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Characteristics associated with marginal hearing loss and subjective well-being among a sample of older adults

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Abstract--The influence of marginal hearing loss on subjective well-being was studied in order to assess the audiological rehabilitation needs of older individuals. Behavioral and audiological data were obtained from 40 subjects 61-81 years of age. Group A included 20 subjects with normal audiometric thresholds. Group B included 20 subjects with mild-to-moderate degrees of high-frequency hearing loss. Each subject completed a hearing loss screening survey, an Assistive Technology Device Predisposition Assessment (ATD PA) and a Profile of Hearing Aid Performance (PHAP). The PHAP and hearing loss screen were adequate assessments of self-reported hearing loss, as was the subjective rating of hearing section of the ATD PA. People with high-frequency marginal hearing loss reported less satisfaction with their independence, reduced emotional well-being, and more limitation from their hearing loss than those with normal hearing. It is concluded that marginal degrees of hearing loss in older persons can influence subjective well-being, which suggests the importance of a renewed emphasis on audiological rehabilitation for this population.

Key words: *assessment, communication aids--hearing, psychosocial rehabilitation, quality of life.*

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INTRODUCTION

At the present time, some 26 million adults and children in the U.S. have hearing loss (1), and by the year 2030, it is predicted that 21 million more adults will join them (2). While hearing loss is a significant factor to address in all age groups, that beginning at age 50-60 and older seems to be an important influence on a person's general health and subjective well-being. The importance of this influence needs to be studied, especially in light of the increasing proportion in our population of persons 60 years old or older and of the possibility that hearing loss creates an adverse psychological impact on the individual, and on his/her interpersonal and family relationships. Also of great concern is decreased end-of-career job productivity due to psychological and communication problems associated with hearing loss. Loss of mid- to end-of-career productivity becomes even more significant as the average retirement age increases.

Efforts to quantify the impact of a hearing loss have ranged from audiometric averages to questionnaires and self-assessment surveys. Of particular interest to the present study is the self-assessment technique inherent in the

Matching Person and Technology (MPT) Model and its relevance to persons with hearing loss (3-6).

The Matching Person and Technology Model

Developed to provide a more personal approach to matching persons with the most appropriate technologies for their use, the MPT assessment portfolio (3) consists of a series of instruments designed for the evaluation and selection of assistive and other technologies. At present, the following instruments are included:

- The Worksheet for MPT to obtain user and provider perspectives of a person's particular limitations, goals, and interventions.
- The Survey of Technology Use (SOTU) to help identify technologies and technology functions/features the person is likely to feel comfortable or successful in using in order to develop any new technology around existing comfort or success.
- The Assistive Technology Device Predisposition Assessment (ATD PA) to select the most appropriate assistive technology for a person's use and pinpointing areas for training and further assessment.
- The Educational Technology Predisposition Assessment (ET PA) to assist students in the process of using technology to reach certain educational goals.
- The Workplace Technology Predisposition Assessment (WT PA) to assist trainers and others who introduce technologies into work settings.
- The Health Care Technology Predisposition Assessment (HCT PA) to assist health care professionals in helping individuals adopt and adjust to medical devices.

These instruments are designed to ensure that user input drives the MPT process; to guide providers into considering all relevant influences on the use of a technology while focusing on the user's quality of life; to identify possible mismatches between a proposed technology and a potential user in time to reduce inappropriate use or nonuse of the technology and the accompanying disappointment and frustration; to help individuals choose the most appropriate technology when there is a choice of several; to decide on the most appropriate training strategies for a person's optimal use of a technology; and to decide whether a particular technology is the most appropriate choice given the characteristics of the person's needs and preferences, the technology under consideration, and the environments of use.

The MPT model has three crucial areas of focus that represent the primary components found to most influence successful use of assistive technologies: the characteristics of the prospective user, the technology itself, and the milieu or environment(s) of use. In turn, each of these can contribute either a positive or a negative influence on technology use. If there are too many negative influences, the chance of the technology being successfully used is greatly reduced. In fact, the technology itself can appear perfect for a given need, but without the appropriate personal/social characteristics or the necessary environmental support, that perfect technology may go unused, or it may be used inappropriately and cause frustration and expense for all those involved.

Each of the MPT Model assessment instruments emerged from actual experiences of technology users and nonusers and thus have content validity. Additional research studies provide evidence for their reliability and criterion-related validity (3).

Varying Perspectives of Hearing Loss

The emotional and psychological adjustment to onset of hearing loss in adulthood is highly variable, depending on the life experiences, customary ways of managing challenges, and degree of sociability of the individual. Those who are outgoing, prefer group activities, and have careers that emphasize interpersonal contacts, react differently from those who lead more private lives. While hearing aids are, for some, a lifeline, for others they are an inconvenience. The bottom line, according to one woman, is: [ext]You have to make the choice between being connected and not connected. All the devices and modifications are not going to help if there isn't an emotional readiness.

his woman paraphrased D.A. Ramsdell (7) who, 50 years ago, characterized hearing as occurring on three psychological levels: a) the social or symbolic level: the capability to receive and understand language; b) the signal or warning level: enabling individuals to respond to such cues as a baby's cry or a fire alarm; and c) the level of fundamental "connectedness:" giving people the sense of being in touch with the surrounding environment (even

though unaware of people moving around the house or the clock ticking). It is the last level, the fundamental sense of connectedness, that gives quality to life and defines the world as being "alive." Many adventitiously deafened individuals talk about how the world has seemed to have gone "dead," and that they feel isolated and out of contact with it. Here is one value of hearing aids that cannot be overstated: even though they may not restore the person's hearing, they have the potential for providing a sense of connection to the world.

Recent literature regarding audiological rehabilitation (2,8-11) confirms the need for professionals to become sensitive to, and knowledgeable about, the emotional aspects of hearing loss as experienced by older persons. One means for identifying personal and interpersonal concerns is the use of the ATD PA (12), one of the assessment instruments in the MPT model. Our preliminary study (4,13) assessed differences in adjustment to hearing loss and predispositions to hearing aid use in two groups of older persons. The first group had moderate/severe degrees of loss and routinely made use of hearing aids and a variety of assistive listening devices. They also used peer support to devise strategies for being connected with the world around them. The second group came from the membership of an organization devoted to the life-long learning of older adults: they were previously determined in an audiological screening examination to have mild degrees of hearing loss, but none were using hearing aids or assistive listening devices. Participants were matched according to age, gender, socioeconomic status, general health status, and level of social participation. To assess perceptions of their hearing loss, psychological adjustment to hearing loss, and benefit from hearing aid use, each individual completed the Communication Profile for the Hearing Impaired (CPHI) that contains 145 items (14), and the ATD PA of 63 items, 4 subscales. The results suggested that the most differentiating variables between the two groups were the psychosocial ones. It was determined that the results from the ATD PA and CPHI were sufficiently correlated to warrant the use of only the shorter ATD PA in subsequent research on the adjustment to hearing loss. To further explore the relationship between behavioral adaptation and hearing loss as a distinct relationship beyond the effects of aging, the present study was designed to focus on those elderly individuals who have marginal degrees of high-frequency hearing loss (audiometrically classified as mild or moderate) but who chose not to use hearing aids or assistive listening devices as compared to a cohort with normal audiometric thresholds.

Research Questions

The goal of this research was to learn more about the relationships among hearing loss, subjective well-being, and ratings of health status, and thus contribute to the eventual goal of devising appropriate ways to assess these relationships. In particular, this research sought to answer the following three questions:

1. Does late-onset marginal hearing loss in elderly subjects alter their perception of their psychological adjustment and subjective sense of well-being?
2. If differences emerge between groups of elderly persons with and without hearing loss, how might this information be used to target more appropriate audiological and psychological rehabilitation interventions?
3. Does the ATD PA satisfy the need for a brief paper-and-pencil inventory that reveals self-reported well-being and adjustment to hearing loss?

METHODS

Subjects

Forty elderly subjects, equally divided between those with and those without mild gradual high-frequency sensorineural hearing loss, participated in this study. Based on screening test results from audiometric and speech testing, subjects were assigned to either Group A for persons within the clinically normal range of hearing, or Group B for individuals outside the normal range. Group A ranged in age from 60 to 81 years with a mean of 67.8 (SD ±5.8). Group B ranged in age from 61 to 81 years with a mean of 71.2 (SD±5.8). A two-sample t-test assuming unequal variance ($p>0.05$) resulted in no difference, thus indicating that both groups were drawn from a common population that had been previously determined to be representative of the general population in this age range.

Audiometric Testing

The 20 subjects of Group A had average pure tone thresholds ranging from 5.3 dB to 16.3 dB at octave intervals

between 250 and 4,000 Hz. The 20 in Group B had audiometric thresholds ranging from 12.8 dB to 41.3 dB over the same range. Pure tone averages for the 1.0, 2.0, and 4.0 kHz range were 10.7 dB HL for Group A and 25.4 dB HL for Group B. A two-factor with replication ANOVA resulted in a difference between groups ($F(1,76) = 77.70$, $p<0.001$) and a difference between measures ($F(1,76) = 21.34$, $p<0.001$) and no interaction between group and threshold measure ($F(1,76) = 3.78$, $p>0.05$). These results indicate that Group A and Group B were representative of two different populations of elderly listeners: Group A individuals would not require hearing aids, while those of Group B could benefit from the use of electronic amplification devices, but their use would likely be optional and environment-dependent.

Speech Testing

To further reveal differences in hearing performance between the groups, we assessed their ability to understand speech in the quiet condition (i.e., no background noise). An adaptive paradigm (15) and three types of speech materials were utilized. Speech perception thresholds, defined as 50 percent correct response, were obtained for 1) spondee words in isolation, 2) target words in sentences that provided supportive context for the identification of the word (designated high probability or PH), and 3) target words in sentences that did not provide supportive context (designated low probability or PL) for the identification of the target word. Detailed descriptions of the test materials and procedures are available in a previous publication (16). A two-factor with replication ANOVA resulted in a difference between groups ($F(1,114)=31.08$, $p<0.001$) and a difference between speech materials ($F(2,114)=90.24$, $p<0.001$) and no significant interaction between group and speech materials ($F(2,114)=0.30$, $p>0.05$). These results indicate that the level of hearing loss in Group B is causing some degree of difficulty in perceiving speech even under favorable listening conditions.

Elderly listeners frequently complain that they have difficulty in understanding speech in noisy environments. Therefore, speech recognition in noise performance was assessed by superimposing a background noise consisting of 12-talker babble (16), a condition somewhat reminiscent of background noise in crowded social gatherings. Speech recognition in noise performance by Groups A and B was compared on both PH and PL sentences, presented at conversational level (70 dB SPL) while noise was varied adaptively in 2 dB steps. This experimental condition yields a signal-to-noise ratio that served as the dependent variable in this study. A two-factor with replication ANOVA indicated a difference between groups ($F(1,76)=21.35$, $p<0.001$), a difference between speech materials ($F(1,76)=130.30$, $p<0.0001$), and no significant interaction between group and speech materials ($F(1,76)=1.07$, $p>0.05$). The fact that there was no interaction, yet differences were found between the two groups, indicates that the differences were due to hearing differences and not to differences in the speech materials. Even though the degree of hearing loss in Group B is only marginal, these results manifest a real problem in elderly subjects attempting to converse in noisy background environments.

Additional Screening

All subjects were screened for eligibility for inclusion in the study according to absence of medical conditions involving the auditory system and absense of cognitive deficit. The subjects were in good health as revealed in their medical histories and were clear of genetic and exogenous factors known to have a deleterious effect on the auditory system. Specifically, their medical histories were free of the following: middle ear pathology, familial deafness, previous or current use of tranquilizers or ototoxic medications or tranquilizers, and medical conditions of high blood pressure, cardiovascular disorders, kidney or liver pathology, head injury with loss of consciousness, seizures, dementia or other neurological disorder, and finally, excessive occupational or recreational noise exposure.

All subjects were screened for cognitive deficits with the Mini-Mental State examination (17,18). In addition, a comparison of performance on sentences that did and did not provide contextual support was used as a measure of cognitive function. Difference scores between performance on PH and PL sentences were computed. Mean difference scores for Groups A and B were 4.2 dB and 5.0 dB, respectively. A two-sample assuming unequal variance t-test ($p>0.05$) resulted in no difference between groups, thus providing further evidence that the two groups did not differ in cognitive function.

Subjects were recruited through announcements external and internal to the host institution. English was the native language of all, and all were paid for their participation. All appeared intellectually active, which may have contributed to their high motivational level to participate in this research project.

Instrumentation

Instruments that profile individuals on several critical behavioral dimensions were administered to all participants following their auditory tests:

1. Hearing Survey (13 items, 1 total score). A brief self-report screening tool designed for the general population. Respondents indicate on a 5-point scale the portion of time they have difficulty with a) conversation (over the phone, two or more people talking, in a noisy background), b) hearing such sounds as TV, a ringing telephone, or doorbell, and c) speech reception (confusion where sounds originate, straining to understand conversation, needing people to repeat). The higher the total score, the fewer difficulties with hearing were self-reported. 2. The ATD PA described earlier (12). 3. The PHAP, a 66-item inventory with 7 subscales, 4 scales.

For each statement the respondent indicates on a 7-point scale the proportion of time the statement is true (19,20). It has been used previously to estimate consumer-assessed hearing aid performance before the purchase of hearing aids (21).

The PHAP explores hearing within the context of seven subscales. *Familiar Talkers* (FT): seven items describing communication under relatively easy listening conditions with persons whose voices are known. *Ease of Communication* (EC): seven items describing the effort involved in communication under relatively easy listening conditions. *Reverberation* (RV): nine items describing speech understanding in moderately reverberant rooms. *Reduced Cues* (RC): nine items describing communication without visual cues or when intensity is low. *Background Noise* (BN): sixteen items describing speech understanding in the presence of multitalker babble or other environmental competing noise. *Aversiveness of Sounds* (AV): twelve items describing negative reactions to environmental sounds. *Distortion of Sounds* (DS): six items describing the quality of voices and other sounds.

These are combined into four PHAP scales. Environment A (SA) is a combination of the FT and EC subscales resembling face-to-face communication in a quiet environment. Environment B (SB) is a combination of the RB and RC subscales resembling a situation of limited or absent visual cues in low-noise background with reverberation. Environment C (SC) is the same as the BN subscale, resembling the use of visual cues in a high-noise background. Environmental Sounds (ES) is a combination of the AV and DS subscales. The authors report that the PHAP has moderate reliability and validity.

RESULTS

T-tests were done with all items from the ATD PA, Hearing Survey, and the 7 subscales and 4 scales of the PHAP. **Table 1** lists the items that differentiated persons in Group A from those in Group B at alpha 0.05 or less.

Table 1.
Items that received significantly different mean responses between individuals in Group A and those in Group B.

		GROUP A		GROUP B			
SURVEY	**ITEM/SCALE**	**Mean**	**SD**	**Mean**	**SD**	***t* value**	**sig.**
ATD PA	2, hearing	4.20	0.77	3.35	1.23	2.63	0.01
	10, satis. with indep.	4.90	0.31	4.50	0.83	2.03	0.05
	19, hearing limits	4.75	0.55	3.85	1.23	3.00	0.01
	47, things to accomp.	3.80	0.41	3.45	0.51	2.39	0.02
	55, have funding	2.45	1.67	3.70	1.69	-2.35	0.02

	58, benefit from aid	1.55	0.89	2.60	1.43	-2.79	0.01
PHAP	SA	4.83	4.06	10.51	8.54	-2.68	0.01
	SB	17.16	8.00	26.45	13.25	-2.69	0.01
	SC	17.64	8.94	27.94	10.80	-3.28	0.01
	EC	5.21	3.51	12.08	8.87	-3.22	0.01
	RV	14.79	8.59	24.83	13.31	-2.83	0.01
Hearing	TV volume too high	4.90	0.31	4.05	1.50	3.47	0.01
Survey	miss phone, doorbell	4.95	0.22	4.65	0.49	2.49	0.01
	miss party conversation	3.95	0.76	3.05	1.15	2.93	0.01
	misunderstand people	4.90	0.31	4.55	0.51	2.63	0.01

Discriminant analyses further revealed that differences on these items correctly classified 85 percent of the subjects according to their membership in either group as shown in **Table 2.** The results of the discriminant analyses, and the observation that the items tended to cluster according to hearing loss experienced and psychosocial perspectives of the loss, suggest that the results were not due to chance.

Table 2.
Variables predictive of group membership by severity of hearing loss.

		Predicted Group (% Predicted Correctly)	
Actual Group	**N**	**1**	**2**
A: Mild Loss	20	90.0	10.0
B: Mild/Moderate Loss	20	20.0	80.0
Percent of individuals correctly classified = 85.00%.			

The PHAP and Hearing Survey are determined to be adequate paper-and-pencil assessments of self-reported hearing loss, as is the subjective rating of hearing of the ATD PA. More germane to this study, Group B individuals self-reported on the ATD PA less satisfaction with their independence, reduced emotional well-being, and more limitation from their hearing loss than did those in Group A. Group B also reported "having many things to accomplish" less frequently, but believe they would benefit from a hearing aid(s) and indicated they have the funding for the aid(s). Yet, in spite of their reported difficulties, the marginally hearing-impaired individuals were not wearing hearing aids at the time of their participation in this study.

Individuals in Group B indicated they would not feel self-conscious using hearing aids around family, friends, at school/work, or out in public. Thus, vanity does not appear to be a reason (in persons of the type participating in this study) for nonuse. They do believe they would benefit from using hearing aids, but they do not believe hearing aids will enhance their quality of life. It may be that the persons in this study either have a realistic view of what they would gain from hearing aid use and/or they are not placing a high value on better hearing as far as its contributing to their overall quality of life. These are physically healthy, active people who, nonetheless, are not satisfied with their independence. Their lower ratings on emotional well-being suggest that they may have priorities other than improved hearing.

DISCUSSION

Forty individuals, half with normal audiological thresholds (Group A) and half with mild/moderate, or marginal, degrees of high-frequency hearing loss (Group B) completed assessment instruments regarding their subjective hearing loss, emotional well-being, and their adjustment to hearing loss. The results from the ATD PA, Hearing Survey and PHAP together suggest that late-onset marginal hearing loss in elderly subjects does alter their perception of their psychological adjustment and subjective sense of well-being. These preliminary results, however, need to be tested on larger groups with varying degrees of hearing loss, subsequent use of hearing aids, and degree of psychosocial adjustment. Yet, implications for audiological/psychological rehabilitation are evident:

1. Even though their degree of hearing loss in may be only marginal, elderly subjects experience a real problem in attempting to converse in noisy background environments. Their acceptance of help in understanding and living with a hearing loss can be enhanced when their personal and interpersonal concerns are identified and addressed in the context of degree of hearing loss and recommended treatment/rehabilitation course. This comes under the purview of audiological rehabilitation, which needs enhanced focus in all managed care and VA health care environments.
2. In light of the differences emerging between groups of elderly persons with and without hearing loss, more appropriate audiological and psychological rehabilitation interventions need to be developed. The likelihood of a recommended or prescribed treatment program being adopted by the individual can be estimated by assessing his or her predisposition to use. This finding corroborates that of Crowley and Nabelek (21). By screening for predispositions to use, more appropriate treatment strategies can be devised and implemented. This, in turn, may reduce the frustration with hearing aids many individuals report and their subsequent nonuse/abandonment.
3. Assessing the quality of the match of a person with a treatment/rehabilitation regimen should result in a better match and a higher rate of treatment/rehabilitation compliance. This should result in a sense of well-being, which, in turn could result in an improved perception of health and general health status. These findings are consistent with those of other researchers (1,8-11,21) and add additional support to the potential efficacy of the audiologic rehabilitation approach suggested by Kricos (10).
4. The value of the ATD PA as a brief, easy-to-score, paper-and-pencil instrument for assessing predispositions to the use of an assistive technology or prosthetic aid was confirmed. It assessed relationships among hearing loss and subjective well-being and provided information on individuals' current perspectives of their psychosocial functioning and psychological adjustment to hearing loss. Together with audiological data, this tool has the potential to contribute to the formulation of consumer-directed needs and goals for audiologic rehabilitation.

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Hearing loss is a partial or total inability to hear. Hearing loss may be present at birth or acquired at any time afterwards. Hearing loss may occur in one or both ears. In children, hearing problems can affect the ability to acquire spoken language, and in adults it can create difficulties with social interaction and at work. Hearing loss can be temporary or permanent. Hearing loss related to age usually affects both ears and is due to cochlear hair cell loss. In some people, particularly older Older adults have been found to be with decreased levels of personal growth and purpose in life associated with higher age. Nevertheless, available empirical data about differences in psychological well-being between youngâ€“old and oldâ€“old are limited and inconclusive in community-dwelling older adults (MelÃ©ndez et al., Reference MelÃ©ndez, AgustÃ, Delhom, RodrÃguez and Satorres2018).Â A Web-based survey was conducted to collect information about sociodemographic characteristics of older adults, self-perceived health, and features of the COVID-19 lockdown situation. The following standardized questionnaires were also Web-based administrated: The Family APGAR (Smilkstein, Reference Smilkstein1978). Hearing loss was associated with a weaker capacity to process bound features which appeared to be accounted for by a weaker sensitivity for change detection (Aâ€™). Our findings give insight into the neural mechanisms underpinning neurocognitive decline with ARHL and its temporal sequence.Â You are using a browser version with limited support for CSS. To obtain the best experience, we recommend you use a more up to date browser (or turn off compatibility mode in Internet Explorer).Â We examined differences in accuracy between older adults with hearing loss and a control group on the VSTMB task from a single feature (shapes) condition to a feature binding (shapes-colors) condition. The influence of marginal hearing loss on subjective well-being was studied in order to assess the audiological rehabilitation needs of older individuals. Behavioral and audiological data were obtained from 40 subjects 61-81 years of age. Group A included 20 subjects with normal audiometric thresholds. Group B included 20 subjects with mild-to-moderate degrees of high-frequency hearing loss.Â @article{Scherer1998CharacteristicsAW, title= {Characteristics associated with marginal hearing loss and subjective well-being among a sample of older adults.}, author={M. Scherer and D. R. Frisina}, journal={Journal of rehabilitation research and development}, year={1998}, volume={35 4}, pages={. 420-6 } }.