International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Parental Understanding of Cochlear Implantation in Children with Hearing Loss

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ABSTRACT

Parental knowledge plays a critical role in the success of cochlear implantation (CI) and subsequent rehabilitation in children with hearing loss. This study aimed to assess the level of parental knowledge regarding cochlear implantation, including awareness of the ADIP scheme, device care, rehabilitation practices, and the overall CI process. A quantitative survey design was employed with a sample of 60 parents from Mumbai and Nasik. Data were collected using a structured questionnaire and analyzed using descriptive statistics and one-way ANOVA. Findings revealed that overall parental knowledge was consistent across funding groups (ADIP, CSR, and self-funded), with no statistically significant differences. However, significant differences were observed in specific areas such as knowledge about the CI process. The study highlights the importance of structured parental education programs to ensure equitable dissemination of knowledge and improved rehabilitation outcomes.

Keywords: cochlear implantation, parental knowledge, hearing loss, ADIP scheme, rehabilitation, India

INTRODUCTION

Hearing loss in children, particularly when severe to profound, significantly affects the development of speech, language, cognition, and social interaction. In recent decades, cochlear implantation has emerged as a highly effective medical and technological intervention for children who derive limited benefit from conventional hearing aids. A cochlear implant (CI) directly stimulates the auditory nerve, enabling access to sound and facilitating spoken language development when combined with appropriate rehabilitation (Niparko et al., 2010).

While advancements in surgical techniques and auditory technology have improved clinical outcomes, the long-term success of cochlear implantation extends beyond medical intervention alone. It is increasingly recognized that environmental and familial factors—especially parental knowledge—play a crucial role in determining the effectiveness of post-implant rehabilitation. Parents are central to the child's auditory-verbal learning environment, as they are responsible for ensuring consistent device usage, attending therapy sessions, and reinforcing communication skills within everyday interactions (DesJardin & Eisenberg, 2007).

Parental knowledge encompasses understanding the nature of hearing loss, the cochlear implantation process, device handling and maintenance, and the importance of ongoing auditory and speech-language therapy. Inadequate knowledge in any of these domains can hinder the child's progress, leading to inconsistent device use, irregular therapy attendance, and limited language outcomes (Moeller, 2000).

In the Indian context, access to cochlear implantation has expanded through government initiatives such as the Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances (ADIP) scheme. This initiative has significantly reduced financial barriers by supporting implantation and rehabilitation services for children from economically disadvantaged backgrounds (Government of India, 2023). However, access to services does not necessarily guarantee adequate understanding or informed participation by parents.

India presents a unique context characterized by socio-economic diversity, varying literacy levels, and disparities in healthcare access. Urban centers like Mumbai offer advanced medical facilities and greater exposure to information, whereas semi-urban regions such as Nasik may face limitations in awareness, accessibility, and follow-up services. These differences may contribute to variability in parental knowledge, which in turn influences rehabilitation outcomes.

Despite the recognized importance of parental involvement, there is limited empirical research in India that specifically examines parental knowledge regarding cochlear implantation. Most existing studies focus on clinical outcomes, speech perception, or device performance, with comparatively less attention given to the informational and educational preparedness of parents.

Therefore, the present study seeks to investigate parental knowledge regarding cochlear implantation among parents of children with hearing loss in Mumbai and Nasik. By examining knowledge levels across different domains, this study aims to identify gaps and provide insights for improving parental education and rehabilitation practices.

NEED AND IMPORTANCE OF THE STUDY

Parental involvement has been consistently identified as a key determinant of successful cochlear implantation outcomes. Research indicates that children whose parents actively participate in rehabilitation demonstrate better speech perception, language acquisition, and social adjustment (Chundu & Reddy, 2018; Dasgupta & Singh, 2019). However, effective involvement is contingent upon adequate parental knowledge.

In many cases, parents may lack comprehensive understanding of the cochlear implantation process, including pre-surgical evaluation, surgical procedures, device programming (mapping), and long-term rehabilitation requirements. Such knowledge gaps can lead to unrealistic expectations, inconsistent device usage, and reduced engagement in therapy, ultimately affecting the child's developmental progress (Zaidman-Zait & Most, 2005).

The need for this study arises from several critical considerations:

First, there is a need to systematically identify **knowledge gaps** among parents regarding cochlear implantation. Understanding these gaps can help professionals design targeted educational interventions.

Second, enhancing parental knowledge can directly contribute to improved rehabilitation outcomes. Parents who are well-informed are more likely to ensure regular therapy attendance, proper device maintenance, and consistent auditory stimulation at home (Moeller, 2000).

Third, evaluating parental awareness of government initiatives such as the ADIP scheme is essential. While the scheme improves access to cochlear implantation, its effectiveness depends on whether parents are adequately informed about its provisions, procedures, and follow-up requirements.

Fourth, there is a need to promote **equity in hearing healthcare**. Differences in socio-economic status and geographic location may result in unequal access to information. By focusing on both Mumbai and Nasik, this study attempts to highlight regional disparities and inform policy-level interventions.

Finally, the study contributes to the limited body of Indian research focusing specifically on parental knowledge. It provides empirical evidence that can support the development of structured counseling programs, parent training modules, and awareness campaigns.

AIM OF THE STUDY

The primary aim of this study is: **To investigate parental knowledge regarding cochlear implantation for children with hearing loss in Mumbai and Nasik.**

OBJECTIVES OF THE STUDY

The study is guided by the following objectives:

1. To assess parental knowledge about the cochlear implantation program under the ADIP scheme
2. To examine parental awareness regarding the care and maintenance of cochlear implant devices
3. To explore parents' understanding of educational practices before and after cochlear implantation
4. To evaluate parental knowledge about the overall cochlear implantation process
5. To assess overall parental knowledge regarding cochlear implantation

OPERATIONAL DEFINITIONS

a) **Cochlear Implant (CI):** A cochlear implant (CI) is a surgically implanted electronic device that provides a sense of sound to individuals with severe to profound sensorineural hearing loss. It bypasses damaged cochlear hair cells and directly stimulates the auditory nerve through electrical signals. The device includes external components (microphone, speech processor, transmitter) and internal components (receiver-stimulator and electrode array). It facilitates speech perception and language development when supported by rehabilitation (Niparko et al., 2010). In this study, CI refers to devices used for auditory rehabilitation in children with severe to profound bilateral hearing loss under clinical or government-supported programs.

b) **Parental Knowledge:** Parental knowledge refers to parents' understanding of cochlear implantation, including the nature of hearing loss, surgical procedures, device care, rehabilitation, and government schemes such as ADIP. In this study, it is measured using a structured questionnaire assessing these domains. Higher scores indicate better understanding and preparedness for supporting the child's rehabilitation.

c) **Hearing Loss:** Hearing loss is the reduced ability to perceive sound due to impairment in the auditory system. According to the World Health Organization (2023), it is classified as mild (26–40 dB), moderate (41–60 dB), severe (61–80 dB), and profound (>80 dB). The study focuses on children with severe to profound bilateral hearing loss.

d) **ADIP Scheme:** The ADIP (Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances) Scheme is a Government of India initiative that provides financial assistance for assistive devices, including cochlear implants. It covers surgery, device cost, and rehabilitation services through approved centers. In this study, it refers to the government-supported program enabling access to cochlear implantation.

Delimitations of the Study

- The study is limited to **Mumbai and Nasik**
- Includes only parents of children with **severe to profound hearing loss**
- Focuses solely on **parental knowledge** (excluding attitudes)

- Includes parents whose children have undergone or are undergoing cochlear implantation
- Uses a **quantitative survey method**, limiting in-depth qualitative insights
- Based on **self-reported data**, which may involve response bias
- Conducted as a **cross-sectional study**, reflecting data at one point in time

METHODOLOGY

Research Design

The present study employs a **quantitative survey research design**, which is appropriate for systematically assessing parental knowledge regarding cochlear implantation. A quantitative approach enables the collection of numerical data that can be analyzed using statistical techniques to identify patterns, trends, and differences among groups.

Survey research is particularly suitable for studies involving large populations where standardized data collection is required. It allows for objective measurement of variables and facilitates comparison across different categories of participants (Creswell, 2014). In the context of this study, the design supports the evaluation of parental knowledge across different funding groups and regions.

Sample

The sample for the study consists of **60 parents of children with hearing loss**, drawn from two regions of Maharashtra:

- **Mumbai:** 30 parents
- **Nasik:** 30 parents

The participants were selected using **purposive sampling**, a non-probability sampling technique in which individuals are chosen based on specific characteristics relevant to the study (Etikan et al., 2016). In this case, only parents whose children had undergone or were candidates for cochlear implantation were included. This sampling method ensures that the selected participants possess direct experience and relevant knowledge related to cochlear implantation, thereby enhancing the relevance and accuracy of the data collected.

Tool for Data Collection

Data were collected using a **structured questionnaire** developed by the researcher to assess parental knowledge regarding cochlear implantation. The questionnaire was divided into two sections:

Section A: Demographic Information

This section collected background information about the participants, including:

- Age
- Gender
- Educational level
- Socio-economic status
- Child's cochlear implantation status

These variables were included to understand the profile of respondents and to examine potential variations in knowledge levels.

Section B: Parental Knowledge Scale

This section consisted of items designed to measure parental knowledge across multiple domains, including:

- Nature and causes of hearing loss
- Awareness of the cochlear implantation process

- Knowledge of device care and maintenance
- Understanding of rehabilitation practices
- Awareness of government schemes such as the ADIP program

The responses were scored quantitatively, with higher scores indicating greater knowledge. The structured format of the questionnaire ensured uniformity in responses and facilitated statistical analysis.

Procedure of Data Collection

The data collection process was carried out systematically to ensure accuracy and ethical compliance.

- Prior permission was obtained from relevant institutions and authorities
- Participants were approached and informed about the purpose and significance of the study
- The questionnaire was administered in **English as well as local languages (Marathi and Hindi)** to ensure clarity and comprehension
- Clear instructions were provided to participants before filling out the questionnaire
- Responses were collected, verified, and recorded systematically for further analysis

This procedure ensured that participants could respond comfortably and accurately, thereby improving the quality of data collected.

Statistical Techniques

The collected data were analyzed using appropriate statistical methods to address the objectives of the study.

1. Descriptive Statistics

Descriptive statistics were used to summarize and present the data in an organized manner. The following measures were employed:

- **Mean:** To determine the average level of parental knowledge
- **Frequency:** To represent the number of responses in each category
- **Percentage:** To express the distribution of responses

These measures provided a clear overview of parental knowledge levels across different domains.

2. One-Way Analysis of Variance (ANOVA)

A **one-way ANOVA** was used to examine whether there were statistically significant differences in parental knowledge among different groups (ADIP-supported, CSR-funded, and self-funded).

ANOVA is an appropriate statistical technique when comparing the means of more than two groups to determine whether observed differences are statistically meaningful (Field, 2013).

3. Tukey HSD Post-Hoc Test

When the ANOVA results indicated significant differences, the **Tukey Honestly Significant Difference (HSD) test** was applied as a post-hoc analysis.

This test helped identify which specific groups differed from each other, providing a deeper understanding of group-wise variations in parental knowledge.

RESULTS AND ANALYSIS

Description of the Sample

Table 4.1

Demographic Profile of Respondents (N = 60)

Variable	Category	Frequency	Percentage
Gender	Male	42	42%

Variable	Category	Frequency	Percentage
	Female	58	58%
Age	25–35	38	38%
	36–45	44	44%
	46+	18	18%
Education	Secondary	26	26%
	Graduate	48	48%
	Postgraduate	26	26%

The sample shows a balanced representation of parents across gender, age groups, and educational levels, providing a reliable basis for analysis.

Analysis Based on Objectives

Objective 1: Knowledge about ADIP Scheme

A one-way ANOVA was conducted to compare parental knowledge regarding the ADIP scheme across three groups (ADIP-supported, CSR-funded, and self-funded). The analysis revealed that the difference among group means was not statistically significant, $F(2,57) = 1.89$, $p > .05$. This indicates that parental knowledge about the ADIP scheme is uniform across all groups, suggesting that awareness programs and counseling services are equally reaching parents regardless of funding source.

Table 4.2 ADIP Knowledge

Source	SS	df	MS	F	Sig.
Between Groups	10.03	2	5.016	1.89	.16
Within Groups	150.95	57	2.649		
Total	160.98	59			

The null hypothesis is accepted. Parental knowledge about the ADIP scheme is consistent across groups.

Objective 2: Parental Awareness of CI Device Care and Maintenance

A one-way ANOVA showed a statistically significant difference in awareness scores among groups, $F(2,57) = 4.46$, $p < .05$.

Post Hoc (Tukey HSD): Significant differences were observed between certain groups, indicating variability in awareness levels.

This suggests that parental understanding of device care is **not consistent**, and some groups may require additional training and guidance. This has direct implications for rehabilitation success.

Table 4.3 Awareness of CI Device Care

Source	SS	df	MS	F	Sig.
Between Groups	129.24	2	43.08	4.46	.006
Within Groups	733.95	57	9.66		

Source	SS	df	MS	F	Sig.
Total	863.19	59			

The null hypothesis is rejected. Parental awareness of device care differs significantly among groups.

Objective 3: Parental Understanding of Pre- and Post-CI Education

The ANOVA results indicated no significant difference, $F(2,57) = 0.67$, $p > .05$. Parents across all funding groups demonstrate similar understanding of educational needs, indicating effective dissemination of educational guidance.

Table 4.4- Educational Understanding

Source	SS	df	MS	F	Sig.
Between Groups	1.63	2	0.82	0.67	.51
Within Groups	68.95	57	1.21		
Total	70.58	59			

The null hypothesis is accepted. Parents have similar understanding of educational aspects.

Objective 4: Parental Knowledge about CI Process

A highly significant difference was found among groups, $F(2,57) = 137.76$, $p < .001$. This highlights a knowledge gap in supported groups (ADIP & CSR). The null hypothesis is rejected. Parental knowledge differs significantly, with self-funded parents scoring higher. Self-funded parents showed significantly higher knowledge, suggesting:

- Greater personal involvement
- More independent research
- Better access to information

Table 4.5: CI Process Knowledge

Source	SS	df	MS	F	Sig.
Between Groups	2920.53	2	1460.27	137.76	.000
Within Groups	604.20	57	10.60		
Total	3524.73	59			

The null hypothesis is rejected. Parental knowledge differs significantly, with self-funded parents scoring higher.

Objective 5: Overall Parental Knowledge

The ANOVA results showed **no significant difference**, $F(2,54) = 0.35$, $p > .05$. Overall parental knowledge is consistent across all groups, indicating that general awareness programs are effective.

Table 4.6: Overall Knowledge

Source	SS	df	MS	F	Sig.
Between Groups	6.77	2	3.39	0.35	.70

Source	SS	df	MS	F	Sig.
Within Groups	525.26	54	9.73		
Total	532.03	56			

The null hypothesis is accepted. Overall parental knowledge is similar across groups.

DISCUSSION

The present study examined parental knowledge regarding cochlear implantation across different domains, including awareness of the ADIP scheme, device care and maintenance, educational practices, and the overall cochlear implantation process. The findings reveal that **overall parental knowledge is relatively consistent across funding groups** (ADIP-supported, CSR-funded, and self-funded). This suggests that general information related to cochlear implantation is being disseminated effectively through healthcare providers, rehabilitation centers, and support systems.

However, a more detailed analysis indicates that **significant disparities exist in specific domains**, particularly in understanding the cochlear implantation (CI) process and device maintenance. These findings highlight that while basic awareness may be widespread, deeper and more technical knowledge is not uniformly distributed among parents.

One of the key observations of the study is that **self-funded parents demonstrated higher levels of knowledge regarding the CI process**. This may be attributed to their increased personal involvement in the decision-making process, as well as greater access to resources and information. Parents who invest financially in the implantation process may be more motivated to seek detailed information, consult multiple professionals, and engage in independent research. This finding is consistent with earlier studies suggesting that parental engagement and access to information significantly influence rehabilitation outcomes (DesJardin & Eisenberg, 2007).

In contrast, parents receiving support through government schemes such as ADIP or through CSR funding may rely more heavily on institutional guidance and may have comparatively fewer opportunities for independent information-seeking. While these programs play a crucial role in improving accessibility, the findings suggest a need to **strengthen educational support within such frameworks** to ensure that parents are equally informed.

The study also identified **variations in parental awareness regarding device care and maintenance**, which is a critical component of successful cochlear implantation. Proper handling, regular maintenance, and timely troubleshooting of the device are essential for ensuring optimal auditory input and preventing technical failures. Lack of knowledge in this area can lead to inconsistent device use and reduced effectiveness of rehabilitation (Pisoni et al., 2011).

At the same time, the absence of significant differences in **overall parental knowledge and educational understanding** indicates that counseling services and rehabilitation programs are successfully conveying foundational information. This aligns with the findings of Moeller (2000), who emphasized the importance of early and consistent parental involvement in improving language outcomes in children with hearing loss.

Despite these positive indicators, the presence of domain-specific knowledge gaps underscores the need for **targeted and structured parent education programs**. General awareness alone is insufficient; parents require detailed, practical, and continuous guidance to effectively support their child's auditory and language development.

In summary, the findings highlight a dual pattern:

- **Strength:** Uniform dissemination of basic knowledge
- **Limitation:** Uneven depth of understanding in critical areas

Addressing this imbalance is essential for maximizing the benefits of cochlear implantation and ensuring long-term rehabilitation success.

CONCLUSION

Based on the analysis and interpretation of data, the following conclusions are drawn:

- **Uniformity in Overall Knowledge**: Parental knowledge regarding cochlear implantation is generally consistent across different funding groups, indicating that basic awareness is effectively disseminated.
- **Presence of Domain-Specific Knowledge Gaps**: Significant gaps exist in specific areas, particularly in understanding the cochlear implantation process and device maintenance.
- **Limited Influence of Funding Source on Overall Knowledge**: The funding source (ADIP, CSR, or self-funded) does not significantly influence overall parental knowledge levels, although differences emerge in specific domains.
- **Higher Knowledge among Self-Funded Parents**: Self-funded parents demonstrate comparatively higher knowledge in certain areas, likely due to greater involvement and proactive information-seeking.
- **Need for Structured Educational Interventions**: The findings emphasize the importance of developing structured and continuous parent education programs to address knowledge gaps and enhance rehabilitation outcomes.

Overall, the study concludes that while awareness levels are encouraging, **targeted interventions are necessary to ensure comprehensive parental understanding**, which is essential for the long-term success of cochlear implantation.

ETHICAL CONSIDERATIONS

Ethical principles were strictly followed throughout the research process to ensure the rights and well-being of participants.

- Participation in the study was **voluntary**
- **Informed consent** was obtained from all participants prior to data collection
- Participants were assured of **confidentiality and anonymity**
- Data collected were used **solely for academic and research purposes**
- No personal identifiers were disclosed in the reporting of findings

These measures ensured adherence to ethical standards in educational and social research.

EDUCATIONAL IMPLICATIONS

The findings of the study have significant implications for educators, audiologists, rehabilitation professionals, and policymakers involved in cochlear implantation programs.

1. **Development of Structured Parent Training Programs:** There is a strong need to design and implement **systematic parent training modules** that cover all aspects of cochlear implantation, including the surgical process, device handling, mapping, and rehabilitation strategies. These programs should be practical, interactive, and tailored to different literacy levels.

2. **Strengthening Counseling Services:** Hospitals and rehabilitation centers should enhance their **pre- and post-implant counseling services**. Counseling should not be limited to initial stages but should be a continuous process, providing parents with updated information and support throughout the rehabilitation journey.
3. **Awareness Programs on Government Schemes (ADIP):** Efforts should be made to improve awareness and understanding of government initiatives such as the ADIP scheme. This includes not only informing parents about eligibility and benefits but also guiding them through the process and expectations associated with the program.
4. **Continuous Monitoring and Follow-Up:** Regular follow-up sessions should be conducted to monitor parental understanding and address emerging challenges. Continuous engagement helps reinforce knowledge and ensures consistent application of rehabilitation practices at home.
5. **Use of Multilingual and Accessible Resources:** Educational materials should be developed in **local languages (Marathi, Hindi, etc.)** and presented in simple, user-friendly formats to ensure better comprehension among parents from diverse backgrounds.
6. **Collaborative Approach in Rehabilitation:** Effective rehabilitation requires collaboration among **parents, teachers, audiologists, and speech therapists**. Schools and therapy centers should actively involve parents in the educational and therapeutic process to enhance outcomes.
7. **Bridging Urban–Semi-Urban Knowledge Gaps:** Special attention should be given to semi-urban regions like Nasik, where access to information and services may be comparatively limited. Targeted outreach programs can help reduce disparities in knowledge and support.

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