

## Knowledge on Cochlear Implants among Medical Students, Tanzania

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### Abstract

**Background:** Cochlear implantation is one of the most performed surgery worldwide currently to people mostly children with sensorineural hearing loss to solve the effects of severe to profound hearing loss and without this, these children would be left with deafness for life. Tanzania has also developed and started to perform cochlear implantation to children in 2017.

**Objective:** The main aim of this study was to assess Knowledge on cochlear Implants among senior medical students and interns who are going to be the primary care providers and will be required to make proper diagnosis and referrals for children requiring cochlear implants to the right facilities for further management hence their knowledge is of great essence.

**Methodology:** Descriptive cross sectional study was used, a structured questionnaire was used to collect data and Stratified random sampling method was used to get participants. Self-administered questionnaires was used for data collection and collected data was coded and analysed using IBM SPSS version 24.0.

**Results:** In this study which involved 203 participants, we found that only 87.2% have ever heard about cochlear implants and only 80.2% knew that cochlear implants may restore hearing to the deaf and 11.3% did not know that children who received cochlear implant could learn spoken language also 35% of the participants did not know that cochlear implant is being done in Tanzania despite starting performing the surgery since 2017. More than half of the participants are knowledgeable to different candidacy criteria for cochlear implantation however only 23.2% of the participants knew that a child without a cochlear is not a candidate for cochlear implants. More than 90% of participants knew that Audiologist, Otolaryngologist and speech therapist are key members of cochlear implant team but only 65% knew that a social worker is also a member of the team. We also found that more than half of the participants knew that infections, device failures, cerebral spinal fluid fistulas facial nerve paresis and cholesteatomas are complications associated with cochlear implantations. It was also found that there was an association between the university studied/studying and the level of knowledge, Majority of government owned university students having high knowledge while those of private owned having moderate knowledge.

**Conclusion:** This study provides a general image on knowledge of cochlear implants among intern doctors and final year medical students in Tanzania and still there is a knowledge gap among the participants and few still don't know that cochlear implantation surgery is done in Tanzania which is a very good step in the country but also a call to the primary care physicians to be well knowledgeable in indications, possible complications and the whole process involved in cochlear implantation to be able to properly manage these children and be able to refer them timely for the surgery. Also, a call to Ear Nose and Throat Specialists and Academicians to ensure this knowledge gap is covered.

**Keywords:** Cochlear Implant; Hearing Loss; Knowledge

## Abbreviations

MNH: Muhimbili National Hospital; MUHAS: Muhimbili University of Health and Allied Sciences; ORL: Otorhinolaryngology; ENT: Ears, Nose and Throat; CLSI: Clinical and Laboratory Standards Institute

## What is known about cochlear implant?

- Cochlear implant is the surgical intervention to help a deaf child to hear.
- We have needy population in Africa who should be educated and referred to the centers which provide the services (which are currently few in Africa).
- Primary health care providers should have enough knowledge on cochlear implant for them to educate the community.

## What is not known about Cochlear implant?

- Is there community awareness on cochlear implant in Tanzania?
- Are the primary health care providers aware of the current Cochlear implant services being provided at the tertiary hospital in Tanzania?
- Do the primary health care providers have enough knowledge on the Cochlear implant which will help them to give correct information to the needy population/community?

## Introduction

Cochlear Implants (CI) are surgically implanted electronic devices used to treat severe-to-profound sensorineural hearing loss in those individuals who do not benefit from conventional hearing aids [1].

The first CIs in the 1960s were single channel electrodes; later in the 1980s, multiple electrodes were introduced in Australia [1].

The first CI was implanted in 1961 by William House and John Doyle of Los Angeles, California. In 1964, Blair Simmons and Robert White of Stanford University, placed a 6-channel electrode through the promontory and vestibule directly into the modiolus [2].

In Tanzania Specialists at MNH Started to perform Cochlear Implantation in 2017 starting with six children aged below one year.

Since then, research and development has continued to improve patient outcomes in hearing implant technology with a common objective: to enable people with severe to profound sensorineural hearing loss or even total deafness to hear [3].

Currently cochlear implantation is a safe and proven procedure helping to improve hearing and the quality of life for over 300,000 people worldwide [3].

In severe to profound hearing loss, hearing aids are not powerful enough and if the ear damage is too severe, traditional hearing aid will have no effect in amplifying sound. The cochlear implant overcomes this by sending the signal directly to the auditory nerve by bypassing the damaged areas of the ear. They capture the sound, process it and electrically stimulate the auditory nerve [3].

WHO defines disabling Hearing impairment in children less than 15 years old as permanent unaided hearing threshold for the better ear of 31 dB or greater and in adults 41 dB or greater [4].

Worldwide 360 million people live with disabling hearing loss, in which 32 million are children and nearly 180 million are older adults and nearly 90% of the people with hearing loss live in low and middle-income countries, which often lack resources and strategies to address the hearing loss [5].

It is recommended by WHO that identification of hearing impairment should be done by Primary Health care (PHC) workers with training and skills in primary ear and hearing care (PEHC) [4].

WHO has developed a set of excellent and well-illustrated training guides for hearing care at the basic, intermediate and advanced levels aiming at equipping primary care health workers and communities in developing countries with simple and effective methods to reduce the burden of hearing disorders [6].

Many low- and middle-income countries have large shortages of trained professionals who can provide hearing assessments and ongoing support services [7].

**Methodology**

**Study design**

Descriptive cross sectional study because it is quick, cheap, easy to analyze and many variables can be included.

**Study population**

The study population was 5<sup>th</sup> year medical students from government and private owned universities and Intern doctors at MNH.

**Inclusion criteria**

Fifth year medical students and Intern doctors at MNH who consented to the study and signed consent form for participating in the study.

**Exclusion criteria**

Students with incomplete courses.

**Sampling technique**

The sampling technique used was stratified random sampling. The strata was the different universities, and then a proportion of the 5<sup>th</sup> year students from the Universities was sampled into the study and Simple random sampling was used for the intern doctors at MNH.

**Data collection methods and tools**

Self-administered questionnaires was used. They contained closed ended questionnaires containing structured and multiple choice questions. The participants participated by answering the questions in the questionnaires and these answers were then cod-

ed for easy data entry and analysis, no personal information of the respondent was taken. The participant had the right to withdraw from the study at any time if he/she wished to and all participants were briefed about their rights before the study was carried out.

**Data processing and analysis**

Data was coded and entered in a computer software IBM SPSS version 24.0 for analysis. For the case of knowledge, the questions which asked, the responds (delete)were coded and the frequency determined for each response. In determining the level of knowledge the questions asked were:

1. Can Cochlear Implant restore hearing to the deaf?
2. Can Cochlear Implant be used as a management modality for people with hearing loss?
3. Can children who receive cochlear implant learn spoken language?
4. Whether participants new if Tanzania performs cochlear implant or not.

Two points were given for every correct answer making maximum score of 8 and analysed as those scoring < 4 low knowledge, 4 - 6 moderate knowledge, 7 - 8 high knowledge. Numeric data collected was analysed by descriptive statistics such as mean, median and standard deviation. On the other hand, categorical information was analysed by measure of frequencies and percentages.

**Results**

**Demographic characteristic of the study participants**

Demographic	Frequency (%)	
Sex of participant	Male	133 (65.5%)
	Female	70 (34.5%)
	Total	203 (100%)
Education level of participant	Intern Doctors	54 (26.6%)
	Medical Students	149 (73.4%)
	Total	203 (100%)

**Table 1:** Social demographic characteristics.

Our study involved a total of 203 in which majority 133 (65.5%) were males and also among the 203, majority 149 (73.4%) were medical students as table 1 illustrates the participant’s demographics.

**Results on knowledge on cochlear implants**

Demographics/ cross tabulations	Frequency (%)			
	Yes (%)	No (%)	Total	
Sex of participant* Ever heard of Cochlear implant Cross tabulation	Male	115 (86.5%)	18 (13.5%)	133 (100%)
	Female	62 (88.6%)	8 (11.4%)	70 (100%)
	Total	177 (87.2%)	26 (12.8%)	203 (100%)
Education title of participant* Ever heard of Cochlear implant Cross tabulation	Intern Doctors	42 (77.8%)	12 (22.2%)	54 (100%)
	Medical Stu- dents	135 (90.6%)	14 (9.4%)	149 (100%)
	Total	177 (87.2%)	26 (12.8%)	203 (100%)

**Table 2:** Ever heard of cochlear implants.

In our Study, we found that only 177 (87.2%) of the participants had ever heard about cochlear implants among which 115 (86.5%) were males and also 135 (90.6%) were medical students and 26 (12.8%) of the participants had never heard about Cochlear implants as table 2 above outlines the knowledge depending on the participants demographics.

Can cochlear implants restore hearing to the deaf?	Frequency (%)
Yes	142 (80.2%)
No	17 (9.6%)
I don't know	18 (10.2%)
Total	177 (100%)

**Table 3:** Restoration of hearing to the deaf.

In the study, among the 177 participants who had ever heard about cochlear implants, it was also found that 19.8% of the participants either did not know or disagreed to the statement that cochlear implants restore hearing to the deaf as illustrated in table 3.

In this study, it was also found that 11.9% of participants either did not know or disagreed that children who receive cochlear implants can learn spoken language as illustrated in table 4.

Ability to learn spoken language	Frequency (%)
Yes	156 (88.1%)
No	1 (0.6%)
Don't know	20 (11.3%)
Total	177 (100%)

**Table 4:** Ability to learn spoken language.

Is cochlear implant surgery performed in Tanzania?	Frequency (%)
Yes	115 (65.0%)
No	11 (6.2%)
Don't know	51 (28.8%)
Total	177 (100%)

**Table 5:** Knowledge on cochlear implant being done in Tanzania.

In the study it was also found that only 65% of the participants knew that cochlear implants surgery is done in Tanzania as shown in table 5.

**Knowledge on candidacy criteria for cochlear implants**

Criteria	Frequency (%)	
Any deaf child	Yes	26 (14.4%)
	No	131 (74.0%)
	Don't know	20 (11.3%)
	Total	177 (100%)
Child with bilateral sensorineural hearing loss	Yes	131 (74.0%)
	No	18 (10.2%)
	Don't know	28 (15.8%)
	Total	177 (100%)
Child is at least 9 months	Yes	92 (52.0%)
	No	11 (6.2%)
	Don't know	74 (41.8%)
	Total	177 (100%)
Child without/absent Cochlear	Yes	94 (53.1%)
	No	41 (23.2%)
	Don't know	42 (23.7%)
	Total	177 (100%)

**Table 6:** Knowledge on candidacy criteria.

In the study we found that 131(74%) of the participants disagreed that any deaf child is a candidate for cochlear implantation and also 131(74%) of the participants agreed with the statement that bilateral sensorineural hearing loss is an indication for cochlear implantation. Also 92 (52%) of the participants agreed that 9 months is the minimum age for cochlear implantation and only 41 (23.2%) agreed with the statement that a child without cochlear is not a candidate for cochlear implantation.

**Knowledge on cochlear implant team**

Criteria	Frequency (%)	
Audiologist	Yes	170 (96%)
	No	4 (2.3%)
	Don't know	3 (1.7%)
	Total	177 (100%)
Otolaryngologist	Yes	165 (93.2%)
	No	6 (3.4%)
	Don't know	6 (3.4%)
	Total	177 (100%)
Speech Therapist	Yes	163 (92.1%)
	No	5 (2.8%)
	Don't know	9 (5.1%)
	Total	177 (100%)
Social Worker	Yes	115 (65%)
	No	28 (15.8%)
	Don't know	34 (19.2%)
	Total	177 (100%)

**Table 7:** Knowledge on cochlear implant team.

In our study we found that more than 90% of the participant agreed that Audiologists, Otolaryngologists and Speech therapist are required as members of the cochlear implant team however only 65% agreed that Social workers are also members of the team.

**Knowledge on complications**

In the study, we found that more than 90% knew that infection and device failures are among complications of cochlear implants and 80.8% knew that Facial nerve paralysis is also a complication associated and 65.5% knew that CSF fistulas can occur but only 57.1% knew that Cholesteatoma is also a complication that may occur after Cochlear implantation.

Criteria	Frequency (%)	
Infection	Yes	171 (96.6%)
	No	0 (0%)
	Don't know	6 (3.4%)
	Total	177 (100%)
Facial nerve paralysis	Yes	143 (80.8%)
	No	6 (3.4%)
	Don't know	28 (15.8%)
	Total	177 (100%)
CSF Fistulas	Yes	116 (65.5%)
	No	13 (7.3%)
	Don't know	48 (27.1%)
	Total	177 (100%)
Device Failures	Yes	167 (94.4%)
	No	1 (0.6%)
	Don't know	9 (5.1%)
	Total	177 (100%)
Cholesteatomas	Yes	101 (57.1%)
	No	18 (10.2%)
	Don't know	58 (32.8%)
	Total	177 (100%)

**Table 8:** Knowledge on complications associated with cochlear implant.

In this study we also found that majority of students from government owned university (53.3%) had high knowledge while those of Private owned university 78.2% had moderate knowledge.

The p value is 0.019, statistically significant.

Also, we found that among all students (from all universities) majority, 56.5% had moderate level of knowledge.

**Discussion**

**Knowledge on cochlear implants**

This study shows that only 177 (87.2%) of the final year medical students and intern doctors had ever heard about cochlear implants, similar study done in California, United States of America among Primary Care physicians found that only 91% were aware of cochlear implants [12]. This results are alarming since 12.8% had no any idea about cochlear implants.

This study also showed that 19.8% of the respondents either did not know or disagreed that cochlear implants restore hearing to the deaf and a similar survey done in California, United States of America assessing Knowledge and Education of Primary Care Physicians (PCPs) on management of children with hearing loss and Pediatric Cochlear Implantation found that 26% of PCPs did not know that cochlear implants may restore hearing for the deaf [12].

In this study, it was also found that 11.9% of participants either didn't know or disagreed that children who receive cochlear implants can learn spoken language. Similar findings are reported in a study done in the United States that found that 15% of the PCPs did not know that cochlear implants give deaf children the ability to learn spoken language [12].

The study showed that 35% of the participants disagreed or did not know that cochlear implants surgery is done in Tanzania. This results are alarming since Tanzania has been performing cochlear implantation since 2017 at the National Hospital and the primary care physicians are the first people to meet the children in the peripheral hospitals and are required to refer them for cochlear implantation at the National Hospital.

#### Knowledge on candidacy criteria for cochlear implants

This study shows that 131 (74%) of the participants agreed with the statement that bilateral sensorineural hearing loss is an indication for cochlear implantation. A similar study done in Alabama among pediatricians assessing knowledge of, experience with, and comfort levels for CIs in children found that more than half of pediatricians knew that children must have bilateral profound SNHL to be candidates for Cis [10].

This study also found that 92 (52%) of the participants agreed that 9 months is the minimum age for cochlear implantation. A similar study done in Alabama found that 25% of paediatricians new that children below 12 years old are candidates for cochlear implants [10].

Cochlear implantation is currently approved by the FDA for pediatric patients aged 12 months and older. Recently, implantation has been reported in children younger than 12 months [13].

Studies have shown that children implanted below 12 months have superior understanding and found to have receptive and expressive language skills similar to normal hearing peers [18].

Astonishingly, this study showed that only 41 (23.2%) knew that a child without a Cochlear is not a candidate for cochlear implantation. This results are important since the majority of the primary care physicians are likely to mismanage these patients.

#### Knowledge on cochlear implant team

This study showed that more than 90% of the participant agreed that Audiologists, Otolaryngologists and Speech therapist are required as members of the cochlear implant team however only 65% agreed that Social workers are also members of the team. There is still knowledge difference and the importance of social workers in cochlear implant team is not known by many yet they social workers are the ones who obtain psychosocial information related to family dynamics, school and social issues and are crucial in informing the patients and parents about the lengthy rehabilitation needs after cochlear implantation [20].

#### Knowledge on complications

In the study, majority of the respondents were aware about the common complications associated with cochlear implantation where more than 90% knew that infection and device failures are among complications of cochlear implants and 80.8% knew that Facial nerve paresis is also a complication associated and 65.5% knew that CSF fistulas can occur but only 57.1% knew that Cholesteatoma is also a complication that may occur after Cochlear implantation.

#### Association between the university studied/studying and level of knowledge

We found that majority of students from government owned university (MUHAS) 53.3% were highly knowledgeable as compare to those of private owned University in which 78.2 had moderate knowledge according to the criteria and the score was set as currently there is no standard score.

We also found p value of 0.019 which is statistically significant meaning there is an association between the university studied and the level of knowledge. This knowledge difference can be explained by the fact that students from government university have more exposure to cochlear implantation since the surgeries are done at the government teaching hospital.

#### Conclusion

In conclusion, this study has provided a general image on knowledge of cochlear implants among intern doctors and final

year medical students in Tanzania and still there is a knowledge gap among the participants and few still did not know that cochlear implantation surgery is done in Tanzania which is a very good step in the country but also a call to the primary care physicians to be well knowledgeable in indications, possible complications and the whole process involved in cochlear implantation to be able to properly manage these children and be able to refer them timely for the surgery.

### Ethics Approval and Consent to Participate

The approval to conduct the study was granted by Ethics and Research Committee for Muhimbili University of Health and Allied Sciences.

### Consent for Publication

A written informed consent from the study participants/guardians was sought for data collection and possible publishing of the results after analysis for the sake of dissemination.

### Availability of Data and Material

The detailed reported information can be obtained from the corresponding authors when needed and from archives of the department of otorhinolaryngology-MUHAS.

### Competing Interests

The authors declare that they have no competing interests.

### Authors' Contributions

EM participated in preparation of the manuscript, study design, data collection and analysis. DN participated in design of the study and review of the analyzed study findings. HI participated in design of the study and review of the analyzed study findings.

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