13	5.32	5.07	5.35
Social self-control	4.12	4.51 ~	4.94	4.96	4.74	5.03 *	5.15	5.49 *	5.38	5.69

Notes:

\*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) ~ 85% confidence (suggestive of trends only)  
(family) denotes family ratings.



As previously stated, there were no significant differences in measures of “withdrawal” between aided and unaided subjects; this finding is contrary to the literature. However, family members *did* report that non-users in three of five quintiles (1,4,5) were more introverted as evidenced by greater likelihood of being private, passive, shy, quiet, easily embarrassed, etc. (Fig. 19).

Moderate-to-severe hearing loss non-users (Quintiles 3-5) are shown in Fig. 20 to score higher on *external locus of control*, meaning that they were more likely to believe that events external to them control their lives; they feel less in control of their lives and at the whims of external forces. They are also more likely to possess an “active coping” personality style, meaning that they tend to do things themselves, are hard workers and are persistent goal-oriented individuals.

## Health Impact

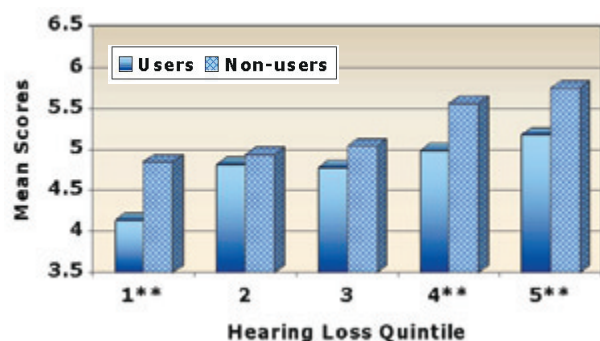
The HIA-NCOA survey asked six generic questions on self-perceptions of health, prevalence of pain and the extent to which the respondent believed that hearing loss impacted their general health. In addition, from a list of 28 health problems, respondents indicated whether they experienced a specific health problem and the extent to which that problem interfered with their activities. The overall indices and three specific health problems (arthritis, heart problems, high blood pressure) are documented in Table 7.

In Fig. 21, overall assessment of health (including absence of pain) would appear to decline as a function of hearing loss, with further deterioration of health associated with non-usage of hearing instruments for the three most severe hearing loss groups (Quintiles 3-5). The percent of respondents rating

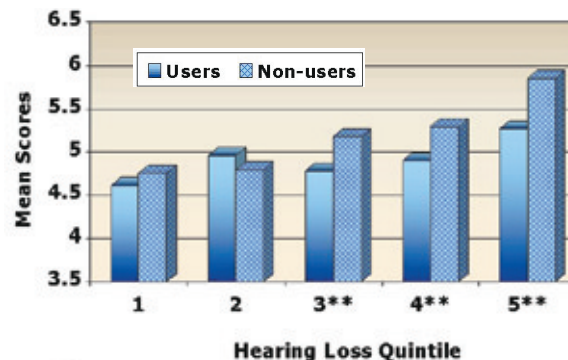
their overall health as “very good” or “excellent” is shown in Fig. 22. Three of the five hearing instrument user groups (Quintiles 1,3,5) reported significantly better health compared to their non-user counterparts. The lowest self-rating of overall health was the non-user group in Quintile 5. There is no consistent evidence that hearing instrument usage is associated with reductions in arthritis, high blood pressure or heart problems (Table 7).

## Perceived Changes in Life Due to Hearing Aid Use

Both respondents and their family members were asked to rate changes they believed were due to the respondent using hearing aids. Sixteen areas of their life were queried (note: family members did not rate “sex life”). Both respondent and family member ratings



**Fig. 19. Personality Measures:** Family member assessment of introversion in respondent. High scores indicate respondent is viewed as private, passive, shy, quite, easily embarrassed, etc.



**Fig. 20. Personality Measures:** External Locus of Control. Higher scores indicate respondents “believe they have little control over the events in their lives.”

**Table 7. Health effects of hearing loss. Hearing aid users versus non-users.**

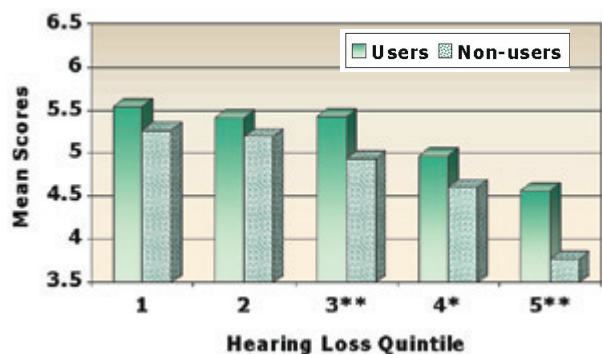
Factors	Degree of Hearing loss in Quintiles									
	Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Overall health/pain assessment	5.55	5.27	5.42	5.19	5.43 ***	4.93	4.96 *	4.60	4.56 ***	3.77
Impact of hearing on health	5.89	5.88	5.58	5.68	5.17	5.18	4.70	4.47	3.79 -	3.31
Very good to excellent self-rating(%)	56.30 **	43.70	46.00	44.80	49.50 ***	36.70	43.40	36.30	34.30 ***	19.10
Family member (%)	38.70	38.70	42.90	37.90	48.90 ***	30.30	36.70	30.20	32.40 ***	19.70
Specific problems										
Arthritis (%)	58.10	56.70	49.00	59.90 **	51.40	58.90	58.40	69.30	65.10	59.30
High blood pressure (%)	45.90	44.40	43.50	38.50	31.30	40.70 **	41.60	46.70	40.70	48.80
Heart problems (%)	18.90	21.40	23.10	23.90	23.10	24.80	23.10	30.70 *	26.30	32.60

Notes:

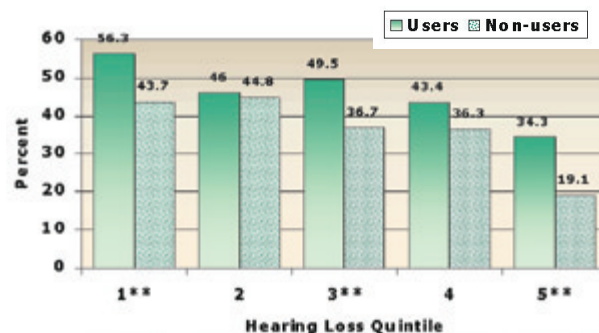
\*\*\* 99% confidence \*\* 95% confidence \* 90% confidence (suggestive of trends only) - 85% confidence (suggestive of trends only)

**Table 8. The perceived benefit of hearing aids on quality of life. Respondent and family ratings of “somewhat” to “lot better” improvements due to hearing aids.**

Factors	Total		Degree of Hearing loss in Quintiles									
			Quintile 1 (20%)		Quintile 2 (40%)		Quintile 3 (60%)		Quintile 4 (80%)		Quintile 5 (100%)	
	Respondent	Family	Respondent	Family	Respondent	Family	Respondent	Family	Respondent	Family	Respondent	Family
Impact of hearing aids (%)												
"Somewhat" to "lot better"												
Relationships at home	56	66	43	60	44	58	44	54	60	71	69	74
Feelings about myself	50	60	40	57	40	52	40	57	50	58	64	67
Life overall	49	62	32	58	34	51	41	54	49	63	63	71
Relations child/grandchild	40	52	27	53	28	40	32	47	39	55	54	56
Mental health	36	39	27	44	30	34	25	31	35	35	50	48
Confidence	39	46	27	35	29	35	30	36	40	46	52	58
Sense of safety	35	37	23	30	26	33	25	24	32	37	48	48
Social life	34	42	22	31	29	26	24	34	33	44	47	52
Participate group activities	34	44	24	40	23	29	26	40	38	44	43	53
Sense of independence	34	39	23	31	29	29	25	30	29	39	48	50
Play card/board games	31	47	22	40	27	39	23	46	27	43	44	55
Relationships at work	26	43	12	44	22	33	24	32	29	48	30	50
Dependence on others	23	32	14	35	19	21	15	21	17	33	35	39
Physical health	21	24	17	28	23	18	11	17	18	23	30	31
Ability to play sports	7	10	9	14	7	9	6	9	4	8	9	11
Sex life	7		3	na	4	na	4	na	7	na	13	na



**Fig. 21. Health Status:** Overall self-assessment of health and absence of pain. Higher scores indicate better health/less pain.



**Fig. 22. Health Status:** Percent of respondents reporting that their health is "very good" or "excellent."

for the five quintile groups are presented in Table 8 (i.e., percent of those responding "somewhat" to "a lot better" improvement). In general, for nearly all quality-of-life areas assessed, the observed improvements were positively related to degree of hearing loss. Family members in nearly every comparison reported greater improvements in the respondent than the respondent reported for him/herself.

The results for the mildest loss (Quintile 1) and most severe hearing loss (Quintile 5) groups are shown in Fig. 23. The top-three areas of observed improvement for both respondents and family members were "relationships at home," "feelings about self" and "life overall." The most impressive improvements were observed in Quintile 5: 11 of 16 lifestyle areas were rated as improved by at least 50% of the respondents or family members.

### Multivariate Analysis

In the previous tables, univariate results have been presented for the five cohort groups comparing users and non-users on physical, social, emotional, psychological outcome measures as well as for selected personality variables. Before proceeding to the conclusions section, it would be useful to consider differences between the users and non-users controlling for potential confounding variables. By the term "confounding", we mean that, for instance, reduced depression scores in favor of hearing instrument owners could be due to differences in affluence and physical health rather than hearing instrument usage; although we acknowledge that hearing instrument usage could also have had an impact on affluence and physical health. What is important to discover is if hearing instrument usage *independently* impacts these quality-of-life factors when the effects of potential confounding variables are removed. The reader will recall in Table 1 that there were significant differences within cohorts on income, education, and age, as well as

physical health in Table 7.

Using *analysis of variance* (ANOVA), the impact of hearing instrument usage was evaluated on the total sample controlling for age, hearing loss (via the FMHT), household income, physical health and education. (The ANOVA analysis was not performed within cohorts since the sample sizes were not adequate within each cohort to perform a multivariate analysis of variance.) Based on the results in Tables 1-7 and Figs. 1-21, *it is our hypothesis that hearing instruments significantly impacted the following quality-of-life parameters:*

Table 2: *Participation in social activities* (Fig. 2);

Table 3: *Interpersonal warmth and negativity in relationships* (Figs. 3-4);

Table 4: *Communication difficulty, compensation for hearing loss, discrimination against hearing-impaired* (Figs. 6-8);

Table 5: *Anger & frustration, anxiety, depression, emotional instability, paranoia, social phobias, self-criticism and self esteem* (Figs. 10-13, 15-17);

Table 6: *Cognitive abilities, introversion, external locus of control* (Figs. 18-20);

Table 7: *Overall physical health* (Figs. 21-22).

There were other significant findings which were more descriptive of hearing instrument owners versus non-owners: *lower stigma* (Fig. 5), *denial* (Fig. 14) and *higher safety concerns* (Fig. 9). These latter three are more likely determinants of trial and usage of hearing instruments.

After controlling for age, hearing loss (FMHT), household income, physical health and education, the following factors previously identified in the univariate analysis as significantly related to hearing instrument usage were deemed to be non-significant correlates of hearing aid usage: *presence of anxiety symptoms and introversion* (Figs. 15 & 19).

### Conclusions & Discussion

Despite the large body of evidence on the impact of hearing loss on quality

of life, there is still a paucity of research on the impact of hearing instruments on quality-of-life issues.

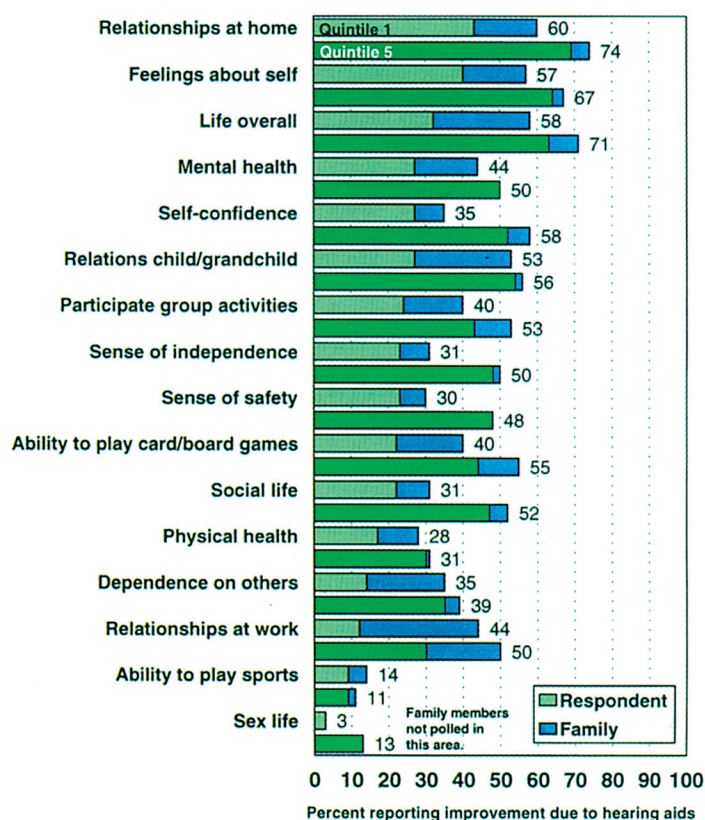
The literature presents a compelling story for the social, psychological, cognitive and health effects of hearing loss (*for a review of the literature [1979-1998], see "Impact of Hearing on Physical and Psychosocial Health" in the Nov. '98 HR, pgs. 26-30*). Impaired hearing results in distorted or incomplete communication, leading to greater isolation and withdrawal and therefore lower sensory input. In turn, the individual's life space and social life become restricted.

One would logically conclude that this restricted lifestyle would negatively impact the hearing-impaired individual's psychosocial well-being. Indeed, the literature indicates that hearing loss is associated with: embarrassment, fatigue, irritability, tension and stress, avoidance of social activities, withdrawal from social situations, depression, negativism, danger to personal safety, rejection by others, reduced general health, loneliness, social isolation, less alertness to the environment, impaired memory, less adaptability to learning new tasks, paranoia, lessened ability to cope and reduced overall psychological health. In view of this, few would disagree that hearing loss *per se* is a serious issue.

Likewise, few would disagree that modern hearing instruments improve speech intelligibility. It would seem that, if one could improve speech intelligibility by correcting for impaired hearing, one should also observe improvements in the social, emotional, psychological and physical functioning of the person with the hearing loss.

► *Previous Literature:* To our knowledge, there have only been a few studies to date comparing hearing instrument owners and non-owners. The majority of studies have used small sample sizes and are usually non-generalizable since they tend to confine themselves to U.S. male veterans. Harless and McConnell<sup>16</sup> (1982) demonstrated that 68 hearing instrument users had





**Fig. 23. Positive Changes and Reported Benefits:** Percent of hearing instrument owners and their family members reporting improvement in their quality of life in 16 areas due to hearing instruments. The first bar is the mildest hearing loss group (Quintile 1, light color), while the second bar within each quality-of-life area is the most severe hearing loss group (Quintile 5, darker bar). In nearly all cases, the family members report greater improvements due to hearing instruments than the hearing instrument wearers.

significantly higher self-concepts compared to a matched group of individuals who did not wear hearing instruments. Dye and Peak<sup>15</sup> (1983) studied 58 male veterans pre- and post-hearing instrument fitting and found significant improvement on memory tests but not on paranoia or depression.

In the most rigorously controlled research to date, Mulrow, Aguilar and Endicott<sup>18</sup> (1990) studied 122 male veterans and 72 patients from primary care clinics. Half were randomly chosen and fit with hearing instruments while the other half were not. After four months, the researchers found significant improvements in the hearing instrument wearers (compared to the control group) on emotional and social effects of hearing handicap (as measured by the Hearing Handicap Inventory for the Elderly), perceived communication difficulties (Quantified Denver Scale of Communication Function), cognitive function (Short Portable Mental Status Questionnaire) and depression (Geriatric Depression Scale or GDS), but not Self-Evaluation of Life Functioning. Additionally, the same researchers in a follow-up study published in 1992 demonstrated that the quality of life

changes were sustainable over at least a year.<sup>19</sup>

In a study of 251 subjects comprised of normal-hearing elderly individuals with hearing instruments and individuals with unaided hearing loss, Bridges and Bentler<sup>12</sup> (1998) determined that hearing instrument wearers had lower depression (GDS scores) and higher quality-of-life (Satisfaction with Life Scale) scores compared to their unaided counterparts. Additionally, in a pre-post study of 20 subjects, Crandell<sup>14</sup> (1998) demonstrated after three months of hearing instrument use that functional health status (Sickness Impact Profile) improved significantly for hearing instrument wearers.

► **Present Study's Findings:** The results of the study presented in this issue of *The Hearing Review*, in the authors' opinions, are unequivocal and are corroborated by the smaller correlational and experimental studies. Hearing instruments are clearly associated with impressive improvements in the social, emotional, psychological and physical well-being of people with hearing loss in all hearing loss categories from mild to severe. As such, these findings provide strong evidence for the

"value" of hearing instruments in improving the quality of life of people with hearing loss. Specifically, hearing instrument usage is positively related to the following quality-of-life issues:

- Greater earning power (especially the more severe hearing losses);
- Improved interpersonal relationships (especially for mild-to-moderate losses), including greater intimacy and lessening of negative dysfunctional communication;
- Reduction in discrimination toward the person with the hearing loss;
- Reduction in difficulty associated with communication (primarily severe to profound hearing losses);
- Reduction in hearing loss compensation behaviors;
- Reduction in anger and frustration;
- Reduction in the incidence of depression and depressive symptoms;
- Enhanced emotional stability;
- Reduction in paranoid feelings;
- Reduced anxiety symptoms (however, this could be related to lower income and reduced physical health status, which are also correlates of hearing aid usage);
- Reduced social phobias (primarily severely impaired subjects);
- Improved belief that the subject is in control of their lives (locus of control);
- Reduced self-criticism;
- Improved cognitive functioning (primarily severe-to-profound hearing loss);
- Improved health status and less incidence of pain, and
- Enhanced group social activity.

Secondly, in this study, both respondents and their family members were asked to independently rate the extent to which they believe their lives were improved *specifically due to hearing instruments*. Both mild and serious hearing loss groups reported significant improvements in nearly every area measured:

- Relationships at home and with the family;
- Feelings about self;
- Life overall;
- Mental health;
- Social life;
- Emotional health, and
- Physical health.

Given that this is an observational study—that is, we compared hearing loss subjects both aided and unaided—we cannot, of course, say that hearing instrument usage "caused" all these positive quality-of-life improvements. In fact, as one esteemed observer stated at the EHIMA presentation, "Perhaps only emotionally stable subjects purchase hearing aids, and thus, maybe the best strategy is to get all unaided

hearing-impaired people into therapy." We think our answer to this is, "We would first have to fit them with hearing aids to improve their speech intelligibility so they could hear the therapist!" None of the literature suggests that those who are inclined to become hearing instrument users are significantly more emotionally, socially or mentally mature than their unaided counterparts. Certainly, the Mulrow et al.<sup>18</sup> and Crandell<sup>14</sup> studies have demonstrated causation due to hearing instrument usage. Short of stating *definite causality*, the evidence is quite compelling and perhaps suggestive of causality for the following reasons:

- The sample, the largest of its kind, is nationally representative of hearing loss subjects ages 50 and above. Thus, we need not be concerned with spurious findings due to sampling methodology;
- Many of the findings held up across all hearing loss quintiles, from mild to profound;
- The specific findings were corroborated *within* the study. That is, significant differences between users and non-users were noted. Secondly, at the end of the survey, respondents and their family members were asked to specifically indicate if their life was improved as a result of wearing hearing instruments in 16 quality-of-life areas. Both *respondents and their family members* indicated significant benefit due to hearing instruments in most areas measured;
- The differential efficacy between the 16 quality-of-life parameters noted by respondents and their family members (low of 4% to high of 74% improvements) indicates that a positive halo or acquiescence did not exist in this sample of respondents;
- The survey findings are consistent with other correlational and (especially) randomized control studies, and pre-post hearing aid fitting studies among smaller, more narrowly defined samples;
- The findings are consistent with the literature on factors impacting hearing loss (i.e., the theoretical improvements which should occur if hearing loss is alleviated);
- The findings are consistent with the observations of clinicians and dispensers of hearing aids.

## A Call to Action

► *Allying with Medical Professionals:* In his speech to the media last summer, James Firman, PhD, said, "This study debunks the myth that untreated hearing loss in older persons is a harmless condition." In focus groups with physi-

cians, the prevalent view is that hearing loss is "only" a quality-of-life issue. The authors would agree with this statement if the definition of "quality of life" was "greater enjoyment of music" or some similar measure. However, the literature and this study clearly demonstrate that hearing loss is associated with physical, emotional, mental and social well-being. Depression, anxiety, emotional instability, phobias, withdrawal, isolation, lessened health status, lower self esteem, etc, are not "just quality of life issues." For many people, uncorrected hearing loss is a serious health issue, *if not a "life or death" issue.*

This study challenges every segment of the hearing care field to intensify interaction and communication with the medical community. We need to do everything possible to help physicians recognize hearing loss as an important *health issue*. Articles need to be published in medical journals that report the results of this study, and more editorial content needs to be created about hearing loss and health for other physician-directed informational sources. Previous efforts, which were proven to be successful, need to be resurrected to help physicians—from those still in school to those in practice—to incorporate basic hearing screening into routine, general physical exams for all adults. All hearing-related organizations must communicate not only with family physicians but also with gerontologists, with specialists in other age-related medical conditions and with other medical and allied health specialties including psychology, social work and optometry. *Hearing care professionals and the hearing care industry must be the ones who ensure that hearing loss is recognized not only for its own treatment, but also as a potential contributing factor to the successful resolution of other medical and psychological conditions.*

Previous HIA consumer research has documented the inclination of people who have a hearing loss to view their problem as a *medical issue*. Consumers believe that their *physicians* should be the source of guidance for hearing problems, like other health issues, so the hearing industry must ensure that physicians are fully prepared to shoulder this responsibility. Physicians should be made aware of the scope and incidence of the problem and the positive health benefits of treatment with hearing instruments.

► *Preparing a New Message for a New Customer in a New Millennium:* This study also demonstrates, possibly for the first time, that individuals with even a mild hearing loss can experience dramatic improvements in their quality of life. This finding is significant because one important challenge for the hearing health care field is to demonstrate to Baby-Boomers with emerging hearing losses that the

hearing care community offers something of value *early on* in their lives and that they do not need to wait until retirement to receive help for a hearing problem. Hearing is not only an issue for the elderly; it is a cradle-to-grave health and quality-of-life issue confronting *all age groups*.

The hearing industry has concentrated historically on demonstrating to consumers that amplification can improve speech intelligibility, or certain products can help hide hearing loss with "invisible" aids, or a certain advanced technology offers improved functionality. These benefits are not enough for most consumers; most consumers simply do not understand the connection between the hearing features that are marketed and the impact on their daily life. As Bridges and Bentler<sup>12</sup> recently stated, "It is up to the hearing care community to demonstrate that hearing aids are necessary, not only for improved communication, but also for enhanced sense of well-being." Our thinking needs to change from "we sell hearing aids," or "we will help you hide your hearing loss with CICs" or "we improve speech intelligibility" to "we have something that will change your life," "we have something that will improve your relationships," or "we have something that has the potential to improve intimacy (Viagra for the ears!), reduce stress, improve your self-concept, make you feel better about yourself and the world, give you confidence, improve your social life, improve your mental function and environmental vigilance..." As demonstrated, this list of potential benefits could go on and on. The point is that the *potential messages on the value of hearing care services and amplification are almost infinite once the focus is on the practical benefits offered to people and their families.*

The Boomers, for themselves and for their families, are impatient with anything that is *less than it might be*, and that includes all aspects of physical well-being. They are reportedly the most willing, as a group, to spend discretionary funds on health improvements, as evidenced by large surges in the use of vitamins and herbal supplements, in the growth of elective cosmetic surgery procedures, and the replacement of contact lens use by refractive surgery. The hearing industry must begin to talk with Baby Boomers about hearing health and its impact on the psychological, emotional and social aspects of their lives. Hearing care professionals, as well as the hearing industry, must aggressively seek communication channels with this 78-million-people segment of society. New messages need to be created that complement physicians' input, and we need to carry these messages in contemporary ways. This includes messages featured in the myriad of health, wellness and prevention publications on the market today and



within the mass media discussions on health issues of all kinds—and perhaps most importantly on the Internet.

If changes can be made to the messages about hearing loss and its primary treatment, hearing instruments, a dialogue can begin with people who need these products and services but who, until now, may not have recognized their problem or comprehended that hearing instruments constitute the best solution for that problem.

In essence, it is time for hearing care to reposition itself for the next millennium. There are millions of potential customers (and their physicians) who are not yet aware of the value that amplification and hearing care services deliver. And they will not know unless the hearing care community shares the secret. In the decade to come, a concerted effort needs to be made by hearing care professionals and the hearing industry to work together to fundamentally change society's perception of the stakes involved in treating (and in not treating) hearing loss. ♦

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The literature and this study clearly demonstrate that hearing loss is associated with physical, emotional, mental and social well-being. Depression, anxiety, emotional instability, phobias, withdrawal, isolation, lessened health status and lessened self-esteem are not "just quality of life" issues. For many people, uncorrected hearing loss is a serious "life or death" issue.

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