International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

A Study on Hearing Aid Benefits in Elderly Using Body Worn Hearing Aid

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Abstract: ***The World Health Organization estimates that the population over 60 years will reach 1.2 billion, with 278 million people affected by disabling hearing loss, mostly in developing countries. In India, hearing impairment is the most common morbidity among the elderly, particularly in rural, economically dependent populations. Hearing loss affects communication and daily functioning. The ADIP Scheme supports elderly individuals by providing hearing aids to improve communication and quality of life. Need of the Study: Hearing-aid outcome measures document treatment benefits, guide clinical decisions, and Self-reported tools highlight the need for EBP research in the Indian elderly-population. Aim & Objectives: Self-reported hearing-aid benefits and perceived benefits as reported by family members in elderly body-worn hearing-aid users, as a function of the gain provided by the hearing aid. A) To measure hearing-aid benefit as a function of gain provided by mild-class hearing aids. B) To measure hearing-aid benefit as a function of gain provided by moderate-class hearing aids. C) To measure hearing-aid benefit as a function of gain provided by strong-class hearing aids. Method: Forty-five elderly participants (≥50 years) using body-worn hearing aids for 2-2.5 years were recruited from AYJNISHD, SRC, Secunderabad, with bilateral severe-to-profound sensorineural hearing, divided into three groups (n=15). The Telugu-adapted Hearing Aid Benefit Questionnaire assessed six domains. Mean, SD, independent t tests, and repeated-measures on ANOVA with post hoc analysis was performed using SPSS-12. Results and Discussions: The mild-class hearing aids yielded greater perceived benefit than moderate and strong classes, with maximum benefit in quiet listening and minimal benefit for music and telephone use. Difficulty increased with greater hearing loss severity. Non-audiological factors such as age, education, cosmetic concerns, and adaptability influenced outcomes. Family members also reported greater benefit in aided conditions. The questionnaire proved to be a practical tool for assessment and rehabilitation planning.***

Keywords: ADIP, Assistance to Disabled Persons for Purchase/Fitting of Aids/Appliances

1. Introduction

According to the World Health Organization (WHO), the global population aged over 60 years is projected to reach approximately 1.2 billion, indicating a significant demographic shift toward an ageing population. WHO estimates from 2005 suggest that nearly 278 million people worldwide are affected by disabling hearing loss, with about two-thirds residing in developing countries. The reported prevalence of hearing loss among older adults varies depending on the criteria used to define hearing impairment and the assessment tools employed (Ventry & Weinstein, 1982; Lichtenstein, Bess, & Logan, 1988; Bess et al., 1989).

Hearing impairment adversely affects everyday communication and contributes to broader psychosocial difficulties in older adults. Many elderly individuals report particular difficulty understanding speech in the presence of background noise. In India, the 58th National Sample Survey Organisation (NSSO) survey conducted in 2002 estimated that approximately 18.04 million individuals live with various forms of disability, significantly limiting their social and economic participation.

Recent statistics on the elderly population in India indicate that nearly 75% reside in rural areas. Women constitute approximately 48.2% of the elderly population, of whom 55% are widows. Additionally, 73% of older adults are illiterate and dependent on physical labour, while nearly one-third live below the poverty line. Overall, about 66% of elderly individuals are considered vulnerable due to inadequate access to food, clothing, and shelter. Furthermore, nearly 90% of older adults are employed in the unorganised sector and lack a regular source of income.

Elderly individuals in India commonly experience dual health burdens, including both communicable and non-communicable diseases, which are further exacerbated by impairments in sensory functions such as vision and hearing. An Indian Council of Medical Research (ICMR) report on chronic morbidity among the elderly identified hearing impairment as the most prevalent condition, followed by visual impairment (Shah, 1999). These findings highlight the substantial health and socio-economic challenges faced by the elderly population, including inadequate attention to ageing-related issues in rural areas, limited recognition of older adults as active contributors to the economy, and insufficient emphasis on targeted policy interventions.

Coping with hearing loss is different from other disabilities in that it is an invisible handicap. The reactions or behaviors associated with hearing loss may not be apparent, and even the sight of a hearing aid doesn't guarantee recognition of a disability.

A day in the life of a hearing-impaired older adult may include struggles with the following, hearing alarms or telephones, understanding someone while talking on the phone, understanding when several people are talking, understanding when a speaker's face is unseen, hearing in a car, wind, or traffic, understanding speech on TV, understanding whispering, understanding people in a large room, understanding unclear or accented speech, being unaware someone is talking, understanding in public places, ordering food, understanding cashiers or sales clerks.

Many efforts are made by the Central and State governments to tackle the problem of economic insecurity by launching policies such as the National Policy on Older Persons, National Old Age Pension Program, Annapurna Program, etc. However, the benefits of these programs have been questioned several times in terms of the meager budget, improper identification of beneficiaries, lengthy procedures, and irregular payment. One such scheme by the Ministry of Social Justice and Empowerment is the Scheme Of Assistance To Disabled Persons for Purchase/Fitting of Aids/Appliances (ADIP Scheme). The main objective of the scheme is to assist the needy disabled persons in procuring durable, sophisticated and scientifically manufactured, modern, standard aids and appliances that can promote their physical, social and psychological rehabilitation, by reducing the effects of disabilities and enhance their economic potential.

The no. of body worn hearing aids distributed from AYJNIHH under such scheme (ADIP Scheme) as per the Annual Report of AYJNIHH is of the 7544 beneficiaries, 2331 were children while 2657 were persons above age of 60 years. During the reporting year 57 hearing aids at 53% cost, 8205 hearing aids at 100% concession and 40 hearing aids without concession were distributed among clients. An amount of Rs.2.98 lakhs was collected from the beneficiaries towards sale of aids and appliances.

Though the above statistics indicates the distribution of body level hearing aids, no data is available about the benefits obtained from these by the recipients. Therefore, the present study is taken up to document the benefits.

Year	No. of Aids Distributed
2006 -2007	8376
2007-2008	7266
2008 -2009	8226
2009-2010	7227
2010-2011	8302

2. Need for the study

For a variety of reasons, there has been an explosion of interest in the area of hearing-aid outcome measures in the past decade (Bentler, Niebuhr, Getta, & Anderson, 1993a, 1993b; Cox & Alexander, 1992, 1999; Dillon, James, & Ginis, 1997). This also includes the measurement and quantification of hearing aid outcome (Humes, Halling & Coughlin, 1996; Mueller 1997).

In general, "outcome" refers to the measurable effect, either real or perceived, of the hearing aid on the wearer's hearing disability or hearing handicap (Weinstein, 1997). Outcome can be either positive or negative. That is, the use of a hearing aid by the wearer can either increase or decrease the hearing disability or handicap. Thus outcome evaluation is a key component of the hearing aid fitting process.

The habilitation and rehabilitation approaches used for hearing impaired individuals ultimately aim for a better quality of life. This surge of interest has been driven by several forces, including audiologists' and consumers' desire to document benefits derived from the use of amplification, manufacturers' desire to comply with regulations from the Food and Drug Administration for the substantiation of advertising claims regarding benefits provided by their products, and researchers' desire to better understand the impact of the hearing aid on the listener's auditory performance, both immediately after delivery and over several weeks or months of use. It can also be noted otherwise that the measurement of outcomes in audiology has received much attention in recent years because of the need to demonstrate efficacy of treatment for consumers, provide evidence for third-party payment, carry out cost-benefit analyses, and justify allocation of resources.

Outcomes measurement allows audiologists to show the benefits that are obtained from a hearing aid, as well as to determine the costs of obtaining those benefits. One aim of self-report outcome assessment is to evaluate the degree to which provision of hearing aids helps individual patients in overcoming their hearing difficulties. While objective outcome measures, such as speech recognition scores, measure the benefit provided by the amplification and other technical features of a hearing aid, self-reporting has the potential to evaluate the entire process of hearing-aid intervention.

Whereas all the test materials developed for evaluating hearing impaired elders focus on diagnosis and intervention, the self reported questionnaire on benefit of hearing aid concept is important in understanding the communication and social participation of hearing-impaired individuals in everyday life. Measuring the benefit will assist the clinicians in making judgments about the areas in which a patient is experiencing more difficulty in everyday listening environment and in revising the possible technologies. Also the "felt needs" of the elderly population can be assessed by self rating questionnaires thereby helping in bringing up strategies for improving their quality of life. Finally research related to Indian population is needed to build up the much needed data base for pedagogical and clinical purposes.

Aim & Objective:
The aim of the present study was to obtain self-reporting hearing aid benefits & perceived benefit by family members from elderly body level hearing aid wearers as a function of gain provided by the hearing aid.

- To measure the hearing aid benefit as a function of gain provided by a mild class hearing aids.
- To measure the hearing aid benefit as a function of gain provided by a moderate class hearing aids.
- To measure the hearing aid benefit as a function of gain provided by a strong class hearing aids.

3. Materials & Methods

Participants:
The participants in this study were recruited from those reporting to the AYJNIHH, SRC centre or from nearby places in Hyderabad and Secunderabad using purposive sampling technique. A total of 45 subjects participated in the study and were divided into 3 groups each consisting of 15 subjects. Each participant met the following selection criteria: (a) age of 50 years and above; (b) hearing loss that was severe to profound (no inter-octave change in hearing thresholds of more than 20 dB) in both ears; (c) hearing loss

that was of sensorineural origin (normal tympanometry and air-bone gaps no greater than 10 dB at three or more frequencies); (d) hearing loss that was bilaterally symmetrical (interaural difference within 30 dB at all octave and half-octave intervals from 250 to 4000 Hz); (e) living independently; (f) having no other pathologies and (g) able to complete printed questionnaires without assistance. (h) All the subjects were using body level hearing aid for a period of atleast 2 years -2.5 yrs.

Tool:

The Hearing Aid Benefit Questionnaire (English, Hindi & Kannada version) developed by Kanwer (2011), was selected as the test tool. The purpose of the scale is to measure communication effectiveness in a variety of situations and listening conditions. It consists of a total of 62 questions that evaluated hearing aid benefit in 6 domains of which, namely communication in quiet, communication in noise, listening over telephone, listening to music, annoyance & perceived benefit by the family members. It was translated along with instructions for patients and adapted into Telugu (Native Language) whenever required as per the International Test Commission Guidelines for Translating and Adapting Tests (1992). The adaptation process took into full account of linguistic and cultural differences and translation verification was conducted to verify that the items in the native-language version were appropriately translated or adapted from the original version. When the faithfulness of the transadaptation was verified through translation verification, that the two corresponding standards-based assessments are measuring the same knowledge, skills and abilities. It was used for the present study.

4. Procedure

Data was collected after obtaining consent letters from each of the participants by explaining to them the aim, objective and need for the study. The demographic data of all the subjects were collected using demographic data questionnaire. An interviewing method was used for collecting data from the client reporting to the centre or nearby places. The Hearing Aid Benefit Questionnaire translated and adapted from English into Telugu was administered to the participants. The scale was administered to each participant individually as a paper-and-pencil task using a combined question- answer form. Instructions were to respond to each item on the basis of experience in one's usual listening mode, that is, with and without the use of hearing aids. The participants were requested to go through the instructions thoroughly & then to rate it on a 5 point scale as A- Never- 1, B-Occasionally- 2, C-Half the time – 3, D- Generally -4 and E-Always -5 The Hearing Aid Benefit Questionnaire consists of 62 questions that evaluated hearing aid benefit in 6 domains of which, namely communication in quiet, communication in noise, listening over telephone, listening to music, annoyance were the self-perceived scales to be rated by the participant & perceived benefit by the family members domain was to be rated by any one of the family members. The responses obtained were calculated separately for each domain (higher score indicated greater perceived benefit) and total scores were computed.

Statistical Analysis

The mean and SD were computed for all the domains individually. To find out statistical significance between unaided (without hearing aid) and aided condition (with hearing aid) for overall score on five self-reporting domains for each group and also to find out significant difference for each individual domain the independent 't' test was used.

Repeated measures of ANOVA were used to compare the overall score obtained among the three groups and post hoc analysis was done to compare between groups using SPSS software version 12.

5. Result

The mean, standard deviation, t –value and significance is depicted in Table 1.1 it is evident that the mean scores obtained were higher in aided condition (197.13) as compared to unaided condition (133.93) with the t-value significant (t=24.60, p=0.00).

Table 1.1: Mean, SD, t value of overall scores of gain provided by a mild class hearing aid

Condition	N	Mean	S.D.	t - value	Significance
Without Hearing Aid	15	133.93	23.30	24.60	0.00
With Hearing Aid	15	197.13	17.24		

To find out the significant difference between unaided and aided condition on individual domains. The mean and SD values were calculated and t-test was computed and results are indicated in table 1.2. it is evident from the table that the mean values are higher in aided condition (64.33, 50.93, 42.20, 15.13 & 20.53) than unaided condition (42.67, 33.40, 29.40, 11.07 & 17.40) with t- value of 5.83,6.35, 4.98, 3.60 and 1.65 significant at P< 0.01 level for all the domains.

Table 1.2: Mean, SD, 't'- value and level of significance of each domains for gain provided by a mild class hearing aid (Module 1-5of self-rating scale)

Domain	N	Condition	Mean	S.D	't'- value	Significance
Communication in quiet	15	Without hearing aid	42.67	13.90	5.83	.00
		With hearing aid	64.33	3.71		
Communication in noise	15	Without hearing aid	33.40	9.01	6.35	.00
		With hearing aid	50.93	5.75		
Listening over telephone	15	Without hearing aid	29.40	9.75	4.98	.00
		With hearing aid	42.20	1.90		
Listening to music	15	Without hearing aid	11.07	3.71	3.60	.00
		With hearing aid	15.13	2.32		
Annoyance	15	Without hearing aid	17.40	5.23	1.65	.00
		With hearing aid	20.53	5.12		

To estimate the benefit derived from hearing aid on the perceived benefit by family member domain the scores of unaided and aided condition were compared using t –test and results indicate mean score to be higher in aided condition (41.27) with t value of 8.82 significant at P<0.5 level as shown in table 1.3.

Table 1.3: Mean, SD, t value and significance on the perceived benefit by family member domain for gain provided by a mild class hearing aid (6thModule of scale)

Condition	N	Mean	S.D.	t - value	Significance
Without Hearing Aid	15	26.00	4.30	8.82	0.27
With Hearing Aid	15	41.27	5.13		

The mean, standard deviation, t –value and significance is depicted in Table 2.1 it is evident that the mean scores obtained were higher in aided condition (155.67) as compared to unaided condition (95.60) with the t-value not significant (t= 6.26, p= 79).

Table 2.1: Mean, SD, t value of overall scores of gain provided by a moderate class hearing aid

Condition	N	Mean	S.D	t value	Significance
Without Hearing Aid	15	95.60	24.32	6.26	.79
With Hearing Aid	15	155.67	28.06		

To find out the significant difference between unaided and aided condition on individual domains. The mean and SD values were calculated and t-test was computed and results are indicated in table 2.2. it is evident from the table that the mean values are higher in aided condition (55.33, 40.80, 28.67, 12.73 & 17.46) than unaided condition (28.80, 21.93, 19.13, 8.93 & 16.80) with t- value of 8.89, 5.64, 4.98, 3.60 and 1.65 significant at three domains namely communication in noise, listening to music & annoyance P< 0.5 & p> 0.5 in two domains.

Table 2.2: Mean, SD, 't'- value and level of significance of each domain for gain provided by a moderate class hearing aid (Module 1-5of self-rating scale).

Domain	N	Condition	Mean	S.D	't'- value	Significance
Communication in quiet	15	Without hearing aid	28.80	6.89	8.89	.76
		With hearing aid	55.33	9.27		
Communication in noise	15	Without hearing aid	21.93	5.56	5.64	.00
		With hearing aid	40.80	11.70		
Listening over telephone	15	Without hearing aid	19.13	6.22	3.67	.79
		With hearing aid	28.67	7.89		
Listening to music	15	Without hearing aid	8.93	4.16	2.79	.20
		With hearing aid	12.73	3.24		
Annoyance	15	Without hearing aid	16.80	6.93	0.28	.23
		With hearing aid	17.46	5.86		

To estimate the benefit derived from hearing aid on the perceived benefit by family member domain the scores of unaided and aided condition were compared using t –test and results indicate mean score to be higher in aided condition (38.93) with t value of 6.44 not significant at P>0.5 in table-2.3.

Table 2.3: Mean, SD, t value and significance on the perceived benefit by family member domain for gain provided by a moderate class hearing aid (6th Module of scale).

Condition	N	Mean	S.D.	t- value	Significance
Without Hearing Aid	15	24.40	5.25	6.44	.514
With Hearing Aid	15	38.93	6.97		

The mean, standard deviation, t –value and significance is depicted in Table 3.1 it is evident that the mean scores obtained were higher in aided condition (159.47) as compared to unaided condition (86.33) with the t-value significant (t= 9.06, p< 0.5).

Table 3.1: Mean, SD, t value of overall scores of gain provided by a strong class hearing aid.

Condition	N	Mean	S.D.	t- value	Significance
Without Hearing Aid	15	86.33	16.85	9.06	0.23
With Hearing Aid	15	159.47	26.33		

To find out the significant difference between unaided and aided condition on individual domains. The mean and SD values were calculated and t-test was computed and results are indicated in table 3.2. it is evident from the table that the mean values are higher in aided condition (56.13, 43.80, 29.20, 12.33 &18.00) than unaided condition (26.60, 20.53, 17.87 ,8.00 &13.33) with t- value of 11.65, 8.53, 4.18, 3.42 and 2.41 significant at P< 0.5 in four domains & p> 0.5 in one domain.

Table 3.2: Mean, SD, 't'- value and level of significance of each domains for gain provided by a strong class hearing aid (Module 1-5of self-rating scale)

Domain	N	Condition	Mean	SD	't'- value	Significance
Communication in Quiet	15	Without hearing aid	26.60	6.10	11.65	.55
		With hearing aid	56.13	7.69		
Communication in Noise	15	Without hearing aid	20.53	3.58	8.53	.00
		With hearing aid	43.80	9.93		
Listening over Telephone	15	Without hearing aid	17.87	5.47	4.18	.23
		With hearing aid	29.20	8.96		
Listening to Music	15	Without hearing aid	8.00	3.00	3.42	.24
		With hearing aid	12.33	3.87		
Annoyance	15	Without hearing aid	13.33	5.35	2.41	.80
		With hearing aid	18.00	5.22		

To estimate the benefit derived from hearing aid on the perceived benefit by family member domain the scores of unaided and aided condition were compared using t –test and results indicate mean score to be higher in aided condition (39.20) with t value of 7.49 not significant at P>0.5 level as shown in table 3.3.

Table 3.3: Mean, SD, t value and significance on the perceived benefit by family member domain for gain provided by a strong class hearing aid (6th Module of scale).

Condition	N	Mean	S.D.	t-value	Significance
Without Hearing Aid	15	23.40	5.35	7.49	0.66
With Hearing Aid	15	39.20	6.17		

One way ANOVA was used to compare the test score of among three groups in terms of between group and within group variables and the results were obtained in form of F ratio. The F ratio is 13.30 which are more than the f probability indicating that there is significant difference across 3 groups thus indicating that, the performance of adults in three groups (individuals with mild class hearing aid usage, individuals with moderate class hearing aid usage and individuals with strong class hearing aids usage) statistically significant.

Table 4: The mean & standard deviation, is depicted in Table 4.

Group	Condition	Mean	SD	F Value	Significance
With hearing aid	Mild	197.13	4.45	13.30	0.000
	Moderate	155.67	7.25		
	Strong	159.47	6.80		

Post hoc analysis between groups shows the mean difference between groups 1 & 2 and 1 & 3 is higher than between group 2 & 3 indicating that there is significant effect on gain provided by hearing-aid.

Table 5: Mean & significance of comparisons among each group.

Condition	Between Group	Mean difference	Significance
With hearing aid	Mild-Moderate	41.47	0.000
	Mild-Strong	37.47	0.000
	Moderate-Strong	3.80	0.671

6. Discussion

The results of the present study showed that the benefits obtained from a mild class hearing aid were better than a moderate class. However the mean value obtained from a strong class hearing aid was comparatively poorer. Hearing aid use increases with increasing degree of hearing loss (Brännström & Wennerström 2010). However, outcome is not uni dimensional but has several independent dimensions associated with it such as the technology of hearing aid. Digital hearing aids yield better outcomes than analog devices. A digital hearing aid though costly, can be programmed according to the degree & type of hearing loss based on the frequencies most affected & the requirements of a hearing impaired. It is equipped with various technologies that allow the user to listen well in a background of noise, enjoy music, converse over telephone & watch television, reduce feedback etc. These options are not available with an analog body level hearing aid.

The domains represent the self-assessed hearing-aid benefit perceived by the participants for without and with hearing aid conditions in communication in quiet, communication in noise, listening over telephone, listening to music and annoyance. In general, across all domains, hearing aids were judged to be "helpful." However, the perceived benefit provided by hearing aids varied significantly across the domains, as confirmed with a repeated-measures analysis of variance. Thus, the hearing aids were considered to be most helpful in quiet listening conditions, significantly less helpful for non- speech stimuli like music. Difficulty in listening & speaking over telephone, listening music etc increased as the degree of loss increased. Similar results have been obtained previously by Walden, Schwartz, Williams, Holum-Hardegen & Crowley (1983). Subjects with sensorineural hearing losses show significantly poorer scores on items concerning introspective aspects of the outcome in comparison to subjects with mixed hearing losses and subjects with conductive hearing losses (Brännström & Wennerström 2010).

Behavioral and personality changes in older patients often create problems of adaptation to the hearing aid which in turn may also affect the fitting of an aid and the patient's ability to learn to use it (Kricos & Patricia 2000). Age of the user, education & social status, knowledge about care & use of amplification system are also considered to be some of the non-audiological factors affecting these outome (Erwin, George, Adriana, Zekveld, Sophia, Kramer, Goverts, Joost, Festen, and Houtgast 2007). These factors may be

positively/negatively associated such that high aided performance tends to lead to high benefit, which tends to lead to high satisfaction, which, in turn, leads to high amounts of use. Cosmetic appearance could be another major factor that affected the outcome. Patients were often unwilling to use the hearing aid due to its large size & heavy appearance. The results of our study correlated with Brooks and Bulmer (1981) and Brooks (1984) who reported about improvements in the quality of life and improvements in the individuals' social life using hearing aid.

The scale also predicts the outcomes on the domain of perceived benefit by family member which also shows that the perceived benefit provided by the hearing aid is better than the unaided condition for all the three groups.

7. Conclusion

The hearing aid benefit questionnaire possesses a number of features which make it potentially useful for a variety of applications. It can be used as a quick screening questionnaire & is an easy to measure outcome procedure in outreach programms where facilities & manpower for carrying out objective evaluation are limited.

Hence, it can be concluded that measuring the hearing aid benefit with the self- assessment questionnaires will assist the clinicians in making judgments about the areas in which a patient is experiencing more difficulty in everyday listening environment and in revising the possible technologies. It also highlights the medical and socio-economic problems faced by the elderly and helps in bringing up strategies for improving their quality of life. Thus, it reiterates the importance of tailoring auditory rehabilitation towards the needs of the individual.

Perceived benefits by family members subscale help in to measure the family point of view towards the patient's problem & this information is also useful in counselling for hearing aid user's family members to provide support & motivation to the patients. Thus, it enlightens the family members the need of support to the hearing aid users.

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