

# IMPACT OF ASSISTIVE LISTENING DEVICES WITH HEARING AIDS

## ABSTRACT

**Background:** Hearing aids play a significant role in management of hearing loss. Communication technologies when integrated with hearing aids lead to a better understanding of listening and a better outcome in their quality of life. **Objective:** To measure the quality of life with the use of Assistive Listening Devices (ALD) when paired with hearing aid. **Methods:** Cross sectional study conducted in the Delhi and NCR region across hospitals and clinics. Total 109 participants were included in this study over a period of one year. **Results:** Assistive listening devices when used with the hearing aids, participants reported a significant improvement in quality of life. **Conclusion:** It is recommended to use ALDs with hearing aids for a satisfactory listening quality which leads to a better quality of life.

**Key words:** Assistive Listening Devices, Hearing Aids, Hearing Loss,

## Introduction

Human ear has vital function in the body, this includes balancing system of the body and hearing. Hearing plays a key role in communication. It helps us to mix in the society, express thoughts and emotions and keeps us aware of surrounding. Hearing sensitivity and awareness keep us safe from any risk. Sound waves are collected from environment and collected by pinna, the visible part of ear (Brownell & Alford, 2010). It transports the sound signal to tympanic membrane or ear drum through auditory canal, this collected signal strikes tympanic canal and enters the middle ear in form of mechanical vibrations. Middle ear has tiny bones which acts like a chain to send the signal to inner ear. This chain of middle ear bones is also known as ossicular chain. This mechanical signal now enters cochlea which is an organ in inner ear. Cochlea is a fluid filled compartment housed in petrous part of mastoid bone. The sent mechanical signal gets converted into electric impulses and the signals are transported to auditory nerve and further neural pathway for processing of the signal. Hearing loss or hearing impairment is cause due to damage or dead cells in cochlea. Sensory part of hearing is considered till cochlea.

Hearing loss or hearing impairment is a partial or total failure to hear. It may occur in one or both ears. In children hearing problems can affect the ability to learn spoken language and in

adults it can cause work related difficulties. In some people, particularly older people, hearing loss can result in loneliness, and it can be temporary or permanent. (Lasak et al. 2014) Hearing loss is the most common sensory deficit in humans today. As per WHO estimates in India, there are approximately 63 million people, who are suffering from Significant Auditory Impairment: this places the estimated prevalence at 6.3% in Indian population (Verma et al., 2022).

Hearing aids are non-implantable amplification device which fits on the ears, worn by a person with hearing impairment. Hearing aids provides amplification on each frequency on which an individual is in-capable of hearing sounds. Hearing aids lets you hear all the sounds which could not be heard due to hearing impairment. Hearing loss can be partial or complete, in both condition hearing aids are recommended. If hearing aids doesn't work, then further solutions for the management can be opted. Hearing aids are clearly associated with impressive improvements in the social, emotional, psychological, and physical well-being of people with hearing loss in all hearing loss (Dawes et al. 2015). There are different types of hearing aids such as Behind the Ear (BTE), Receiver in the Canal (RIC), In the Ear (ITE), In the Canal (ITC), Completely in the Canal (CIC) and Invisible in the Canal (IIC). These are categorized based on the size. Based on technology these are Analog and Digital. There are many performances level in digital hearing aids which gives better quality of sounds when one proceeds from essential segment to premium segment (Cox et al. 2016). There are still certain limitations in the hearing aids even if the user is using the highest technology. Problem faced are difficulty in listening in noisy environment, difficulty in listening distant speech, phone calls and mobile media streaming is again a problem for the hearing aid users. To cope up this problem, there are additional devices available which has been giving to be a life changing experience and users are very comfortable to use hearing aids. (Lesner, 2003). These additional devices are connected to hearing aids and mobile or other external devices like microphone or TV connector etc. These are known as Assistive Listening Devices or ALDs. There are diverse types of amplification equipment designed to improve the communication of persons with hearing loss and to ensure optimal communication when individual hearing instruments are not sufficient. There used to be a time where ALDs were not so popular as it has only connectivity with iOS applications. (Kim and Kim 2014). Made for All technology allows all kind of Bluetooth devices with the hearing aids.

Assistive Listening Devices are additional accessories which are used with Hearing devices to cope the limitations of the Hearing devices like listening through distance, listening in

noisy environments, calling over phone and listening to music like a personal headphone. These functions of calling, media steaming can be solved through hearing aids alone, but maximum of the time, especially with severe to profound hearing loss it become difficult to give a comfortable listening in challenging situations. It is also seen all the hearing aid users who are using ALDs have better listening skills compared to non- ALD users (Chen et al., 2021).

### **Objective**

To measure the quality of life with the use of Assistive Listening Devices when paired with hearing aid.

### **Methodology**

**Type of Study:** Quantitative, Cross sectional

**Study Area:** The study was conducted in through different Audiology clinics across Delhi and National Capital Region.

**Study period:** Data was collected from January 2018 to January 2019 (i.e., 1 year).

**Study Population:** Total 109 participants were included in this study from the clinics for a duration of 1 year.

### **Tools & Technique:**

1. pre-tested questionnaire was used for collecting the data.
2. face to face interview was conducted.

**Data analysis:** The data was entered in Microsoft Excel and analysed using statistical software IBM SPSS version 21.

The categorical variables related to Demographic profile, quality of life measured and presented using frequency and percentages. The quantitative variables such as age and duration of ALD use in month were summarized using Mean and standard deviations. Comparison tests such as Chi square test was applied. P value less than 0.05 was considered as statistically significant.

### **Inclusion**

- Age of 15 years or above

- Mode of communication must be verbal
- Using ALD technology for both calling media streaming and remote microphone.
- User of binaural fitting
- Minimum experience of 3 months
- Hearing aid wearing time should be minimum of 10 hours per day

### Exclusion

- Patients with unilateral hearing
- Children below 15 years of age were excluded from the study

### Results

To measure the quality of life with the use of Assistive Listening Devices when paired with Hearing aid for the quality-of-life section, the responses were recorded as Yes, or No.

A total of 109 samples were collected with a mean age of  $43.7 \pm (16.44)$  years. Out of total study subjects, 73% (79) were males and 28% (30) were females.

**Table 1. Age wise distribution of respondents & Mean age of participants**

Age (in years)	Frequency	Percentage
18- 28	23	21.10
29-38	24	22.02
39-48	18	16.51
49 & above	44	40.37
<b>Total</b>	<b>109</b>	<b>100.00</b>
<b>Mean age: 43.7</b>		<b><math>\pm</math> SD: <math>\pm</math> 16.44</b>

The above table shows that maximum 40.37 % of the respondents were aged 49 & above whereas minimum 16.51% were aged between 39-48 years.

**Table 2 wise distribution of respondents**

Gender	Number of participants	Percentage
Male	79	72.00
Female	30	28.00
<b>Total</b>	<b>109</b>	<b>100%</b>

The above table 2 shows that maximum 79% of the respondents were male whereas minimum 28% of the respondents were female.

Among the included participants, for hearing loss in Right ear: 33% (36) reported as moderately severe, 26% (28) moderate, 24% (26) severe, 9% (10) as profound and 9% (8) as mild hearing loss. Likewise in Left ear: 44% (48) reported severe hearing loss, 23% (25) moderate hearing loss, 19% (20) as moderately severe and 7% (8) for both mild and profound hearing loss. Most study participants opted for hearing aids 98% (107) in Right ear and 99% (108) in left ear rather than Cochlear Implant, mean duration of ALD technology usage was 17.23( $\pm$ 12.94) months. Among the various ALD technologies, Bluetooth was the most used by the study participants i.e., 51% (55) than the 2.4GHz and FM.

For the quality-of-life section, the responses were recorded as yes, or no. Description was done by calculation of Frequency and percentages. Among the 109 study participants, 88%(96) were confident enough in talking to people on call, 84%(91) could speak comfortably with people in public place in presence of noise, 15%(16) needed others to assist them while having one to one conversation, 9%(10) subjects needed others to assist them while having group conversation, 6%(7) participants felt ashamed while talking to people, 7%(6) avoid talking to strangers, 50%(54) felt that they are developing memory loss, 7%(8) frequently asked people to repeat what they said, 92%(100) attended workplace/school/college or meeting with peers regularly, 93%(101) met their friends, 91%(99) attended social gatherings, 87%(94) were able to concentrate, 87%(94) enjoyed their life, 87%(95) reported they had future plannings, 87(95) were comfortable to use public transports, 5%(5) had negative feelings, such as blue mood, despair, anxiety, depression and 98% (106) participants reported that they were satisfied with the present condition of life.

**Table 3. Assessment of Quality of life with ALD**

<b>SN</b>	<b>With Assistive listening Devices</b>	<b>Yes n (%)</b>	<b>No n (%)</b>
1	Are you confident enough in talking to people on call?	96(88)	13(12)
2	Do you speak comfortably with people in public place in presence of noise?	91(84)	18(16)
3	Do you need others to assist you while having one to one conversation?	16(15)	93(85)
4	Do you need others to assist you while having group conversation?	10(9)	99(91)
5	Do you feel ashamed while talking to people?	7(6)	102(94)
6	Do you avoid talking to strangers?	8(7)	101(93)
7	Do you frequently ask people to repeat what they said?	8(7)	101(93)
8	Do you attend workplace/ school/college or meeting with peers regularly?	100(92)	9(8)
9	Do you meet your friends?	101(93)	8(7)
10	Do you attend social gatherings?	99(91)	10(9)
11	Are you able to concentrate?	94(86)	15(14)
12	Do you enjoy your life?	95(87)	14(13)

13	Do you have future plannings?	95(87)	14(13)
14	Are you comfortable to use public transports?	95(87)	14(13)
15	Do you have negative feelings, such as blue mood, despair, anxiety, depression?	5(4)	104(96)
16	Are you satisfied with your present condition of your life?	106(98)	3(2)

The Above table 3 shows the assessment of quality of life of the participants assessed through a pre-tested questionnaire.

### **Discussion**

There have been many developments happening in Audiology and Hearing aid industry but integrating communication technology with hearing aids has significantly changed quality of life of persons with hearing impairment (Anon and Edwards 2007). The study consisted of 109 participants. Minimum age of the participant was 18 years maximum age of the participant was 79 years with a mean age of 43.7 years. Out of total study subjects, majority was of male participants with a weightage of 73% and 28% of the females took part in the study. It was found 88% were confident enough in talking to people on call, 84% could speak comfortably with people in public place in presence of noise. (Maidment and Amlani 2020) stated in his study that patients with Bluetooth featured hearing aids gives several benefits including enhancements in social involvement and better quality of hearing through hearing aids. They also observed the old hearing aid users who were using conventional hearing aids, showed significant improvement.

Fifteen percent of the total participants needed others to assist them while having one to one conversation and 9% subjects needed others to assist them while having group conversation. One to one conversation requires active participation which may result in missing out some information whereas in group conversation an individual may not be focus on every detail and hence he reports less requirement of others for assistance. In a similar study. (Chen et al.

2021) showed a significant improvement in challenging listening environment when remote microphone was used along with the hearing aids. Lack of hearing, hearing aid use, and sign language. They are unable to participate in conversations due to stigma, making hearing impaired feel lonely, unexpressed, and socially marginalized. This results in chronic stress and depression (Mousley and Chaudoir 2018) and (Wallhagen 2010). When hearing aids were fitted with ALDs, only seven participants reported they feel ashamed while talking to people and 6 avoid talking to strangers.

Ninety-three percent of the participant reported they don't ask people to repeat what they said. It was seen that 100 participants which constitute 92% who were attending their workplace/ school/college or meeting with peers on regular basis. Ninety-three percent were meeting friends, and 91% attended social gatherings. Also, only 5% of all had negative feelings like such as blue mood, despair, anxiety, depression. (Shukla et al. 2020) studied on social isolation due to hearing loss and showed that a strong association between hearing loss, and loneliness and social isolation. A significant fall in perceptions of loneliness after four to six weeks of hearing aid usage. Subjects with moderate-to-severe hearing loss experienced the highest reduction in perceived loneliness with hearing aid use. (Weinstein, Sirow, and Moser 2016)

Eighty-seven percent were able to concentrate. This has increased their participation and involvements in social gatherings. Also, 87% of the respondents reported that they are satisfied with their life with hearing impairment that mean they are enjoying their life, 87% of the subjects have future plannings which significantly shows an improved quality of life where they are not grieving about their hearing loss, but they have planned their future overcoming the hurdles. Eighty-seven percent were comfortable to use public transports which is again showing the confidence to come of their houses without any hesitations. Ninety eight percent participants reported that they were satisfied with the present condition of life. People often see persons with hearing impairment in a sympathetic eye but, hearing aids user with the use of assistive listening devices have been living a satisfactory life where they are happy with their present. Therefore, it is recommended to use ALDs with hearing aids for a satisfactory listening quality which leads to a better quality of life.

### **Conclusion:**

A questionnaire with sixteen questions was given to the participants. They had to select if they were satisfied or not satisfied using ALD in a particular environment

mentioned in the questions. Maximum of users were confident to talk on telephone calls, comfortable conversation in presence of noise. Similarly, when asked about difficulty in conversation in one-to-one situation or group conversation, most of the participants are comfortable in both the situation. Furthermore, when asked if they feel ashamed while talking or avoid talking to strangers, a few of the respondents accepted the same. When asked about attending workplace/ school/college, meeting friends, or attending social gatherings, many of the participants gave a positive response. When asked if they are enjoying their lives and satisfied with present condition of their lives, it was reported to be satisfactory by maximum participants. A significant difference was observed when tested with Speech recognition in Noise. Even though participants could perform good without ALDs, the activation of ALDs show a better outcome when it came on listening sounds in presence of noise. With the above study and its findings, an Audiologist must recommend a patient to use ALDs along with their hearing devices for a better outcome.

### **Consent**

**As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).**

### **Reference**

- Brownell, William E, and Bobby R Alford. 2021. "HOW THE EAR WORKS-NATURE'S SOLUTIONS FOR LISTENING Hearing-Survival & Society A Brief History of Hearing-From Early Anatomy to Active Hearing." *Volta Review* 99(5): 9–28.
- Chen, Jing et al. 2021. "Effects of Wireless Remote Microphone on Speech Recognition in Noise for Hearing Aid Users in China." *Frontiers in Neuroscience* 15.
- Cox, Robyn M., Jani A. Johnson, and Jingjing Xu. 2016. "Impact of Hearing Aid Technology on Outcomes in Daily Life I: The Patients' Perspective." *Ear & Hearing* 37(4): e224–37.

- Dawes, Piers et al. 2015. "Hearing-Aid Use and Long-Term Health Outcomes: Hearing Handicap, Mental Health, Social Engagement, Cognitive Function, Physical Health, and Mortality." *International Journal of Audiology* 54(11): 838–44.
- Edwards, Brent. 2007. "The Future of Hearing Aid Technology." *Trends in Amplification* 11(1): 31. /pmc/articles/PMC4111503/ (November 22, 2022).
- Kim, Jin Sook, and Chun Hyeok Kim. 2014. "A Review of Assistive Listening Device and Digital Wireless Technology for Hearing Instruments." *Korean Journal of Audiology* 18(3): 105.
- Lasak, John M., Patrick Allen, Tim McVay, and Douglas Lewis. 2014. "Hearing Loss: Diagnosis and Management." *Primary Care - Clinics in Office Practice* 41(1): 19–31.
- Lesner, Sharon A. 2003. "Candidacy and Management of Assistive Listening Devices: Special Needs of the Elderly." *International journal of audiology* 42 Suppl 2(SUPPL. 2).  
<https://pubmed.ncbi.nlm.nih.gov/12918632/> (November 22, 2022).
- Maidment, David W., and Aryn M. Amlani. 2020. "Wireless Connectivity for People with Hearing Loss: Argumentum Ad Ignorantiam: Smartphone-Connected Listening Devices." *Seminars in Hearing* 41(4): 254. /pmc/articles/PMC7744166/ (November 21, 2022).
- Mousley, Victoria L, and Stephenie R Chaudoir. 2018. "Deaf Stigma: Links Between Stigma and Well-Being Among Deaf Emerging Adults1." *The Journal of Deaf Studies and Deaf Education* 23(4): 341–50.
- Shukla, Aishwarya et al. 2020. "Hearing Loss, Loneliness, and Social Isolation: A Systematic Review." *Otolaryngology–Head and Neck Surgery* 162(5): 622–33.
- "The Future of Hearing Aid Technology - PMC."  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4111503/> (November 22, 2022).

VERMA, RAVNEET RAVINDER et al. 2022. "Prevalence of Hearing Loss in India." *The National Medical Journal of India* 34: 216.

Wallhagen, Margaret I. 2010. "The Stigma of Hearing Loss." *The Gerontologist* 50(1): 66.  
[/pmc/articles/PMC2904535/](#) (November 21, 2022).

Weinstein, Barbara E., Lynn W. Sirow, and Sarah Moser. 2016. "Relating Hearing Aid Use to Social and Emotional Loneliness in Older Adults." *American Journal of Audiology* 25(1): 54–61.

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