EVALUATION OF EXPENDITURE TOWARDS COCHLEAR IMPLANT

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A Masters Dissertation Submitted in Part Fulfilment of

Degree of Master of Science (Audiology)

University of Mysore, Mysuru

ALL INDIA INSTITUTE OF SPEECH AND

HEARING MANASAGANGOTHRI,

MYSURU – 570 006

September 2023

CERTIFICATE

This is to certify that this dissertation entitled 'EVALUATION OF EXPENDITURE TOWARDS COCHLEAR IMPLANT' is a bonafide work submitted in part fulfilment for the degree of Master of Science (Audiology) of the student with Registration Number **P01II21S0077**. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru

September, 2023

Dr. M. Pushpavathi

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Mysore
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DECLARATION

This dissertation entitled ‘EVALUATION OF EXPENDITURE TOWARDS COCHLEAR IMPLANT’is the result of my own study under the guidance of Dr. Manjula. P, Professor of Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier to any other university for the award of anyother Diploma or Degree.

Mysore

Sept. 2023

Registration No. PS01II21S0077

Dedicated to my father

Dedication to a Father:

In heartfelt acknowledgment, I pay tribute to the guiding light of my life, my beloved father. Your unwavering support, boundless wisdom, and unconditional love have shaped me into the person I am today. You have been my rock, my mentor, and my inspiration, showing me the true essence of strength and compassion.

With a heart full of gratitude, I dedicate my achievements and successes to you, knowing that they are a reflection of the values you instilled in me. Your sacrifices and hard work have paved the way for my dreams, and I am forever indebted to you for the opportunities you've given me.

As I journey through life, I carry your teachings with me – the importance of integrity, perseverance, and kindness. Your presence in my life has been a blessing beyond measure, and I strive to make you proud in all that I do.

Though words may fall short in capturing the depth of my appreciation, please accept this acknowledgment as a token of my everlasting love and respect. Here's to you, my dearest father, the embodiment of strength, love, and endless support.

Words cannot describe the strength, guidelines that you have given to me ,**I K**now if world is against me ,you will stand by me .

I thank my mother who made me as a Resilient girl .

Everybody has special friend and who will be internal part of our life , cheers to my 21 years of friendship. From going to school together and talking about future ,over the years you came across all emotions in me, thanks for baring my idiotic things sincere thanks to my dearest friend **Chiranth** .

To all my cousins' # KK members, your unwavering belief in me has fueled my determination to achieve my goals.This dedication is a tribute to the cherished memories we've created together, the laughter we've shared, and the support we've provided for each other. May our bond continue to grow stronger with each passing day.

As I reflect on the moments we've shared, I am reminded of the beautiful moments that have shaped our relationship. Thank you **Theju attige** who has been my listening ear .And special mention to **Akku** baby for special lecture in perspective of life yet it was boring sometime and usefull though.

I thank my girls who made my college life more memorable **(chuppi, kulli, kasthu, dhana, varsha, puttgowri & likhi.)**

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Chapter 1

INTRODUCTION

Cochlear implant has become a popular rehabilitation option for individuals with severe to profound hearing loss. Children with hearing impairment who receive an implant in the first couple years of life develop excellent speech and language skills (Ching et al., 2013). A cochlear implant bypasses the impaired cochlea and stimulates the auditory nerve electrically. In the majority of cases of sensorineural hearing loss, the primary site of lesion is localised to the cochlear hair cells, which are auditory sensory cells, or to the structures that support the electrochemical environment within the cochlea that is required to allow for effective stimulation of the hair cells.

When cochlear implants were first made available in the early 1980s, only those with profound or severe to profound sensorineural hearing loss were candidates (Niparko et al., 2009). The selection criteria for candidates have been updated through years because to advancements in technology, surgical procedures, and the intervention's proven safety and efficacy. More people with residual hearing are now eligible for cochlear implantation.

A cochlear implant is an expensive device, but proven to be cost effective (O'Neill, 2002). Cochlear implant is a rehabilitation option to the individuals who meet the eligibility criteria such as audiological, radiological and medical selection criteria. This rehabilitative option is not affordable to most of the patients in our country. The expenses involved for a CI such as hospital admission, surgical cost, device cost, and post-implant mapping and rehabilitation keep the cochlear implants out of reach for the

millions of individuals with hearing impairment in the developing countries (Wilson & Dorman, 2008)

The main hurdle to procure the CI is the cost of the device, both initial and maintenance of the device. Parents / implantees face difficulties once they start using the device. These difficulties may include the cost of device upgrade, spares and service/ repair due to the common complaints regarding device functioning intermittently/ battery not getting charged/ device getting dropped and not working, etc. At the time of pre-implant stage and at switch-on the implantees and care givers will be counselled regarding the device usage. In such situations, it is required that the parents/ implantees should be aware of the information on parts of the devices and their maintenance cost. Cochlear implant (CI) requires long-term financial cost to ensure that the devices always functions optimally and to use it regularly.

Cochlear implantation needs long term assistance in maintaining the device. The maintenance phase, with its associated every day running costs of the device and regular maintenance of it, will continue throughout the implantee's lifetime. Improvements in technology continue to be made and the maintenance phase will also involve a degree of replacement and upgrading of processors over time (Hutton et al., 2015). Upgrading the externally worn speech processor allows implantees access to improved technology and also ensures that they are able to continue using their implant even after older speech processors become obsolete. The rehabilitation and maintenance phases are of particular importance, when considering long-term use and benefit from cochlear implantation.

A cross sectional study was done by (Noblitt et al., 2018) to access barriers in audiology and speech and language pathology who had undergone cochlear implant surgery from 1993 to 2013. Out of 35 parents, 21 parents were from rural residents and

14 were urban residents. Travelling was most crucial factor for the parents of rural sector compared to urban sector. And out of 100 children who had undergone CI, 17 parents reported difficulties in usage of CI for the following reasons:

1. Two children reported sweating to be a cause of discomfort in wearing CI

2. Two children reported of head ache after using CI in their study.4 3. Thirteen children reported improper functioning of speech processor of CI as a reason for irregular use.

In a Questionnaire survey by (Noblitt et al., 2018) more than 90% of parents reported regarding the knowledge of operating the device and had a basic knowledge about trouble shooting the device and also in reassembling the components of the implant. 76% of parents had knowledge regarding the warranty of the device. All the parents knew whom to contact in case of difficulty or trouble in usage of the implant. Only 62% of parents were able to buy the spare parts components for their children

In the current study, 80% of parents have been involved in parent empowerment programs conducted by the centre, remaining parents have reported regarding difficulties in travelling as the primary factor for not attending the programs. 58% of the parents were able to provide financial support for the child with CI along with his/ her typically developing siblings. According to the current study, travel distance was the primary barrier to routinely attending to therapy appointments. 98% of parents reported that visiting for rehabilitation was a barrier. The parents felt difficult in making the required preparations for the remainder of the family, the parents of children with cochlear implantation were under pressure due to the lengthy travel time to and participate in rehabilitation and follow-up appointments.

38% reported that their children not able to wear the cochlear implant due to the spare components being broken or repaired and they needed long-time to afford the spares parts. Parents also reported that children need long-term to adjust to the implant after the replacement of new accessories.

In a study by Punch and Hyde (2011) parents reported about persistent issues with implant malfunctioning and components needing to be changed often when these could not be rapidly replaced, it was difficult for both implantees and parents.

Balakrishnan and Thangaraj (2023) also reported that the successful outcome of the child fitted with cochlear implant depends on the financial status of the parents to provide continuous support for rehabilitation and the maintenance of the implant.

Need for the study

Cochlear implantation is an expensive rehabilitative option but cost-effective intervention. It can provide individuals with severe-to-profound hearing impairment with better sound perception in comparison to that obtained with the hearing aids. Therefore, cochlear implant team members must ensure that those who are eligible and those who benefit from the amplification device (cochlear implant) should be aware of the immediate and future costs involved in the long-term maintenance of cochlear implant (Kerr et al., 2012) .

The expenditure involved for cochlear implantation must take into account not only the initial expenditure but also cost for the maintenance expenditure (Thum et al., 2020). This aspect should be a part of pre-implant and post implant counseling. Generally, certain post-surgical management cost of the CI is covered under warranty for a specific duration. After warranty period, the parents of cochlear implantees are

supposed to maintain the expenses of their child's implant accessories / repair with their own funds. Therefore, it is essential for the parents to understand the expenses involved in the cochlear implantation and its maintenance in order to use the device optimally and efficiently. This is because the benefit from the CI is directly dependent on the regular and effective utilisation of the hearing device.

Many children have procured the cochlear implant under free schemes of the central government or state government. There is a dearth of scientific literature reports on the effective utilisation of government funds and parental satisfaction (Dutta et al., 2020). There is also a need that the schemes allocate appropriate amount towards maintenance of the CI so that regular use of the device is ensured.

There are reports of discontinuing the use of the device as the caregivers cannot afford the maintenance cost involved. Therefore, it is necessary to analyse expenditure, initial and maintenance cost, on CI. The CI user needs to have regular visits to audiologists to find solutions to the problems related to the device, regarding spare and maintenance of cochlear implant (Telmesani et al., 2022). The audiologist will be able to guide regarding the appropriate steps to be taken.

The results of the present study can serve as a baseline for economic evaluations such as maintenance cost for devices, spares and repair of CI. This can be considered while setting the package cost of cochlear implant per beneficiary in free Cochlear Implant schemes.

Aim of the study:

To conduct a study on expenditure on cochlear implantation from the point of view of a client.

Objectives of the study

1. To collect information on pre-cochlear implant expenditure
2. To collect information on hospital and device cost of the cochlear implantation
3. To collect information on post-cochlear implant mapping and rehabilitation expenditure.
4. To estimate the cost for spares and repair/ service of the cochlear implant.

Chapter 2

REVIEW OF LITERATURE

Cochlear implant (CI) is for life time use. As such long-term care and maintenance is essential. CI being an expensive device, there expenditure involved from pre-implant assessments to surgical & device cost, to mapping & rehabilitation cost, and the cost involved in maintenance. Many governments funded schemes aid only for the device and the surgery cost. And the maintenance cost of the device will have to be borne by the caregivers/ parents.

There are several funding schemes for CIs in the country, viz. ADIP scheme of Ministry of SJ&E, RBSK/ NPPCD funding, etc. Though in some of these schemes, cost involved in pre-implant assessment, surgery & device, mapping & rehabilitation, and maintenance expenditure are covered, only a few implement. Thus, it is imperative that audiologists give an idea on the expenditure involved in cochlear implants from the point of view of the patient/ caregiver. The policy makers also require an idea on the cost involved in cochlear implant. This helps in budgeting in the funding schemes.

Different funding schemes allocate money for cochlear implantation per beneficiary. Eg. The approved rate by NPPCD of Karnataka state is Rs.6,17,000/- that covers pre-implant assessments, cochlear implant device, surgery, initial switch on, mapping, and Auditory Vrbal (AV) therapy for one year, food, travel, and wage loss for the parents and motivational costs to ASHA workers (HEALTH Government of Karnataka , 2022; Ministry of Social Justice & Empowerment Department of Disability Affairs, 2022) .

The ADIP Scheme recognizes a national institute from each zone to recommend children eligible for cochlear implants under the Scheme, with the Government funding a maximum of Rs.6.00 lakh.

A cochlear implant is a costly but effective lifelong option for people who have severe to profound hearing loss in both ears and who get limited benefit from the hearing aids. The major goal of this study was to collect information on the expenses of cochlear implantation.

A questionnaire and patient record review method were used to survey individuals (n=154) who had received cochlear implants from the University of Stellenbosch-Tygerberg Hospital Cochlear Implant Unit in Cape Town, South Africa. Total average cost is calculated for the first five to ten years. Ten years is the maximum period considered in the study during which the information on estimated expenditure for spares and repairs of the cochlear implant was collected. The most expenditure was spent on batteries followed by spare parts and travel for both adults and children cochlear implantees.

In their study, the cost of batteries was impacted by the sound processor that was used. Battery prices were often lower for body-worn devices than for ear-level sound processors. The ear-level processors were more expensive. The costs for ear hooks, magnets, drying kits, snug-fits, cables, and coils have been studied as part of the spare parts analysis in their study. Those individuals who had implants for more than two years had spent R276 (~Rs.1200) annually on spares on an average. Though varied on an individual basis, with some members incurring no costs, and other individuals pay out R916 (~Rs.4000) annually. On an average, spares costed more for children, particularly

three to five years after implantation. Over a period of ten years, the average cost of cables and coils was R2 838 (~Rs. 3600).

Repair costs: The sound processor required R3000 (~Rs.13000) for repairs on an average per year. Especially after six years, the percentage of devices in need of maintenance rose. Most devices required only one repair over the 10-year period.

Processor up gradation: The second-highest expense involved, amounting to over 40% of the initial system cost, was upgrading the sound processor. Eleven individuals who had been implanted for over twenty years had at least upgraded twice, while two individuals had three upgrades and one had four. More than half of those who had implants for between fifteen and twenty years had undergone two upgrades. Every person who had been implanted for over fifteen years had undergone at least one up gradation. With over a quarter upgrading twice, most of the participants who had implants for between 11 and 15 years had upgraded at least once. More than half of the individuals who had been implanted for six to ten years had upgraded their sound processor, the majority once and a few, twice. Most participants whose sound processors had been in use for less than five years had not been replaced (Kerr et al., 2012).

To investigate the prevalence and types of cochlear implant repair concerns in children who have worn either the body-level or ear-level design for 4 to 5 years, data were analyzed for children who received cochlear implants from one of the investigators between 1994 and 2002 and who had 4 to 5 years of follow-up for either the body- or the ear- level design. Implant issues were related to internal components and external components. The batteries, case, ear hook, cords/cables, microphone, speech processor, coil, and/or external magnet were further classified as external component related; the

internal magnet, electrode(s), or other were further classified as internal component related difficulties.

18.2 %, had issues with internal components. The annual repair rate for the external components was 4.1 %for the body style and 2.7% for the ear-level type respectively. The average number of repair issues decreased throughout that time for the body-worn and ear-level implants, respectively, for the group of children who were followed up with every four years, by 32% and 43%, respectively. Based on 4 and 5 years of usage of the implant, the mean annual repair cost for body-worn and ear- level types was $794 and $317 (Silverman et al., 2010).

Direct costs of CI in adults included preoperative costs of outpatient visits related to audiological evaluations and radiological examinations were 20,217 crowns (5% of the estimated total cost of the first year). The primary implant procedure (hospitalization, surgery, and implant) was 366,406 crowns. Re-hospitalization for surgical treatment was the most important expenditure and were 19,237 crowns (Rs.70196) (i.e., 4% of the total costs of the first year).

Post-operative costs related to device activation, fitting and audiological monitoring in the first year after implantation was 23,780 crowns (Rs.86773) 6% of total costs. As a result, the total value of the expenses incurred in the first year was estimated at 429,640 crowns. In addition, long-term costs of the device and especially the costs associated with the annual routine monitoring of device added about 107,535 crowns (Rs.392395)**.** Including possible costs over a longer period thus yielded a discounted total cost of crowns in 537,175(Rs.1960152) adult CI recipients (Neilson, 2006).

Cochlear implantation is regarded as an expensive procedure. In contrast, a methodical review of the economic assessments and cost analyses of cochlear

implantation published between 1995 and 2001 found that, out of a possible 48 studies, 26 were included. Cochlear implantation is more expensive than other medical treatments, regardless of age (Costa et al., 2011).

Even though the research was carried out in various nations, the assumption was that the cochlear implant was determined to be a cost-effective course of action in a unilateral implant case for adults and children who are bilaterally profoundly deaf (O'Neill, 2002).

Cochlear implantation involves several expenses in addition to the cost of the implant system itself. The implementation process is typically divided into four parts for economic evaluation purposes: pre-implant evaluation, implantation, maintenance and rehabilitation. There are expenses related to each stage. Before the procedure may start, clients must visit specialized centres where cochlear implants are implanted. The service is only offered in a few places because it is so specialized. Centres and prospective implantees could have to travel long distances to find a suitable facility in their vicinity (Hutton et al., 2015).

The candidacy process starts with pre-implant ENT and audiological assessments, pre-implant speech and language evaluation, clinical psychological evaluation, radiological evaluation (CT/MRI) and other tests when indicated (Niparko et al., 2000). Implantation phase includes surgery (electrode insertion) and post-operative care for 2-3 days. Switch on date varied from 10 to 16 days (about 2 and a half weeks) after the post-surgery (Clark et al., 1997).

The mapping of the device, followed by routine visits for auditory rehabilitation and, for children, speech and language therapy as well as other therapies that may be necessary, starts of the rehabilitation phase after the device has been activated.

Rehabilitation continues to be an essential and fundamental part of a child's development despite technological advancements and better results. Cochlear implants have advanced, but they still cannot provide auditory experiences that are exactly like those that originate from a normal auditory system. Aural rehabilitation is therefore a crucial step in the overall rehabilitation process for those who use cochlear implants because they get a special electrical auditory signal. (Kerr et al., 2011) that stimulates the auditory nerve directly.

Rehabilitation continues until an implantee reaches their full potential. While post-implant rehabilitation is crucial for everyone who receives a cochlear implant, children require particular care and maintenance, some of them require continuous support during their education. In addition, other important considerations include the family's social environment and the availability of schooling support. Hence, Cochlear implantees require long-term care and maintenance (Hutton et al., 2015).

Chapter 3

METHOD

The goal of the study was to investigate the expenditure involved in cochlear implantation from the client's point of view. For this, the study was carried out in two phases. Phase I involved the development of questionnaire to assess the pre-implant, implantation, and post implant cost involved in cochlear implantation. Phase II involved administration of the questionnaire and analysing the responses.

Phase I: Development of Questionnaire

Literature was explored in order to list out the aspects on which expenditure was incurred by recipient/ caregiver towards cochlear implantation. Based on this, a questionnaire was developed in English language to include questions seeking information on pre-implant, implantation and post implant charges. This questionnaire was meant to be used to interview the clients/ caregivers of cochlear implant.

The questionnaire included four domains:

a. Client and device details
b. Pre-implant expenditure
c. Implantation expenditure
d. Post- implant expenditure

The fourth domain i.e., post implant expenditure included questions regarding expenditure that was common to devices from all four cochlear implant makes. It also included questions specific to the different makes. In total there were 90 questions. Even though there were 90 questions, any single case would be using a device of specific

make. Hence any single case would have had to answer company specific questions. The total number of questions varied as follows:

1. For cochlear implants from Advanced Bionics India Pvt. Ltd
    - Marvel CI (26 common questions + 4 model specific questions)
    - Naida CI (26 common questions + 2 model specific questions)
    - Harmony CI (26 common questions + 2 model specific questions)
    - Neptune CI (26 common questions + 3 model specific questions)
2. For cochlear implants Cochlear Medical Device Company India Pvt Ltd
    - CP802 (26 common questions + 5 model specific questions)
    - CP910 (26 common questions + 3 model specific questions)
    - Freedom (26 common questions + 4 model specific questions)
    - Kanso (26 common questions + 1 model specific question)
    - Kanso 2 (26 common questions + 3 model specific questions)
    - N7 (26 common questions + 2 model specific questions)
    - N8 (26 common questions + 2 model specific questions)
3. For cochlear implants Otic hearing solutions Pvt. Ltd
    - Saphyr and Saphyr neo (26 common questions + 5 model specific questions)
4. For cochlear implants MED-EL India Pvt Ltd
    - Opus 1 (26 common questions + 4 model specific questions)
    - Opus 2 (26 common questions + 3 model specific questions)
    - Rondo and Rondo 2 (26 common questions + 3model specific questions)
    - Sonnet (26 common questions + 2 model specific questions)

    Only that were relevant to the make of their device.

5. Pre-implant charges:

Pre-implant charges include charges for different evaluations which are necessary to decide on the CI candidacy. Generally, before the cochlear implantation, the routine tests include ENT evaluation, audiological evaluation, speech and language evaluation, radiological evaluation, and speech-language & listening training. Additional tests such as from an ophthalmologist, paediatrician, clinical psychologist (especially in case of children), Orthopedic surgeon, Physio therapist (PT) / Occupation therapist (OT), neurologist are warranted when indicated. In addition, cost for immunization and laboratory investigations are also involved.

- Pre-implant audiological evaluation: Pre-implant audiological evaluation includes pure tone audiometry, speech audiometry, tympanometry, otoacoustic emission (OAE) test, Auditory Brainstem Response (ABR) measurement.
- Pre-implant speech and language evaluation includes receptive and expressive language age of the child.
- Pre-implant clinical psychological evaluation involves child's IQ /DQ/SQ (intelligence quotient, developmental quotient, Social Quotient) assessment.
- Pre-implant radiological assessment: The protocol of CT and MRI of temporal bones and auditory pathways to include the following sequences:
  - HRCT of both temporal bones
  - Cochleogram – 3D reconstruction, Axial, coronal, and sagittal oblique CISS sequences; axial T2 weighted sequence through the brain; 3D reconstruction through the cochlea and semicircular canals and 1 mm axial and coronal reconstructions through petrous temporal bones.

6. Implant charges:

An implant surgery cost include expenditure for the device, surgery, and hospital charges intraoperative measurements, post-operative X-ray/ CT scan, and medications.

3. Post-implant charges:

Post-implant charges include post-implant charges for different procedures/ evaluations which are necessary, such as switch-on, mapping, audiological evaluation, and speech and language evaluation and therapy. Further, PT/OT (if any), maintenance, re-implantation (if any) and up gradation (if any) cost are also included. Other expenditure included are travel, food, accommodation and wage loss.

Relevant questions for cochlear implantation were framed based on the information available in literature. The questions were either of multiple choice or open-ended types. Post-implant charges include company specific charges for different makes of cochlear implant. They were Advanced Bionics, Cochlear Nucleus, Med El, and Neurelec - Digisonic

The details of the Questionnaire are as follows: It consisted of consists of a total of 90 questions.

- Question number from 1 to 5 included basic demographic details of the participant/ recipient and the device. Viz., Name of the cochlear implantee, E-mail, phone number, name of the caregivers/ recipient, and model & serial number of the implant and speech processor.
- Question number from 6-10: include pre-implant cost involved in evaluations such as pre-implant audiological, speech and language, ENT

consultation, pre-implant radiological evaluations, and any other assessments when indicated.

- Question number from 11-15: include device charges, contains implant/hospital charges, post-implant radiological expenditure, and expenditure spent on dressing, medications.
- Question number from 16-22: include post-implant charges, contains switch-on charges, travel, food & accommodation charges, re-implant charges (if any), and post implant rehabilitation service (viz. listening, speech & language therapy, PT/OT etc.).
- Question number 23-38: include maintenance and spare parts cost which is common to all four companies/makes of cochlear implant mentioned above.
- Question number 39: Has company/make and model specific expenditure. The participant has to choose the CI model which they are using and questions relevant to that specific make only will be included.

Question number from 40-62: Cochlear Medical Device Company India Pvt Ltd

- Specific model speech processor questions include spares parts other than common questions.

Question number from 63-72: MED-EL India Pvt Ltd

- Specific model speech processor questions include spares parts other than common questions.

Question number from 73-84: Advanced Bionics India Pvt. Ltd

- Specific model speech processor questions include spares parts other than common questions.

Question number from 85-90: Otic hearing solutions Pvt. Ltd

- Specific model speech processor questions include spares parts other than common questions.

Phase II: Content Validation of Questionnaire -

The Questionnaire was titled 'Questionnaire on expenditure towards cochlear implant'. Before this questionnaire was administered on the implantees /caregivers, content validity was evaluated. This questionnaire was validated for content by three qualified audiologists who had a minimum of five years of experience in the field of cochlear implant. The suggestions provided by them are in Table 3.1. The content validation was performed by these audiologist based on the Content validation questionnaire. Items in the questionnaire that were accepted were retained, items suggested to be included were also introduced, some of the rejected items were included and the reason is provided in the last column of Table 3.1.

Table 3.1: Suggestions from audiologists for content validation of questionnaire.

Sl. No.	*Question*	*Accepted*	*Rejected*	*Reason for including in the study*
1.	Name of the cochlear implantee	✓		
2.	Name of the care giver	✓		
3.	E-mail & mobile no.	✓		
4.	Model & Serial no. of the implant, Model & serial no. of the speech processor	✓		
5.	Duration of the implant use	✓		
6.	Pre-implant audiological test expenditure	✓		
7.	Pre-implant speech & language test expenditure	✓		
8.	Pre-implant clinical psychological evaluation expenditure	✓		
9.	Pre-implant radiological evaluation expenditure	✓		
10.	Hospital /implant charges	✓		
11.	Pre-surgical lab test expenditure	✓		
12	Surgical expenses (dressing, additional charges)	✓		

13	Post switch-on expenditure	✓
14.	Food and accommodation expenditure	✓
15.	Re-implantation (if any) expenditure (Model & serial no.)	✓
16.	Post-implant radiological evaluation expenditure	✓
17.	Mapping & Rehabilitation service expenditure	✓

Common questions to all the participants

18.	Microphone guard/ cover expenditure	✓
19.	Magnet expenditure	✓
20.	Processor up gradation expenditure (Model)	✓
21.	Dry aid kit expenditure	✓
22.	Coil cable expenditure	✓
23.	Batteries (rechargeable and non-rechargeable) expenditure	✓
24.	Processor repair expenditure	✓
25.	Processor service expenditure	✓

26.	Travel charges	✓	✓	This question was retained, as most of the expenditure incurred by the parents was on travelling charges.
27.	Name of the scheme that the child got implanted through	✓		
28.	Bilateral CI (sequential or simultaneous)	✓		
29.	Charges involved for bilateral CI	✓		

Questions on company specific model (Maintenance cost)

	Cochlear Nucleus CP802 (N5)			
30	Battery charger	✓		
31.	Safety line	✓		
32.	Sleeve	✓		Included after content validation.
33.	Snugfit	✓		

34.	Earhook	✓		
	Cochlear Nucleus CP910 (N6)			
35.	Lite wear cable	✓		
36.	Earhook	✓		
37.	Snugfit	✓		
	Cochlear Nucleus Freedom			
38.	Baby worn audio cable	✓		
39.	Body worn controller	✓		
40.	BTE controller	✓		
41.	Snugfit	✓		
	Cochlear Nucleus Kanso			
42.	Safety liner	✓		
	Cochlear Nucleus Kanso 2			
43.	Socket cover	✓	✓	Included to check on the items used or not used (with least expenditure or no

			expenditure)
44.	Charger cable	✓	
45.	Safety line	✓	
	Cochlear Nucleus N7		
46	Snugfit	✓	
47.	Earhook	✓	
	Cochlear Nucleus N8		
48.	Ear hook	✓	
49.	Snugfit	✓	
	Med-El		
50.	Decapo frame		Included after content validation
	Med-El Opus 1		
51.	Activity cover	✓	
52.	Safety lock	✓	
53.	Ear hook	✓	
	Med-El Opus 2		
54.	Safety lock	✓	

55.	Earhook	✓		
	Med-El Rondo/Rondo2			
56.	Attachment clip (clothes/ hair)	✓		
57.	Water resistant wear	✓	✓	Included to check the items used / not used (with least expenditure or no expenditure)
	Med-El Sonnet			
58.	Huggie /ear hook/ ear clip	✓		
	Advanced bionics Marvel CI			
59.	Head piece	✓		
60.	Aqua kit	✓		
61.	Miscellaneous accessories (snuggie, earhook, T-Mic, etc.)	✓		
62.	Connectivity accessories (Roger select, connectivity mic, acoustic ear hook etc.)	✓		
	Advanced Bionics Naida CI			

63.	Aqua kit	✓
64.	Connectivity accessories (Roger select, connectivity mic, acoustic ear hook etc.)	✓
	Advanced Bionics Harmony CI	
65.	Head piece	✓
66.	Connectivity accessories (T-Mic, Snuggie, Connectivity Mic, Acoustic ear hook, etc.)	✓
	Advanced Bionics Neptune CI	
67.	Head piece	✓
68.	Acoustic coil cable	✓
69.	Miscellaneous accessories (Clip, Covers)	✓
	Digisonic (Saphyr and Saphyr neo)	
70.	Antenna cable	✓
71.	Miscellaneous accessories (Protective case, Tester tool, microphone earphones)	✓
72.	Cover clip	✓
73.	Huggie	✓

74.	Ear gear	✓	Included after content validation

The common questions were selected based on the frequent expenditure spent on maintenance of CI by the implantees irrespective of the model/make of the cochlear implant. In a study (Silverman et al., 2010 to investigate the prevalence and types of CI repair concerns in children who had worn either the body-level or ear-level CI design for 4 to 5 years. Data were analysed for children who received CIs from one of the investigators between 1994 and 2002 and who had 4 to 5 years of follow-up. Implant issues were divided into internal and external categories. The batteries, case, ear hook, cords/cables, microphone, speech processor, coil, and/or external magnet were classified as external difficulties; the internal magnet, electrode(s), or other internal parts were classified as internal difficulties.

18.2% had issues with internal components. The annual repair rate for the external components was 4.1% for the body level type and 2.7% for the ear level type. The average number of repair issues decreased throughout that time for the body worn and ear level devices, for the group of children who were followed up with every four years, by 32% and 43%, respectively. Based on 4 and 5 years of usage of the implant, the mean annual repair cost for body worn and ear level types was $794 and $317 (Silverman et al., 2010).

Questionnaire was accepted based on the rating given by the audiologists during content validation.

A rating scale on a five-point rating scale with the given parameters;

1. **Relevancy:** Whether the material is culturally and ethically acceptable?
2. **Coverage of parameters:** Does the resource material contain the essential domains to be assessed in CI candidates?
3. **Simplicity:** Are the questions comprehendible?
4. **Presentation:** Are the number of questions in each section placed properly?
5. **Total questions:** Is the overall number questions appropriate?
6. **Accessibility:** Are the questions user-friendly?
7. **Flexibility:** Can the questions be easily modified?

The questions that were rated on different parameters based on a five-point rating scale by the audiologists during content validation. The rating scale is given below. The questions retained in the questionnaire were those questions which was marked **'strongly agree'** and **'agree'** and for the questions with **'disagree'** as an answer, relevant suggestions were taken and the questions were modified.

Strongly agree	Agree	Neither agree nor disagree	disagree	Strongly disagree

Later the questions were administered on four caregivers, one caregiver for the child using each of the four CI makes. Their suggestions were as follows:

1. Expenditure was spent on post-implant surgery for dressing, medications for wound site

Infection.

2. Expenditure was spent on food and accommodation.

3. Expenditure was spent on travel.

These suggestions were recommended by the caregivers and the same were incorporated in the final questionnaire.

Phase III: Administration of Questionnaire:

The Questionnaire on Expenditure borne by the implantee towards cochlear implant was administered on caregivers/implantees who were the participants of this study. The participants were in the following three groups

Group A participants: Caregivers of children with less than three years of cochlear implant use

Group B participants: Caregivers of children with three to five years of cochlear implant use

Group C participants: Caregivers of children with greater than five years of cochlear implant use.

General oral instructions were provided. Informed consent was taken before administering the questionnaire. Basic frame of the questionnaire was prepared in Google document format. The structure of the final questionnaire included 1. Demographic details, 2. Pre-implant charges and 3. Post-implant charges using company/model specific questions.

The interview method, either face-to-face (direct) or telephonic, was used to elicit the answers for the items in the questionnaire. A direct interview method was used where the investigator administered the questionnaire directly to the participants and answers/responses were recorded by the investigator in Google form.

Telephonic interview method was also included in the study to collect the information from those who are not available for direct interview method.

The validated questionnaire was administered on caregivers of cochlear implanted children. General instruction was provided before administering the questionnaire. The investigator informed the participants regarding the following:

1. The investigator introduced herself to the participants
2. First participants were introduced to the goals of the study and how the study will help the recipient.
3. Explained with the need of the study
4. Participants were assured regarding the information confidentiality
5. Informed consent was taken from each participant before administering the questionnaire.

The questionnaire consisted of general questions applicable to all participants. It also consisted of model specific questions. The participants were asked name and serial number of the model. The rest of the questions were based on the model of the cochlear implant. The participants were required to answer the relevant questions concerning the particular model. Some of the questions were given multiple choice option and some questions were answered in sentences or words descriptively.

3.1. Aim of the study:

To estimate the recipient borne expenditure involved in cochlear implantation.

3.2. Specific objectives of the study:

3.2.1. To develop questionnaire on expenditure towards cochlear implant

3.2.2. To estimate the expenditure involved for pre-cochlear implant Evaluations

3.2.3. To estimate the expenditure involved in switch-on and mapping of cochlear implant

3.2.4. To estimate the expenditure involved in post-cochlear implant mapping and rehabilitation.

Chapter 4

RESULTS & DISCUSSION

The study investigated the information regarding expenditure involved towards cochlear implant, from the point of view of the patient. The study included 104 participants, who were parents of children using cochlear implants. A google form (questionnaire) was administered in order to seek information on expenditure involved in various stages of cochlear implantation, viz., Pre-implant assessments, Implantation, and Post implantation mapping & therapy, maintenance of the device, food, accommodation, and travel. The results of study are discussed in the following sections.

1. Name of the cochlear implant and speech processor:

The cochlear implants being used by the children of the participants were from four different manufacturers. Table 4.1 gives the number of participants using different models of speech processors. The participants were not aware of the implant model being used by their children. The information about implant model, implant serial number, and processor serial were not known to the participants. A few participants did not even know about the model of the speech processor that their child were using. They were told to check the model name in the kit provided by the company and also mentioned in the mapping book.

Table 4.1: Number of participants using different models of speech processors

Make (no. of CI users)	Model of speech processor	No. of children using CI
Advanced Bionics (11 nos.)	Neptune CI	3
	Marvel CI	1
	Naida Sky Q30 CI	5
	Harmony CI	2
Cochlear (65 nos.)	CP 802	52
	CP 810 / N5	2
	CP 910 / N6	8
	Freedom	1
	Kanso (CP 950)	1
	Kanso 2 (CP 1150)	1
Otic Medical (2 nos.)	Saphyr/ Saphyr Neo	2
Med El (26 nos.)	Opus 1	1
	Opus 2	23
	Sonnet	1
	Rondo 2	1
	Total	**104**

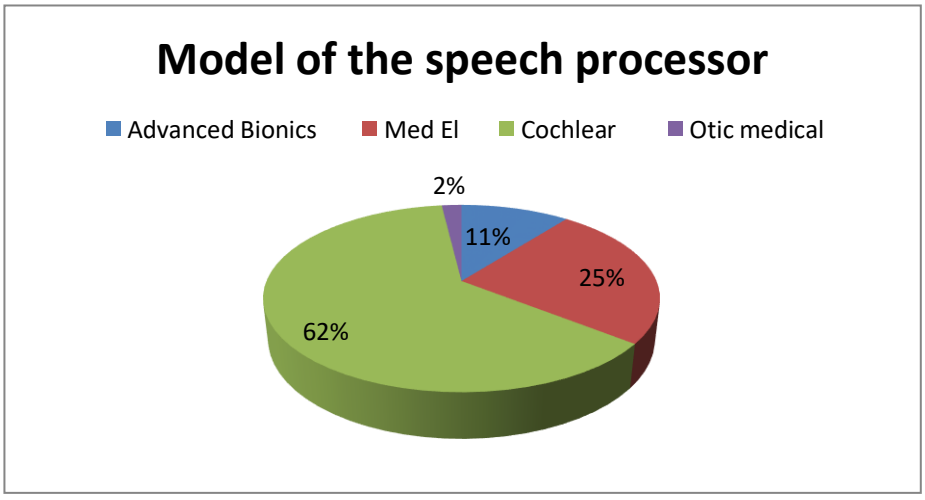

Figure 4.1: Number of implantees using different makes of CI

From Table 4.1 and Figure 4.1, it was noted that out of 104 participants, 65 participants were using devices from Cochlear Medical Device Company India Pvt. Ltd., 26 participants were from Med-El India Pvt. Ltd., two from Otic hearing solutions Pvt. Ltd., and 11 from Advanced Bionics India Pvt. Ltd. Of these 104, four children were using bilateral CI. All four were sequential users, the second CI was added within last one year. There was no expenditure incurred for the second implant. Hence, the second CI was not considered in computing the expenditure.

2. Ear implanted:

Out of 104 participants, 85 children had right ear implanted, 15 children had left ear implanted, and remaining 4 were bilaterally implanted. Table 4.2 gives these details.

Table 4.2: Number of children with right/left/bilateral ears implanted

Ear implanted	No. of children using CI
Both ears	4
Left ear only	15
Right ear only	85
Total	**104**

Right ear cochlear implantation is preferable to left ear implantation and it is advised to select the right ear in cases of bilateral severe/profound deafness of the same degree and no anatomical anomalies in either ear for the cochlear implant (Mohammed & Sarwat, 2014). This is because of handedness, those with right handedness (i.e., right handed cases will find it easier to operate the device on the right ear) will have left hemisphere dominant. Right ear advantage has also been reported in literature since majority of fibres from right ear travels to left hemisphere (Kraaijenga et al., 2017) .

3. Name of the scheme through which child got implanted:

There were participants using CIs availed through either state or central government schemes for free-of-cost. Other CI users in the study were self-funded. Table 4.3 gives the details.

Table 4.3: Name of the funding source through which the child got implantation

Source for funding	No. of children using CI
ADIP, Min of SJ&E, GoI	61
NPPCD/RBSK, GoK	26
Self-funded	17
Total	**104**

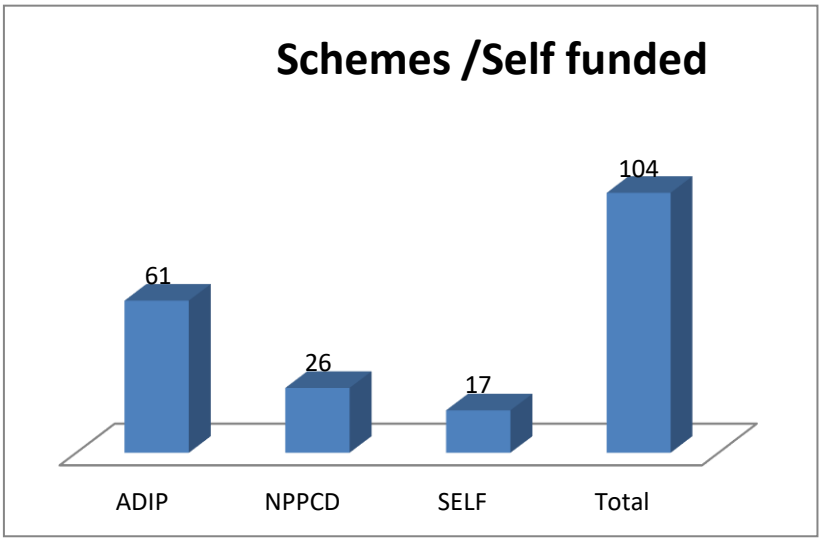

Figure 4.3: Name of the funding source through which the child got implantation

4. Duration of implant use:

Duration of CI use is an important factor for speech and language outcomes. In the present study, Table 4.4 depicts the number of participants who had different lengths of CI use.

Table 4.4: Duration of implant use by the children

Duration of CI use	No. of children using CI
Less than 6 months	38
6 months to 3 years	40
3 years to 5 years	11
Greater than 5 years	15
Total	**104**

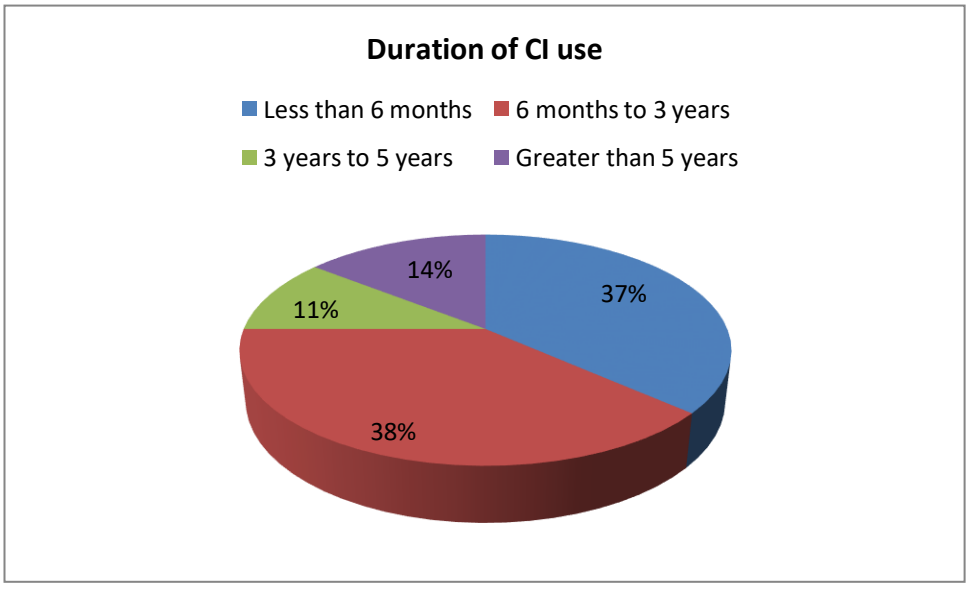

Figure 4.4 Duration of implant use by the children of the participants

Table 4.4 and Figure 4.4 depict that there were 38 participants with a duration of less than six months CI use, 40 participants were using the device between 6 months to 3 years. There were 11 participants between 3 to 5 years of CI use and 15 participants with greater than 5 years of CI use.

5. Expenditure involved in pre-implant audiological evaluation:

The expenditure towards pre-implant audiological evaluations is provided in Table 4.5.

Table 4.5: Expenditure involved for pre-implant audiological tests

Break-up of cost for pre-implant audiological tests	No. of children using CI
Free-of-cost	74
Rs. 10 to 1000	3
Rs. 1001 to 2000	1
Rs. 2001 to 5000	14
Rs. 10,000 to 30,000	12
Total	**104**

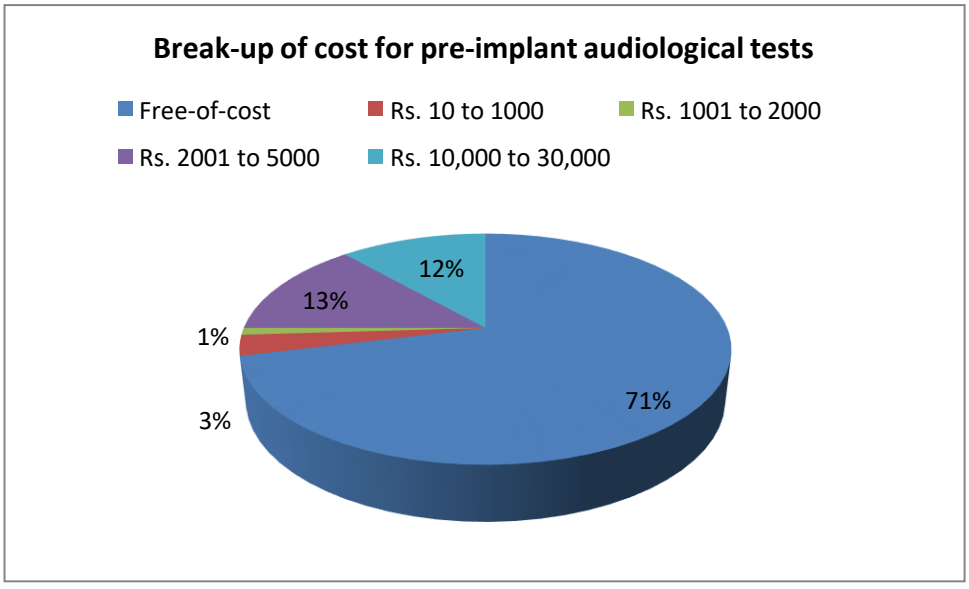

Figure 4.5: Expenditure involved for pre-implant audiological tests

From Table 4.5, it can be seen that 74 participants availed pre-implant audiological evaluations for free-of-cost. Three participants spent Rs.10 to 1000; one participant spent

Rs. 1001 to 2000; and 14 participants spent Rs. 2001 to 5000; 12 participants spent Rs.10,000 to 30,000 for pre-implant audiological tests.

6. Expenditure involved in pre-implant speech and language evaluations:

Expenditure involved in pre-implant speech-language assessments is provided in Table 4.6.

Table 4.6: Expenditure involved in pre-implant speech-language evaluations

Break-up of cost for pre-implant speech and language evaluations	No. of children using CI
Free-of-cost	96
Rs.10 to 1000	3
Rs.1001 to 2000	5
Rs.2001 to 5000	0
Total	**104**

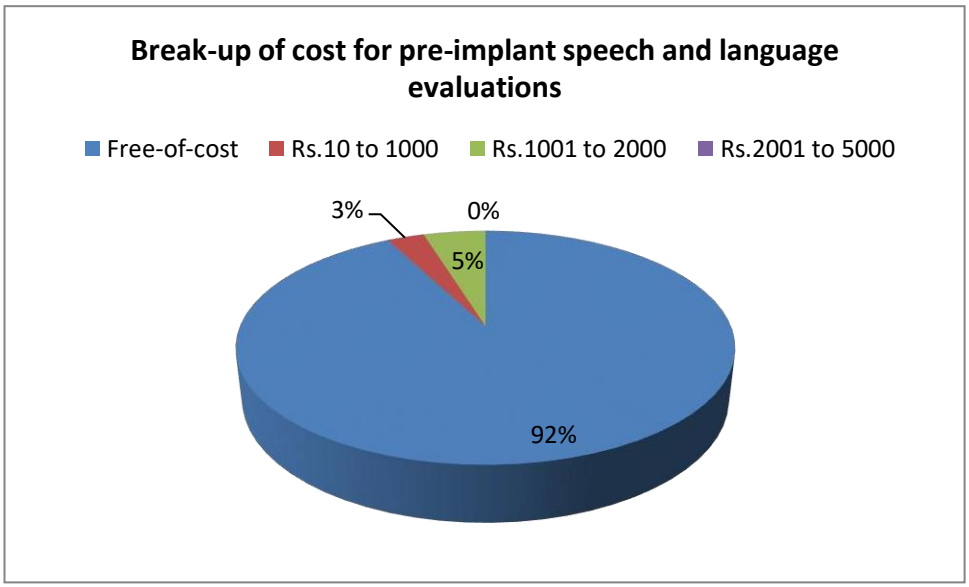

Figure 4.6: Expenditure involved in pre-implant speech-language evaluations

Table 4.6 reveals that 96 participants availed pre-implant speech and language evaluations for free-of-cost. Three participants spent Rs.10 to 1000 and five participants spent Rs. 1001 to 2000 for this.

7. Pre-implant clinical psychological evaluation:

The expenditure for pre-implant clinical psychological evaluations is given in Table 4.7.

Table 4.7: Expenditure involved for clinical psychological evaluations

Break-up of cost for Pre-implant clinical psychological evaluation	**No. of children using CI**
Free-of-cost	100
Rs.10 to 1000	3
Rs.1001 to 2000	1
Total	**104**

From Table 4.7, it can be noted that 96 participants availed pre-implant clinical psychological evaluation for free-of-cost. Three participants spent Rs.10 to 1000 and one participant spent Rs. 1001 to 2000 on this.

8. Pre-implant radiological evaluation (CT/MRI):

The expenditure for pre-implant radiological evaluations (CT/MRI) expenditure are given in Table 4.8.

Table 4.8: Expenditure involved for Pre-implant radiological evaluations

Break-up of cost for Pre-implant radiological evaluation	No. of children using CI
Free-of-cost	23
Rs.1000 to 5000	9
Rs.5001 to 10000	56
> Rs.10000	16
Total	**104**

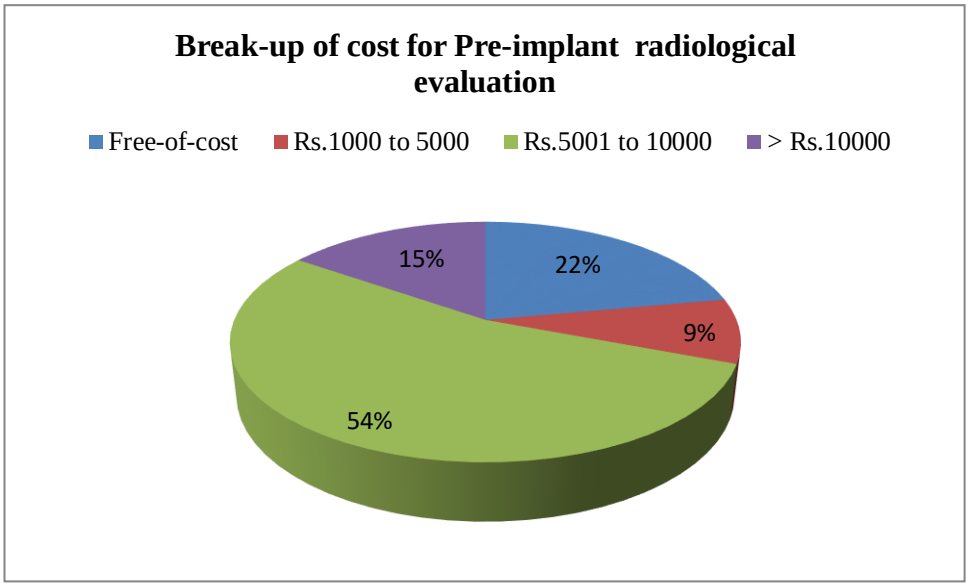

Figure 4.8: Expenditure involved for Pre-implant radiological evaluations

In Table 4.8, 23 participants availed pre-implant radiological evaluation (CT scan and MRI scan) for free-of-cost. Nine participants spent Rs. 1000 to 5000 and 56 participants spent Rs. 5001 to 10,000. And sixteen participants spent greater Rs.10000. Majority of population spent Rs.5001 to 10,000 for pre-implant radiological evaluations.

9. Cochlear implant surgery / Hospital charges:

The expenditure for surgery/hospital charges is given in Table 4.9. There were 87 children who availed free CI schemes. These spent specific amount as shown in Table 4.9. The rest 17 children got their implant self-funded. The cost for surgery/hospital and device for these 17 children ranged from Rs, 8,00,000 to Rs, 12,00,000.

Table 4.9: Expenditure involved for Cochlear charges/Hospital charges

Break-up of expenditure involved for cochlear implant surgery/ hospital charges	**No. of children using CI**
Free-of-cost	70
< Rs. 10,000	3
Rs. 50,001 to 1,00,000	14
Total	**104**

10. Pre-surgical lab investigations:

Lab test are mandatory before implant surgical procedure. The expenditure involved for this is depicted in Table 4.10.

Table 4.10: Expenditure involved for pre-implant lab investigations & vaccination

Cost for pre-implant lab investigations + vaccination	No. of children using CI
Nil	51
Rs. 100 to 1000	6
Rs. 1001 to 2500	7
Rs. 2501 to 5000	30
Rs. 5000 to 10000	9
Information not available	1
Total	**104**

Out of 104 participants, 50% of the population spent on pre-surgical lab test. The expenditure incurred for majority of them ranged from Rs.2501 to 5000 for vaccine and lab investigations. There were 51 participants who did not spend on pre-surgical lab investigations and vaccination.

11. Post-surgical expenses for dressing /additional medication:

After the surgery, the surgeon prescribes medicines for wound healing and to prevent/treat infections. The expenditure for this is given in the Table 4.11.

Table 4.11: Expenditure involved for post-surgical expenditure

Post-surgical expenditure for dressing, prevent/treat infection etc.	No. of children using CI
Nil	96
<Rs. 1000	2
Rs. 1000 to 5000	3
>Rs. 5000	3
Total	**104**

Out of 104 participants, two participants spent over Rs.1000, three participants spent Rs.1000-5000 for surgical and three participants spent greater than Rs.5000 including dressing /infection of post implant surgery.

12. Expenditure for post implant switch-on:

After the surgical wound heals, the device is switched on. Table 4.12 gives the expenditure involved for this.

Table 4.12 Expenditure on Post-implant switch-on

Post implant switch-on expenditure	No. of Children using CI
Nil	90
< Rs.1000	3
Rs.1001 to 5000	7
Rs.5001 to 10,000	1
Within package *	3
Total	**104**

Note: *= Mapping for one year and staff therapy for 6 months, cost ranging from Rs. 20,000 to Rs. 25,000.

Post implant Switch-on charges varied from Rs.1000 to Rs.5000 in majority cases who spent on switch-on. Around 90 participants did not spend any amount on post implant Switch-on.

13. Expenditure per mapping of CI:

There is a mapping schedule for cochlear implants, which involves 8 to 10 mapping sessions during the first year. Later, the mapping sessions are held one per year. Expenditure for mapping during the first year is given in the Table 4.13.

Table 4.13: Annual expenditure for mapping during first year

Expenditure for mapping	No. of Children using CI
Nil	87
Rs.1000 to 10,000	7
Rs. 10001 to 20,000	1
Rs.20,001 to 30,001	6
Rs.30,001 to 40,000	0
Rs.40,001 to 60,000	3
Total	**104**

Post-implant mapping charges vary from Rs.1000 to Rs.60000 during the first year of implantation. 87 participants did not spend any charges on post implant mapping as they were using the CI from schemes. It was also noted that the charges per mapping session post first year was Rs.1000 to Rs.1500 in majority of the cases who paid. Among the cases who paid three of them paid for a package which costed from Rs.20000 to 25000.

The 87 CI users were from free scheme, hence they did not have to spend on mapping.

14. Re-surgery/ re-implantation:

Re-implantation is involved in rare cases where there is hard or soft device failure. Two of the cases required re-implantation. In addition, there was one case where re-surgery was indicated as the magnet was displaced. Reasons for re-implantation in two cases include:

Of the 104 children, three underwent re-implantation or re-surgery. Two individuals had undergone re-implantation in this study due to device failure. The cost for re-implantation for one case was Rs. 30000 for food, accommodation. The implant was not charged as it was within warranty period. In another case of re-implantation, Rs. 1,65,000 was paid as hospital charges and the implant was not charged as it was within the warranty period. The third case required re-surgery due to displacement of the internal magnet. The expenditure for this was around Rs.35000. In this case, only the internal magnet was replaced.

Complications of cochlear implantation were observed in 11 out of 275 patients at Khalili Hospital, Shiraz University of Medical Sciences. The retrospective analysis covered patients between 2003 and 2009, with follow-up for one to five years. Results showed that 11 patients required revision surgery or medication: 5 due to device failure needing re-implantation, 1 due to electrode misplacement, 2 with telemetry issues from implant magnet migration, 1 with meningitis managed medically, and 2 with scalp hematomas responding to medical treatment. Device failure was the most common cause for cochlear re-implantation in the study by Farinetti et al. (2014).

Prevalence of re-implantation was more for device failure, followed by medical infection. The other unknown reason was the least contributing reason for re-implantation (Liu et al., 2022). And the details of re-implantation in the present study is given the Table 4.14

Table 4.14: Expenditure spent on re-surgery /re-implantation

Reason for re-surgery/ re-implantation	No. of children using CI	Cost Rs.
Re-implantation: Device hard failure	1	Rs. 30000 for hospital charges
Re-implantation: Device soft failure	1	1,65,000 for hospital charges
Re-surgery: Magnet displacement	1	Rs. 35000 for re-surgery+ internal magnet
No re-implantation/ re-surgery	101	-
Total	**104**	**-**

15. Post-implant radiological evaluation:

Post-operative scans are essential for identifying the electrode's misalignment, folding, and dislocation array (if any). In case of electrode or device problems, the information from radiological evaluation helps in mapping and also to decide whether a particular electrode is to be retained in the map. Hence, every person undergoing cochlear implant will have to undergo X-ray or CT scan post surgery.

Table 4.15: Expenditure on Post-implant radiological (CT / X ray)

Post-implant radiological (CT / X ray) expenditure	No. of children using CI
Nil	93
< Rs.500	4
Rs.501 to 2000	2
Rs.2001 to 5000	5
Total	**104**

There were 93 participants who did not spend any amount for post-implant radiological evaluation. Price range varied from Rs. 500 to Rs. 5000. The high cost spent by 5 participants was due to multiple X-ray taken. Even though there were 87 cases under free scheme, 93 reported that radiological evaluation was not charged. The reason could be that the hospital charges were collected as a whole and the patients/ caregivers did not know the cost involved for different particulars.

16. Rehabilitative service:

Post-cochlear implant rehabilitation services play a crucial role in helping individuals adapt to their cochlear implants and maximize their hearing outcomes. Cochlear implant rehabilitation focuses on training the brain to process and understand the new sounds provided by the implant.

The duration and intensity of post-cochlear implant rehabilitation can vary based on individual needs and progress. Usually, the therapy is for duration of one year after the implantation. Children who underwent implant through schemes avail therapy for free-of-cost.

Others paid the charges for therapy based on the income i.e., Rs. 80 per month for those individuals who belong to Slab I (Family income of up to Rs. 22,500 per month) and Rs. 150 per month for Slab II (Family income of Rs. 22,501 to 30,000 per month) and Rs. 350 per month for Slab III (Family income of greater than Rs. 30,000 per month). This is the cost at AIISH. The cost in the private rehabilitation centres depends on the clinic itself and the number of sessions provided.

In the present study, 3 children reported that they opted for package payment which involves one year of mapping and 6 months therapy by staff. The cost of the package ranged from Rs. 20000 to Rs. 25000.

Table 4.16: Expenditure spent on rehabilitative service

Rehabilitation service per month	**No. of children using CI**
Nil	70
Rs.350 to 1000	20
Rs.1000 to 5000	6
Rs. 5000 to 10,000	4
Within package*	4
Total	**104**

Note: *= Mapping for one year and staff therapy for 6 months, cost is Rs. 25,000.

Out of 104 participants, majority of the participants availed therapy through free schemes. As most of the participants were from All India Institute of Speech and Hearing, around 70 % percent of the population availed rehabilitation service free-of-cost through schemes. Three of the cases availed mapping & therapy package and one case paid package amount for therapy for one year.

17. Microphone cover:

Microphone cover/guard: This is being used only for a few models of cochlear implants. The microphone cover of a cochlear implant is an important component that helps protect the microphone from dust, moisture, and other environmental factors which in turn help in maintaining the quality of sounds picked up by the microphone. Proper maintenance of the microphone cover is essential to ensure the continued functionality of the cochlear implant system. Replacement of microphone cover is recommended for every three months. Table 4.17 depicts the expenditure spent on Microphone cover/ guard.

Table 4.17: Expenditure spent on Microphone cover/ guard

Microphone cover expenditure (company old price Rs.1200 per pack with four pieces)	**No. of children using CI with mic covers**
Rs.1000 to 2000	9
Rs.2001 to 3000	20
Rs.3001 to 4000	12
Total	41

As given in Table 4.17, 41 children were using CI models that required microphone covers. The cost of this is Rs. 300 per piece that is required to be replaced once in three months. Majority of these CI users have spent Rs. 2001 to Rs, 3000 on microphone covers per year. This is the expenditure with old price. All the 41 users have changed the microphone covers several times during the usage.

It must be noted that the cost of microphone cover has been revised (Since March 2023) and is ~Rs. 3500 per pack of four pieces. For those availing cochlear implants under certain schemes, additional mic covers (i.e., 20 nos.) are provided in the kit, such that these mic covers lasts for 60 months. The expenditure on mic cover will be only after this period.

18. External magnet:

The external magnet in a cochlear implant is a component that helps secure the external coil in alignment with the internal coil. Proper maintenance of the magnet is important to ensure the stability and functionality of the cochlear implant. While the magnet itself does not usually require regular maintenance unlike microphone cover, coil cables and batteries, only 3 (out of 104 individuals) CI users had to replace the external magnet after three years of usage. For certain models/make, the warranty period for external magnet is one year.

Table 4.18: Expenditure on external magnet replacement

Expenditure on external magnet (company price Rs. 2867 - 4130)	**No. of children using CI**
Rs.3000	1
Rs.4000	1
Rs.4500	1
External magnet not replaced	101
Total	104

Out 104 participants, only 3 participants had to replace the external magnet and the cost informed by the participant is as shown in Table 4.18.

19. Processor up gradation / Processor change:

The cochlear implant recipients will generally have to go for up-gradation of speech processor due to various reasons, such as technology upgrade, replacement of damaged processor, and non-availability of spares and accessories (as the model is not in market, the accessories are not supported by the company).

Thirteen individuals spent on processor up-gradation. The cost spent on up gradation was at least Rs.4, 00,000 to 5, 00,000 per up-gradation. And processor service depends on the use and maintenance cost varies irrespective of company as in the Table 4.19 in the present study.

Table 4.19A: Expenditure on processor up gradation/ processor replacement:

Processor up gradation	**No. of children using CI**
Nil	91
Rs.400000 to 500000	10
Rs.500001 to 600000	3
Total	**104**

Table 4.19 B: Expenditure on processor service:

Processor service	**No. of children using CI**
Nil	81
Rs.10,000 to 20,000	13
Rs.20, 000 to 30,000.	10
Total	**104**

20. Dry brik / Desiccant

Maintenance expenditure was incurred on replacement of dry brik or desiccants which were used with certain models/makes of CI. Replacement of dry brik/desiccants was recommended once in every two months. Average price cost was found to be Rs.150 per brik. In the study, for those individuals who were implanted less than 6 months did not spend on any charges on dry brik as the additional dry briks (10 nos.) were provided in the kit at the time of implant. But for the individuals who were implanted for greater than 20 months, regular replacement of dry brik / desiccants was done for every two months. The annual cost was Rs. 1001 to Rs. 2500 for such cases. Table 4.20 gives the details.

Table 4.20: Expenditure on dry brik / desiccant per year

Cost of dry brik per year (company old price Rs.150 per piece)	**No. of children using CI**
Nil	60
Rs. 500 to 1000	3
Rs. 1001 to 2500	35
Rs. 2501 to 5000	5
Rs. 5001 to 10000	1
Total	**104**

It must be noted that the cost of dry brik/desiccant has increased to Rs. 170 per piece.

21. Dry aid kit

Dry aid kit helps in absorbing moisture of the external device. Some makes of CI have drying systems that is combined with UV disinfectant. In the present study, no much expenditure was involved in dry aid kit, only two individuals (out of 104) reported replacement of dry aid kit. The average cost of a dry aid kit was reported to be Rs.14, 000. In addition, one CI user had to replace only the adapter which costed Rs. 1400.

Table 4.21: Expenditure on replacement of dry aid kit

Dry aid kit /its accessories Company price (Rs.6400 to 9000 per kit)	**No. of children using CI**
Nil	101
Rs.12000	1
Rs.5000	1
Dry aid kit adapter Rs.1400	1
Total	104

As per the Table 4.21, the company price is different from what the participants have given. That shows that the price is over/ under estimated by the informants.

22. Coil cable:

In the study, 75 individuals had no expenditure as there were users who were using the CI for less than 6 months and used spares given in the kit at the time of data collection. The rest of the individuals who were using implant for longer duration spent on coil cable replacement. Average cost was of Rs. 4000 per cable. As number of years of use increased, the number of cables replacement also increased.

Table 4.22: Expenditure on maintenance cost of coil cable per year

Coil cable per year Company price (Rs.2065 to 4100 per cable, cost of coil & cable combined Rs. 11000)	No. of children using CI
Nil	75
Rs. 2000 to 4000	10
Rs.4000 to 6000	10
Rs. 6001 to 10000	2
Rs. 10,001 to 15,000	3
Coil cable replacement within warranty, Cost: Nil	4
Total	104

23. Rechargeable and non-rechargeable battery:

Rechargeable batteries are commonly used in cochlear implant processors as an alternative to disposable/ non-rechargeable batteries. While the initial cost of purchasing a rechargeable battery and its charging equipment can be higher than using disposable batteries, there are potential long-term cost savings. The replacement cost of rechargeable battery is higher compared to disposable battery. However, the recurrent cost of disposable cell is higher. The average cost of disposable battery is around Rs.150 for 6 pieces (675p type). The average cost of rechargeable battery is ~Rs.10, 000.

Table 4.23: Expenditure on rechargeable battery and non-rechargeable battery per year

Rechargeable battery and non-rechargeable battery (Company price for rechargeable battery Rs. 12,095)	No. of children using CI
Nil	76
Rs. 100 to 1000	8
Rs.1001 to 5000	1
Rs.5000 to 10000	7
Rs.10001 to 20000	12
Total	**104**

24. Huggies:

Huggies are the accessories which help in retention of the implant on the ear of the children and maintenance expenditure for this is given in the Table 4.25

Table 4.24: Expenditure on maintenance cost of Huggie per year

Cost range (Company price is Rs. 236)	No .of children using CI
Rs. 100 to Rs.200	14
Rs.201 to Rs. 300	26
Rs. 301 to Rs. 400	13
Rs. 401 to Rs. 500	13
Total	**104**

Average cost for huggie was around Rs. 200 to 300 per year.

25. Company and model specific expenditure:

I. Cochlear Nucleus cochlear implant:-

A. Maintenance cost for Cochlear CP 802:

Out 52 participants using this model, seven participants spent on charger module and those seven were using CI for more than a year. The cost is around Rs.10, 000. And 17 participants spent on safety line. Price for per piece is around Rs.150. The frequency of change is once in 3 months. Four participants spent on sleeve and price varies from Rs.500 to Rs.800.

Two participants spent on ear hook and the price range varied from Rs. 400 to Rs.1000. And only one participant spent on snugfit and maintenance cost is around Rs.2500. Table 4.25 provides the details of expenditure for spares of CP 802. There was no expenditure for other spares of CP802.

Table 4.25: Maintenance cost involved for Battery charger, Safety line and Sleeve of CP 802

Battery charger (company price Rs. 12,254)	**No. of children using CI**	**Safety liner (company price Rs.150)**	**No. of children using CI**	**Sleeve (company price Rs. 885)**	**No. of children using CI**
Rs.10000 charger	3	Rs.100 to 500	4	Rs.2000	1
Rs.1200 cable	1	Rs. 501 to 2000	9	Rs.1600	3
Rs. 2750 cable & adapter	2	Rs. 2001 to 5000	2	-	-
Rs.150 adapter	1	Rs. 5001 to 10,000	2	-	-
Nil	45	Nil	35	-	48
Total	52	Total	52	Total	52

B. Cochlear CP810

It should be noted here that there was only one user of CP810 model. There was no expenditure incurred on the maintenance of this device (such as on accessories Litewear cable, snugfit, and Ear hook).

C. Cochlear CP910

It should be noted here that there was only one user of CP910 model. There was no expenditure incurred on the maintenance of this device (such as on accessories Litewear cable, snugfit, and Ear hook).

D. Freedom

It should be noted here that there were only three users using this model. The details of expenditure incurred for this model is provided in Table 4.26.

Table 4.26: Maintenance cost Freedom speech processor

Accessories	No. of children using CI	Expenditure cost
Baby worn audio cable	3	Rs. 6000 (2)
(Company old price Rs.9038)		Rs. 10000 (1)

Out of 3 participants, all the threes replaced baby worn cable, and the price varied from Rs.6000 to Rs.10000. No expenditure was spent on Snugfit and BTE controller.

E. Cochlear Kanso & Kanso2

It should be noted here that there was only one user of Kanso and one user of Kanso 2 model. There was no expenditure incurred on the maintenance of this device (such as on accessories socket cover, charger cable and socket cover).

F. Cochlear N7

It should be noted here that there were three users of N7 model. There was no expenditure incurred on the maintenance of this device (such as on accessories snugfit).

II. Med El cochlear implant:-

There were 26 Med El cochlear implant users. The common accessory on which expenditure was incurred was Decapo frame. The details of expenditure incurred are given in Table 4.27.

Table 4.27: Maintenance cost involved for Decapo frame

Decapo frame (company price Rs.20,720)	**No. of children using CI**
Rs.12000 to Rs. 18000	6
Nil	20
Total	26

Out of 26 participants 6 participants spent on Decapo frame for the maintenance and the cost was around Rs.12000 to 18000.

A. Opus 1

It should be noted here that there was only one Opus 1 user. There was no expenditure incurred on the maintenance of this device (such as on accessories activity cover, safety lock, ear hook).

B. Opus 2

Out of 23 participants using Opus 2, six participants spent on safety lock and the price varied from Rs.150 to Rs.1200. The company price for safety lock is Rs. 708. No expenditure was spent over Activity cover and Ear hook.

C. Sonnet

It should be noted here that there was only one user of Sonnet model. There was no expenditure incurred on the maintenance of this device (such as on accessories huggie, cover clip, ear hook).

D. Rondo2

It should be noted here that there was only one user of Rondo 2 model. There was no expenditure incurred on the maintenance of this device (such as on accessories attachment clip, water resistant wear).

III. Otic Medical cochlear implant cochlear implant:-

It should be noted here that there were two users of Saphyr or Saphyr neo models. These models were earlier dealt by Neurelec Digisonic, now taken over by Otic Medical. There was no expenditure incurred on the maintenance of this device except for antenna cable. The cost for replacement was Rs. 5500 to Rs.6000. No expenditure was spent on Ear gear, cover clip.

IV. Advanced Bionics cochlear implant:-

A. Marvel M30 CI

Only one case used Marvel CI. There was no expenditure incurred on accessories included snuggie, earhook, T-Mic, etc., connectivity accessories (Roger select, connectivity mic, acoustic ear hook etc.), aqua kit, and headpiece.

B. Naida Q90 CI

There were five cases using Naida Q90 CI. There was no expenditure by the users on Aqua Kit (Aqua case, bands, clips , caps etc.) and miscellaneous accessories (snuggie, earhook, T-Mic, etc.)

C. Harmony CI

There were two cases using this model. There was no expenditure incurred on headpiece and connectivity accessories (T-Mic, Snuggie, Connectivity Mic, Acoustic ear hook, etc.)

D. Neptune CI

Out of 4 participants, 2 participants spent on replacement of head piece (after three year of use) and the price varied from Rs.5000 to Rs.12000. Two participants spent on replacement of coil cable and price varied from Rs.4000 to Rs.5000. No expenditure was spent on other miscellaneous accessories (Snuggie, Earhook, T-Mic, etc.).

26. Travel expenses per visit:

Most of the participants are far away from the testing/therapy centre (Table 4.28). Along with the candidate, parents will always accompany as the participants were in the age range from 2 to 17 years. As travelling cost involved not only for assessment but even for rehabilitation purpose, most candidates shifted to Mysore to avail service from the institute for rehabilitation. Travel charges varied according to number of people and distance from the institute (Nassiri et al., 2021).

Table 4.28: Cost involved for travel

Cost range per visit	No. of CI Users
Nil	70
Rs. 100 to 1000	16
Rs. 1001 to 2000	6
Rs. 2001 to 5000	11
Rs. 5000 to10000	1
Total	**104**

27. Food and Accommodation expenditure:

Food and accommodation was a burden expenditure for most of the participants. Cochlear implant needs long term assistance and guidance, there has to be regular visits for mapping and therapy services. As most of them are away from the institute, distance was a constraint in availing the service. The participants spent on food and accommodation charges near to the centre. The expenditure depends on number of people staying with the candidates and duration of the stay.

Table 4.29: Cost involved for food and accommodation

Food charges per year	**No. of CI recipients**	**Accommodation charges per year**	**No. of CI recipients**
Nil	41	Nil	41
Rs.10000 to 20000	2	Rs.10000 to 20000	1
Rs. 20001 to 40000	7	Rs. 20001 to 40000	7
Rs.40001 to 60000	39	Rs.40001 to 60000	39
Rs.60000 to 100000	15	Rs.60000 to 100000	13
> Rs. 100000	0	> Rs. 100000	3
Total	**104**	**Total**	**104**

Cochlear implant needs regular care and maintenance throughout life with respect to mapping, rehabilitation service such as listening therapy, speech and language therapy. The food and accommodation charge varies with the number of persons in family and economic status and life style.

Overall estimated cost of expenditure of cochlear implant

The overall cost of the cochlear implantation in the pre-implant, implantation (hospital & device), post implant, (mapping & therapy), and maintenance charges are summarized in Table 4.30. In doing so, the cost for pre-implant, implantation, and switch-on charges are one-time expenditure. The cost for accessories and spares is recurring and has been converted are expenditure per annum. It must be noted here that the majority of the CI users did not spend any of these expenditure. The cost incurred by majority of rest of the users was considered while listing the expenditure under the overall expenditure. In the table, the maintenance cost is provided as per year's cost.

Table 4.30: Overall estimated expenditure towards cochlear implant for models considered in the present study

Charges incurred in different stages of cochlear implantation	Particulars	Minimum cost	Maximum cost
1. Pre–implant charges	Audiological evaluation	Rs. 2001	Rs. 5,000
	Speech and Language evaluations	Rs. 1001	Rs. 2,000
	Clinical psychological evaluations	Rs. 10	Rs. 1,000
	Radiological	Rs.5001	> Rs.10,000

	evaluations		
	Lab test investigations	Rs.2501	Rs. 5,000
2. Implant charges	Hospital charges	*< Rs. 10,000*	Rs.1,50,000
	Device charges		
	Post-surgical expenses		
	(dressing infection)	<Rs. 1000	>Rs. 5000
Charges incurred in different stages of cochlear implantation	**Particulars**	**Minimum cost**	**Maximum cost**
3. Post- implant charges	Post-implant switch on	Rs.1001	Rs.5000
	Mapping charges per session	Rs. 1000	Rs.10,000
	Rehabilitative service charges per year)	Rs. 4200	Rs. 12,000
	Processor change/ up gradation	Rs.400000	Rs.500000
5. Maintenance cost / year	Microphone cover	Rs. 1000	Rs. 4,000
	Dry aid brik / desiccant	Rs.1001	Rs.2500
	Processor service	Rs.10,000	Rs.20,000

Coil cable	Rs.4000	Rs.6000
Rechargeable battery	Rs.10001	20,0000
Non-rechargeable battery	Rs.150	Rs.1800
Huggies	Rs.201	Rs.300

Chapter 5

SUMMARY AND CONCLUSIONS

Cochlear implant is helpful for individuals with severe to profound hearing loss who do not benefit from hearing aids. It is an expensive device. It is important to counsel the parents/ recipients regarding the expenditure incurred by the user during the stages of pre-implantation, implantation, post-implantation (mapping & therapy, and post-implantation maintenance costs.

Parents/caregivers/implantees incur a variety of expenditure including maintenance costs, depending on the particular implant model in use, and the healthcare system / schemes in the vicinity. The present study considered some of these factors into account when estimating maintenance costs. The surgery and device cost are the main expenditures related to cochlear implants. Parents/ implantees face a huge financial burden because of this. In many nations, including ours, there are schemes of central and state governments that cover these expenditure involved. This reduces the burden /strain on the family. It is the onus of the professionals involved in cochlear implant team to provide the cost (both initial and maintenance) involved in cochlear implantation to prospective candidates so that they are better prepared. Such budget estimates will also help policy makers to budget not only for initial cost but maintenance cost also.

The present study aimed to investigate the expenditure involved, from the point of view of the patient/ caregiver, in cochlear implantation. Initially, a questionnaire (in google doc) was developed for the purpose. The questionnaire consisted of total 90 questions including the general demographic details of the participant such as, name of the recipient, caregiver name/s, contact details, and make - model - serial number of the

implant and processor. The questionnaire also had sections on pre-implant charges, implant/ hospital charges, and post-implant charges. In addition, cost for travel and lodging for mapping and therapy sessions were included. Content validation of the questionnaire was done before finalizing the questions.

A total of 104 participants (parents/caregivers) included in the study. Of them, 65 participants were using devices from Cochlear Medical Device Company India Pvt. Ltd., 26 participants were from Med-El India Pvt. Ltd., two from Otic hearing solutions Pvt. Ltd., and 11 from Advanced Bionics India Pvt. Ltd.

Direct interview or telephonic interview method was used to collect the data in the study. The findings on expenditure per patient in the current study are provided here.

1. Pre-implant charges such as audiological, speech and language evaluation, clinical psychological evaluation, radiological evaluation, pre-surgical lab investigations, and vaccine charges costed a minimum of Rs.19,514 to a maximum of Rs.23,000.

2. Cochlear implant charges were free-of-cost for the individuals who met the criteria of ADIP central government scheme or for NPPCD/RBSK Karnataka state government scheme. Charges spent on hospital charges was a minimum of Rs.10,000 to a maximum of Rs. 1,50,000.

3. Cochlear implant device charges for self-funded cases was Rs. 8,00,000.

3. Post-surgical expenses (charges for treatment for infection etc.), post-surgical radiological examinations (CT/X-ray), post-implant switch-on, mapping charges, and rehabilitation services costed around a minimum of Rs. 7200 to a maximum of Rs. 32,000.

4. The annual cost for maintenance/ spares of cochlear implant is given below:

A. Cost involved in replacement of microphone cover/guard (when applicable) was around Rs.2000 per annum per patient. For those availing cochlear implants under certain schemes, additional mic covers (20 nos.) are provided such that the mic covers lasts for 60 months. The expenditure on mic cover is only after this period. Minimum cost was Rs.1000 to a maximum cost of Rs.4000 per annum.

The implantees are required to change the mic cover regularly once in three months. The cost mic cover in the current company pricelist is ~Rs. 875 per piece.

B. Replacement cost for the damaged coil cable is around Rs.6000. The cable is changed only when it is damaged. Minimum cost Rs.4000 to maximum cost Rs. 6000 per annum.

C. Cost involved in replacement of dry brik /desiccants (when applicable) was around Rs.2500 per annum per patient. For those availing cochlear implants under the schemes, additional dry brik /desiccants (10 nos.) are provided such that the desiccants last for 20 months. The expenditure indicated on desiccant is only after this period. The implantees are required to change the desiccant regularly once in two months. The cost of each desiccant in the company pricelist is ~Rs. 270 per piece. Minimum cost is Rs.1001 to a maximum cost of Rs.2500 per annum.

D. For implantees using CIs from free schemes, the implant kit provides one box of disposable batteries (10 strips * 6 batteries 60 nos.). Each disposable battery lasts on an average for about three days; thus, the kit contains batteries that can last for six or seven months if the implantee use only disposable batteries (eg.

For Digisonic Saphyr CI). The maintenance cost thus depends on the frequency of change of the disposable batteries. All the other implantees in the study predominantly used the rechargeable battery that lasted longer. The cost of rechargeable battery ranges from Rs 10,000 to 12,000. The rechargeable battery was replaced by a few users after three years of use.

E. The maintenance cost for the Huggies is around Rs. 300 per annum. On an average, the CI users change the huggies twice in a year.

5. The cost for other accessories such as Ear hook, Snugfit Aqua Kit, T-mic, Activity cover, Lite wear cable, Ear gear were not estimated as the recipients of the study had not purchased/ replaced any of these.

6. Processor kit up gradation costed around Rs. 4,00,000 to Rs. 6,00,000 per up gradation. For 13 cases who upgraded their device, they had used the older device for 5 to 7 years.

7. Travel cost was estimated and it varied across the frequency, distance and mode of transport. The cost depended also on the number of individuals who accompanied the CI user.

8. Food and accommodation charges were much of a burden for those who are staying far from the center for assessment and rehabilitation purpose.

9. The maintenance expenditure for off the ear processor could not be recorded as only one user in the study was using the device for less than one year and reported that there was no expenditure that was incurred. The other user of off the ear processor was using the device for three years. The expenditure incurred was towards safety liner which was Rs. 100 per piece .

10. The cost for therapy at AIISH was Rs. 350 per month for self-funded CI users. For CI users from fre schemes, the cost for therapy was covered atleast for one year.

Thus the estimated cost for initial and maintenance cost of the cochlear implant has to be taken with caution as majority of cases were funded through free schemes. And only certain models of cochlear implants were there in higher numbers.

Implications of the study:

1. Parents can be counseled with the help of the study regarding the expenditure involved in the cochlear implant, which will help them to be prepared for expenditure that will be incurred.

2. Helps the parents create a budget that accounts for all the on-going costs associated with the cochlear implant. Encourage them to plan for these expenses in advance and to explore any available financial aid options.

3. Provides a basis for policy makers for the government schemes while budgeting for initial and maintenance costs of cochlear implants.

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EVALUATION OF EXPENDITURE INVOLVED IN COCHLEAR IMPLANTATION

Dear parents of the implantee ,

The aim of our study is to evaluate the expenditure and maintenance cost involved during pre implantation , implantation and post implantation of an individual .

This study will provide literature support for cost estimation of cochlear implantation which in turn help in planning and funding for the rehabilitation

This questionnaire consists of

1. Demographic details
2. Pre -implant chargers
3. Post- implant chargers of company specific questions Please

choose the correct options before selecting the section .

your participation in this study is voluntary .The information you will share with us will be kept completely confidential to full extent of law .

for any clarification kindly contact

Rohinibn2023@gmail.com

* Indicates required question

1. Name of the cochlear implantee *

2. Model of the implant : Sl No.:
   Model of the speech processor: Sl No.:

3. Email *

4. Provide the names : *
Mother's name Father's name
Caregiver name

5. Phone number

6. When was the child implanted ?

Mark only one oval.

- Less than 6 months
- 6 months to 3 years back
- 3 years to 5 years back
- Greater than 5 years back

7. How much expenditure was involved for pre-implant audiological evaluation ?

Mark only one oval.

- Free-of-cost
- Rs. 10-1000
- Rs. 1001-2000
- Rs. 2001-5000
- Rs. 10,000-30,000

8. How much expenditure was involved for pre-implant speech and language evaluation ?

Mark only one oval.

- Free- of- cost
- Rs.10-1000
- Rs.1001-2000
- Rs.2001-5000

9. How much expenditure was involved for clinical psychological evaluation priorto implantation?

Mark only one oval.

- Free- of- cost
- Rs.10-1000
- Rs.1001-2000
- Rs.2001-5000

10. How much expenditure was for pre-implant radiological evaluation ? (CT andMRI)

Mark only one oval.

- Free- of- cost
- Rs.1000-5000
- Rs.5001-10000
- Greater than Rs.10000

11. How much expenditure was involved for cochlear implant surgery /Hospital charges ?

Mark only one oval.

- ◯ Free-of-cost
- ◯ less than Rs. 10,000
- ◯ Rs.10001 to 50,000
- ◯ Rs. 50,001-1,00,000
- ◯ Rs. 1,00,001-1,50,000

12. If you know the exact cost for cochlear implant surgery, please specify.

_____

13. Is the child implanted in

Mark only one oval.

- ◯ Right ear only
- ◯ Left ear only
- ◯ Both ears *Skip to question 36*

14. What was the expenditure involved for pre surgical Lab tests ?

_____

15. How much did you spend towards surgical expenses (including dressing ,additional medication in case of infection of wound site or other ear related infections etc) ?.

Mark only one oval.

- ◯ Rs. <1000
- ◯ Rs. 1000-5000
- ◯ Rs. >5000
- ◯ Nil

16. How much did you spend on post implant switch-on?

_____

17. How much did you spend on each post implant mapping of cochlear implant?

_____

18. what was the expenditure involved for food and accommodation ?

_____

19. Was there any re-implantation?

Mark only one oval.

- ◯ Yes *Skip to question 20*
- ◯ No

Re-Implantation

20. Was there any re-implantation, what was the expenditure involved ? and reasonfor the Re - implantation .

A . Re - implantation : Yes /No
B. Reason :
C. Cost involved : Rs.
Device : ModelRs.
Hospital charges :

21. How much did you spend on post implant radiological evaluation ? (Xray / CTscan)

22. How much expenditure is spent on rehabilitation service such as (listening, speech-language therapy, PT/OT, etc.) per month ?

23. How frequently do you replace the microphone cover/guard(if applicable) andwhat is the maintenance cost involved for it ?

24. How frequently do you replace the magnet and what is the maintenance costinvolved for it ?

25. Has the child undergone processor upgradation / Processor change. If so, towhich model ? What was the cost involved for upgradation ?

26. How frequently do you replace the Dry aid kit , Dry brik/ Dry aid desiccant andwhat is the maintenance cost involved for it ?

27. How frequently do you replace the coil cable and what is the maintenance costinvolved for it ?

28. How frequently do you replace the non-rechargeable and rechargeable batteryand what is the maintenance cost involved for it ?
    1. Non-rechargeable batteries : Rs.
    2. Rechargeable batteries : Rs.

29. How frequently do you replace the snuggie and what is the maintenance costinvolved for it ?

30. How frequently is the processor service is done ? if so, specify the cost involvedfor it ?
Courier charges :
Service charges :

31. How frequently do you send the processor for repair and what is the maintenance cost involved for it ?
Courier charges :
Repair charges :

32. Are you staying in Mysore ?

Mark only one oval.

- ◯ Yes *Skip to question 35*
- ◯ No, from where ?

33. Name of the scheme through which child got implanted ?

34. If the implantation is not from free scheme, how much is the amount funded for cochlear implant from other funding sources ? Specify the source and amount .

Travel

35. How much did you spend on travel expenses per visit for evaluation ? Howmany visits did you make per month ?

IMPLANT

36. If Bilateral CI ,then was it ?

Mark only one oval.

- Sequential *Skip to question 37*
- Is sequential what was gap between two implants
- Simultaneous *Skip to question 37*

Cost for Bilateral implant .

37. What was the expenditure involved in bilateral implant ?

Hospital charges :

First implant:

Second implant

Device charges :

First implant

Second implant :

38. Any other expenditure spent on implantation ? please specify with cost andreason

39. Name of the cochlear implant company

Mark only one oval.

- Advanced bionics *Skip to question 73*
- Cochlear Nucleus *Skip to question 40*
- Med El *Skip to question 63*
- Neurelec- Digisonic *Skip to question 85*

Cochlear Nucleus

40. Choose the Name of the processor .

Mark only one oval.

- CP802 *Skip to question 41*
- CP810/N5 *Skip to question 46*
- CP910 *Skip to question 49*
- FREEDOM *Skip to question 52*
- Kanso *Skip to question 56*
- Kanso 2 *Skip to question 57*
- N 7 *Skip to question 60*
- N 8 *Skip to question 61*

CP802

41. How frequently do you replace the Battery charger and what is the maintenance cost involved for it ?

42. How frequently do you replace the Safety line and what is the maintenancecost involved for it ?

43. How frequently do you replace the Sleeve and what is the maintenance costinvolved for it ?

44. How frequently do you replace the Snugfit and what is the maintenance costinvolved for it ?

45. How frequently do you replace the Ear hook and what is the maintenance costinvolved for it ?

CP810/N5

46. How frequently do you replace the Lite wear cable and what is the maintenance cost involved for it ?

47. How frequently do you replace the Ear hook and what is the maintenance cost involved for it ?

48. How frequently do you replace the Snugfit and what is the maintenance cost involved for it ?

CP910

49. How frequently do you replace the Lite wear cable and what isthe maintenance cost involved for it ?

50. How frequently do you replace the ear hook and what is the maintenance cost involved for it ?

51. How frequently do you replace the Snugfit and what is the maintenance cost involved for it ?

FREEDOM

52. How frequently do you replace the Baby worn audio cable and what is the maintenance cost involved for it ?

53. How frequently do you replace Body worn Controller and what isthe maintenance cost involved for it ?

54. How frequently do you replace the BTE controller and what is the maintenancecost involved for it ?

55. How frequently do you replace the Snugfit and what is the maintenance cost involved for it ?

Kanso

56. How frequently do you replace the safety line hair clip /safety loop and what is the maintenance cost involved for it ?

Kanso 2

57. How frequently do you replace the socket cover and what is the maintenancecost involved for it ?

58. How frequently do you replace the charger cable and what is the maintenancecost involved for it ?

59. How frequently do you replace the safety line and what is the maintenance cost involved for it ?

N_7

60. How frequently do you replace the Snugfit and what is the maintenance cost involved for it ?

N_8

61. How frequently do you replace the ear hook and what is the maintenance costinvolved for it ?

62. How frequently do you replace the Snugfit and what is the maintenance costinvolved for it ?

MEDEL

63. Choose the Name of the processor .

Mark only one oval.

- Opus 1 *Skip to question 65*
- Opus 2 *Skip to question 68*
- Rondo *Skip to question 70*
- Rondo 2 *Skip to question 70*
- Sonnet *Skip to question 72*

64. How frequently do you replace the Decapo Frame and what is the maintenance cost involved for it ?

Opus 1

65. How frequently do you replace the activity cover and what is the maintenance cost involved for it ?

66. How frequently do you replace the safety lock and what is the maintenance cost involved for it ?

67. How frequently do you replace the ear hook and what is the maintenance cost involved for it ?

Opus 2

68. How frequently do you replace the ear hook and maintenance cost involved forit ?

69. How frequently do you replace the Safety lock and what is the maintenance cost involved for it ?

Rondo /Rondo 2

70. How frequently do you replace the Attachment clip (clothes/ hair) and what is the maintenance cost involved for it ?

71. If using water resistant wear, after how many uses do you replace the waterresistant wear and what is the maintenance cost involved for it ?

Sonnet

72. How frequently do you replace the huggie /ear hook/ ear clip /and what isthe maintenance cost involved for it ?

Advanced Bionics

73. Choose the Name of the processor .

Mark only one oval.

- MARVEL CI *Skip to question 74*
- NAIDA CI SYSTEM *Skip to question 78*
- HARMONY CI SYSTEM *Skip to question 80*
- NEPTUNE CI SYSTEM *Skip to question 82*

MARVEL CI

74. How frequently do you replace the headpiece and what is the maintenance cost involved for it ?

_____

75. How frequently do you replace the Aqua kit and what is the maintenance cost involved for it ?

_____

76. How frequently do you replace the Miscellaneous accessories (snuggie, earhook, T-Mic, etc.) and what is the maintenance cost involved for it ?

_____

77. How frequently do you replace the connectivity accessories (Roger select , connectivity mic, acoustic ear hook etc.) and what is the maintenance cost involved for it ?

_____

NAIDA CI

78. How frequently do you replace the Aqua Kit (Aqua case , bands, clips , capsetc.) and what is the maintenance cost involved for it ?

79. How frequently do you replace the Miscellaneous accessories (Roger select, connectivity mic, acoustic ear hook) and what is the maintenance cost involved for it ?

Harmony CI System

80. How frequently do you replace the Head piece and what is the maintenance cost involved for it ?

81. How frequently do you replace the connectivity accessories (T-Mic, Snuggie, Connectivity Mic, Acoustic ear hook , etc.) and what is the maintenance cost involved for it ?

NEPTUNE CI

82. How frequently do you replace the Head Piece and what is the maintenance cost involved for it ?

83. How frequently do you replace the coil cable and what is the maintenance cost involved for it ?

84. How frequently do you replace the Miscellaneous accessories (Clip, Covers)and what is the maintenance cost involved for it ?

Digisonic

85. Choose the Name of the processor .

Mark only one oval.

◯ Saphyr and Saphyr neo *Skip to question 86*

Saphyr and Saphyr neo

86. How frequently do you replace the Antenna cable and what isthe maintenance cost involved for it ?

_____

87. How frequently do you replace the Care and Miscellaneous accessories (Protective case , Tester tool, microphone earphones) and what is the maintenance cost involved for it ?

_____

88. How frequently do you replace the cover clip and what is the maintenance cost involved for it ?

_____

89. How frequently do you replace the huggie what is the maintenance cost involved for it ?

_____

90. How frequently do you replace the ear gear and what is the maintenance cost involved for it ?

_____