

**Translation and Validation of International Outcome Inventory for
Hearing Aids (IOI-HA) in Malayalam- Adaptation from (IOI-HA)
English**

Jeevan Baby Jacob

14AUD006



**This Dissertation is submitted as part fulfilment
for the Degree of Master of Science in Audiology
University of Mysore, Mysore**

ALL INDIA INSTITUTE OF SPEECH AND HEARING

MANASAGANGOTHRI

MYSORE 570006

May 2016

CERTIFICATE

This is to certify that the dissertation entitled “**Translation and Validation of International Outcome Inventory Hearing Aids (IOI-HA) in Malayalam – Adaptation from (IOI-HA) English**” is the bona fide work submitted in part fulfillment for the degree of Master of Science (Audiology) of the student (Registration No. 14AUD006). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru,
May, 2016.

Dr. S. R. Savithri
Director

All India Institute of Speech and Hearing,
Manasagangothri, Mysuru-570006

CERTIFICATE

This is to certify that this dissertation entitled “**Translation and Validation of International Outcome Inventory for Hearing Aids (IOI-HA) in Malayalam – Adaptation from (IOI-HA) English**” has been prepared under my supervision and guidance. It is also certified that this has not submitted earlier in any other University for the award of any Diploma or Degree.

Mysore,
May, 2016

Dr. K Rajalakshmi
Guide
Professor in Audiology
Department of Audiology
All India Institute of Speech and Hearing
Manasagangothri, Mysore- 570006

DECLARATION

This is to certify that this dissertation entitled “**Translation and Validation of International Outcome Inventory for Hearing Aids (IOI-HA) In Malayalam – Adaptation from (IOI-HA) English**” is the result of my own study under the guidance of Prof. Rajalakshmi K, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not submitted earlier in any other University for the award of any Diploma or Degree.

Mysuru

Register No: 14AUD006

May, 2016

ACKNOWLEDGEMENT

In the first place, I would like to thank my Mom & Dad, without their prayers & blessings I wouldn't have been in this position. I also thank my BRO and cousins for all the support given.

I express my deepest gratitude and thankfulness to my guide, Dr. K Rajalakshmi. I wish to thank you for all the support you gave me all these years. Thank You so much ma'am...You are one of the most inspiring women I have met in my life.

I would like to thank the H.O.D, Dept.of .Audiology Dr Sandeep. M, former H.O.D , Dept.of .Audiology Dr. Ajith Kumar U, all the other staffs of AIISH for their timely support and motivation.

I thank statistician Santhosh sir, for helping me in my dissertation.

I thank all the video up loaders of YouTube for helping me clear my doubts in statistics and writings.

Special thanks to my Dissertation partner Ishu for all the help you have done for me. You were always approachable. Thank you man...U deserve a special mention. I would also like to thank my other dissertation partner Mythri... Thanks for all the fun and learning we had together. Will miss you guys...

I would also like to thank all my teachers at J.S.S institute of speech and hearing for all the knowledge you have shared. I thank all my bachelors classmates and dearest friends Guru, Gsk, Shaaa, Jo, Heps, Nikki, Anu. You guys taught me the value of friendship..

I thank my junior Basih for helping me in completing my dissertation..

I thank all the SFM'S in Mysore.... Jim, Jesnu, Nadeer, Hasheem, Akhil, Jithin, Tareeq, Faraz, Ruben sir & Basih..Thanks for all the parties and fun.

Special thanks to Basih who helped me a lot in finishing my dissertation

I also thank my buddies Akash, Bennet & Jithin U guys taught me how to enjoy life...

I also express my thanks to Sudhy, Tony, Babith & Nidhin for being the 5veee.

I thank all the BOYS in my batch for being wonderful classmates and friends. I will always cherish the moments spent with you guys.

I thank all my class mates for the support you have given to me.

I apologize if I have missed on mentioning anyone here...

THANK YOU ALL

Abstract

Outcome measurement is a fundamental principle of quality assurance in the health care sector. Along with objective/laboratory measurements self report outcomes are important in capturing the true impact of hearing loss and its associated treatment on lifestyle, activity limitations etc. Among all the available self report outcome tools IOI-HA covers most of the subjective factors that will compliment with the objective assessment. It contains 8 items and each of them represent a different outcome. The present study aimed at translating and validating IOI-HA into Malayalam. Initially the questionnaire was translated with the help of a linguist and suitable modifications were done with the help of an Audiologist. Later it was administered on 120 hearing aid users which included children, adults and older adults. Descriptive analysis of the data was done to see the distribution of scores and a normative was developed. Most of the participants were having high scores which indicated that they are happy with their own hearing aids. The questions had good inter-item correlation which was revealed by spearman's correlation test. All the questions were significantly positively correlated with each other. Chi square test results showed no significant association of demographic factors on hearing aid outcome. It was concluded that Malayalam speaking hearing aid users are getting good benefit and are satisfied with their hearing aids.

Table of Contents

List of figures.....	ii
List of Tables.....	iii
Chapter 1.....	1
Introduction.....	1
Chapter 2.....	5
Review of Literature.....	5
Chapter 3.....	19
Method.....	19
Chapter 4.....	22
Results and Discussion.....	23
Chapter 5.....	44
Summary and Conclusion.....	47
References.....	48
Appendix A: IOI-HA Malayalam.....	54

Sl. No	List of Figures	Page No
Figure 1	Frequency distributions for item 1 (USE) in percentage	25
Figure 2	Frequency distributions for item 2 (Benefit) in percentage	26
Figure 3	Frequency distributions for item 3 (residual activity limitations) in percentage	27
Figure 4	Frequency distributions for item 4 (satisfaction) in percentage	28
Figure 5	Frequency distributions for item 5 (residual participation restrictions) in percentage	29
Figure 6	Frequency distributions for item 6 (impact on others) in percentage	30
Figure 7	Figure 7 frequency distributions for item 7 (quality of life) in percentage	31
Figure 8	Template of the individuals norms (mild-moderate category)	33
Figure 9	Template of the individuals norms (moderate-severe category)	33

Sl. No	List of Tables	Page No
Table 1	List of details of questionnaires assessing hearing aid benefit	7
Table 2	List of details of questionnaires assessing hearing aid satisfaction	8
Table 3	List of details of questionnaires assessing hearing disability or hearing handicap	8
Table 4	Frequency distributions of the IOI-HA items of Malayalam version across age groups	23
Table 5	Mode values for each item across age groups	24
Table 6	Inter-item correlations for IOI-HA	35
Table 7	Values of Chi-square test	40

Chapter I

Introduction

Communication is one of the essential and very important need for humans and most communications are achieved by hearing. So a deprivation in hearing will have a huge impact on an individual's life. It not only affects one's ability to comprehend auditory information, but also how to relate to one's culture and environment. More than that it also results in biological, psychological and social consequences. Sensorineural hearing loss is the most common among them and we know that this is an irreversible condition and providing hearing aids will be the first option. With the advancement in the technology the satisfaction level of the hearing aid users are also found to be improved. But, still there are populations who are not satisfied with their hearing aids and there are many factors that can influence this. Studies are going on across the globe to identify the possible factors that contribute to better outcomes. If the hearing loss got untreated then it can result in withdrawal from a variety of social activities and this in turn will affect the quality of life of the individual. So it is necessary to give proper rehabilitation services to the hearing impaired individuals.

Apart from diagnosing the type and severity of the hearing problem an audiologist is concerned about fitting hearing aids to the individual with hearing impairment. To decide about the hearing aid the audiologist considers the tests that are carried out mostly in a laboratory situation like Pure Tone Audiogram, Aided audiogram, Speech Identification Scores, Speech Detection Threshold (SIS/SDT) etc.

But there are other real life domains that cannot be assessed in a laboratory condition. It is important to understand that people take hearing aids not only because they have a hearing loss, it is because they are not able to take part in their social or family life as they wanted. They may experience participation restriction or activity limitation. Sometimes real life situations will be simulated in the measurement but this will not resemble to the real life situations the client encounter.

Health professionals need to be able to demonstrate, to both the community and resource providers, that the services they provide have a positive impact on their clients functional status and quality of life (Uriarte, 2005). So, for quality assurance in the health care sector, outcome measures are very much important. This will also allow the clinician to exhibit how the intervention works and also these measures play an important role in improving the development of a clinic. The clinic that measures the outcomes will be able to detect the areas that require perfection. At present there are many self-report outcome measurement tools available in the field of audiology. Different outcomes can be measured using different measures. There are measures available to assess the satisfaction, benefit, changes in the functional effects, residual participation & changes in relation to individual client's goals etc. Some of them can measure more than one outcome i.e. the multidimensional measures. IOI-HA (International Outcome Inventory – Hearing Aids) is the most well known of these.

Health services are becoming more patient-oriented nowadays. So it is very essential to assess the customer satisfaction in any field. IOI-HA can be used to measure the individual's satisfaction with the hearing aids. Although there are numerous commercially available outcome measures for hearing aids, in this present study, the IOI-HA will be the subject of focus. This is because, as well as being a

useful validation tool, its ability to facilitate cooperation among researchers without adding any limitations to their responsibility and prerogative to plan studies (Cox, Alexander & Beyer, 2003; Cox & Alexander, 2002). By design it is an ideal universal outcome measure intended to pool and compare data across studies and countries, it is brief and inclusive so that it can easily be appended to any research protocol without significant additional costs, time and resource. Because of these same reasons, it is of interest to both practitioners and researchers in the assessment of hearing aid fitting outcomes (Cox, Alexander & Beyer, 2003; Cox & Alexander, 2002; Kramer et al, 2002). There are seven items which cover a broad range of subjective factors and each item represents a different outcome domain. It has five response alternatives, where each response ranges from the worst to the best outcome and the higher scores indicate a better outcome. The items are, (1) "hearing aid usage" (2) "Benefit" (3) "Residual activity limitations" (4) "satisfaction" (5) "Residual participation restrictions" (6) "Impact on others" and (7) "Quality of life". These subjective factors complement well with the objective measures in evaluating the success of the hearing aid fit program.

Bentler and Kramer (2000) illustrate that combining patient self-reports with laboratory and technical data is critical in determining treatment success. Kiessling (2001) also made use of the IOI-HA to realize that appropriate fitting strategies are vital, if users are to receive the full benefits from advancements in hearing technology. The IOI-HA is used as an additional tool that may be complimentary to various hearing aid inventories and hence can be used in research as well as for clinical purposes.

Need for the study

In India there is lesser number of measurement scales to evaluate the extent of the individual's needs and expectations that are fulfilled by using the hearing aids given by the clinician. Though there are several outcome measurement tools available for Western population (Hearing handicap inventory for the elderly (HHIE), Client oriented scale of improvement (COSI), Satisfaction with amplification in daily life (SADL), IOI-HA), none of these tools except the Hindi version of IOI-HA is standardized for Indian population. Among all the available tools IOI-HA covers most of the subjective factors that will complement the objective audiological measures used to evaluate hearing aid fitting success.

Keeping this fact in consideration there is a need to develop a tool which can be used by the clinician to assess the outcome of prescribed hearing aid and can also be used by client to assess the outcome himself. The results obtained can be used to compare outcomes of hearing aid users across different populations.

Aims of the study

- To translate the IOI-HA in to Malayalam
- This study will help in collecting data from the Malayalam speaking population and also in standardization of IOI-HA questionnaire in Malayalam. It can be used to check the effectiveness of the hearing aid service.
- To develop norms for the IOI-HA Malayalam version.
- To investigate factors those contribute to better outcomes.
- Identify those factors which provide better outcomes and use them for effective counselling.

Chapter II

Review of literature

The interest in the area of hearing aid outcome measures had increased significantly in the past decade. This was driven by several factors including the desire to document the benefits achieved by amplification or fitting formulas by audiologists and consumer's, manufacturer's desire to act accordingly with the regulations of Food & Drug Administration and also researcher's who desired to understand the impact of hearing aid on listeners auditory performance, immediately after delivery and or in long term basis. It is very important to know the patients point of view in determining the functional benefits (Humes, Garner, Wilson & Barlow, 2001). In the past, laboratory or technical data was used to judge the success of the intervention plan but at present, along with this, the extent to which the treatment has alleviated the problems in their daily life is also considered. The treatment is said to be successful only when it has shown improvement in the patient's quality of life. Benefit and satisfaction are the two terms used to describe outcome measures in audiological rehabilitation (Humes & Humes, 2004). Cox in 2003 said that the benefit or the degree of change can be measured by the extent of activity limitation or participant restriction and Satisfaction. According to Cox it is "the aggregate of the individually weighted physical, social, psychological and financial changes acquired from using hearing aid".

"Outcome measures will help the audiologist to identify the areas that has to be modified in the service or treatment that will suit the client; provide client with objective information regarding the benefits of certain interventions and technologies;

promote data driven decision making; evaluate the performance of new and existing hearing aid technologies; providing manufacturers of hearing aid with quantitative information regarding client's hearing needs and concerns with hearing aid; and track and compare provider performance over time" (Beck, 2000; Humes et al, 2001). Hearing aid benefit can be measured either objectively or subjectively, objectively aided speech recognition can be compared to unaided or by insertion gain measurements and subjectively by the use of self report questionnaires. Self report items with known psychometric properties can be used to measure the usefulness of hearing aids. The usefulness can be measured across several domains such as satisfaction, acceptance, handicap reduction and benefit.

Cox (2003) gave reasons to use self report measures of benefit and satisfaction. First, for the economic reasons because the health care is becoming consumer driven. The consumer decides what treatment is selected and when it is complete so, a patient point of view is very essential in this scenario. Therefore, it is critical to measure the real world benefit and satisfaction of hearing aid use. The second reason which he put forward was related to the fact that many of these real world experiences simply cannot be measured in laboratory conditions effectively. Self report outcomes should be used to capture the true impact of hearing loss and its associated treatment on lifestyle, activity limitations etc., instead of using the traditional outcome measures like speech recognition in quiet and noise. Third, there are methods in which real world listening situations are simulated in laboratory but, they do not resemble the patient's impression of the actual real life situation.

Therefore, many self report instruments were developed to document the patients view in the evaluation of rehabilitation services using hearing aids (Bentler & Kramer, 2000). Here, the patients can be asked to make a direct assessment or the

comparison of with and without hearing aid similarly, patient's views of their disability can be assessed both before and after the rehabilitation program.

The various scales that have been used widely are listed in the table 1, 2 & 3.

Table 1: *List of details of questionnaires assessing hearing aid benefit*

Benefit scales	Questionnaire	Authors	Year
HAPI	Hearing Aid Performance Inventory	Walden, Demorest & Hepler	1984
PHAP	Profile of Hearing Aid Performance	Cox & Gilmore	1990
PHAR	Profile of Hearing Aid Benefit	Cox, Gilmore & Alexander	1991
SHAPI	Shortened Hearing Aid Performance Inventory	Schum, Dillon	1992
APHAR	Abbreviated Profile of Hearing Aid Benefit	Cox and Alexander	1995
COSI	Client Oriented Scale of Improvement	Dillon, James & Ginis	1997
PAL	Profile of Aided Loudness	Mueller & Palmer	1998
GRABP	Glasgow Hearing Aid Benefit Profile	Gatehouse	1999
IOI-HA	International Outcome Inventory for Hearing Aids	Cox et al	2000

Table 2: *List of details of questionnaires assessing hearing aid satisfaction*

Satisfaction scales	Questionnaire	Authors	Year
HAUQ	Hearing Aid User's Questionnaire	Forster and Tomlin	1988
SADL	Satisfaction with Amplification in Daily Life	Cox and Alexander	1999

Table 3: *List of details of questionnaires assessing hearing disability or hearing handicap*

Hearing handicap profile	Questionnaire	Authors	Year
HHS	Hearing Handicap Scale	High, Fairban and Glorig	1964
HPI	Hearing Performance Inventory	Giolas, Owens, Lamb & Schubert	1979
HHIE	Hearing Handicap Inventory for the Elderly	Ventry & Weinstein	1982

HHIE-S	Hearing Handicap Inventory for the Elderly-Screening	Ventry & Weinstein	1983
RHPI	Revised Hearing Performance Inventory	Lamb, Owens & Schubert	1983
M-A	Mc Carthy-Alpiner Scale of	Mc Carthy-Alpiner	1983
SCALE	Hearing Handicap		
HHIE- SP	Hearing Handicap Inventory for the Elderly-spouse	Newmao & Winstein	1986
CPRI	Communication Profile For the Hearing Impaired	Demorest & Erdman	1987
HHIA	Hearing Handicap Inventory for Adults	Newmao & Winstein, Jacobson & Hug	1990
CSOA	Communication Scale for Older Adults	Kaplan & Bailly	1997

Development of IOI-HA

These self reports assess different domains like benefit, satisfaction, activity limitation and participant restriction. But, none of these does a comprehensive evaluation of all the domains. Most of the researchers use a battery of self report measures to evaluate the hearing aid outcomes. But, this will lead to confusions while comparing between studies. It was Cox and his colleagues' in 2000 developed IOI-HA to compare data from different hearing aid investigations using different methodologies. The original version of IOI-HA was in English, developed at an international workshop on “measuring outcomes in audiological rehabilitation using hearing aids” in Eriksholm in Denmark and at a meeting of the International Collegiums of Rehabilitative Audiology (ICRA), held in Cardiff, UK in 2001. The specialists in the field of Audiology decided to translate IOI-HA into different languages. Accordingly it has been translated to more than 30 languages by 2015. The countries like United Kingdom, Australia, Nederland, United states, Germany, Arabic countries and Nigeria has done large scale outcome measurement. According to researchers IOI-HA can function as a standalone tool for quality assessment. This was originally developed to be used as a supplemental measure to a battery of hearing aid outcome measures (Cox, 2000), but later because of its easiness in administering and scoring, the strong psychometric properties, the inclusion of comprehensive outcome measures and availability of normative data, it emerged as an independent hearing aid outcome measure

About IOI-HA

The IOI-HA contains of 7 items that assesses the following hearing aid outcome domains. 1) “Hours of daily use” (USE), 2) “benefit” (Ben), 3) “Residual activity limitations” (RAL), 4) “satisfaction” (Sat), 5) “Residual participation restriction” (RPR), 6) “Impact on others” (Ioth), 7) “quality of life” (QoL). Item 1 will give data about how many hours they are using their hearing aids per day. Item 2 (Ben) assesses if there is any improvement in a particular situation with the hearing aid when compared to not using it. Item 3(RAL) focuses on residual activity limitations, or the difficulties an individual is facing in a situation despite using hearing aids. Item 4 (Sat) checks the amount of hearing aid satisfaction or the internal fulfilment it has provided. Item 5 (RPR) will assess the amount of residual participation restrictions due to the hearing difficulties. Item 6 evaluates the impact of their hearing difficulties on others. The last item that is the seventh item evaluates whether the quality of life has changed. Each of the items has five response choices and is scored from 1 to 5 where a score of 1 indicating poorer outcome and 5 indicating best outcome. A global score is obtained by adding out the scores for all items. A higher score indicates better outcome (Cox and Alexander, 2002). The most recent version of the IOI-HA includes item 8 which is the hearing difficulty questionnaire. This item is not included while calculating the global score and is used only for normative purposes.

IOI-HA studies

Cox & Alexander (2002) reported the psychometric properties of the English version of IOI-HA and they found that the items are reasonably internally consistent, providing adequate statistical support for summing the scores to generate a total outcome score. They also reported that for obtaining maximal consistency, it would be better to generate two scores for the inventory by considering two factors where factor one is represented by items 1, 2, 4 and 7 and factor 2 is represented by items 3, 5 and 6. The items in factor one could be summarized as satisfaction variables, whereas the remaining items, factor two, reflect issues like as residual participation.

Cox & Alexander (2003) developed norms for the IOI-HA English version. They defined the normative group as adults, who were fitted with bilateral analog single channel, single memory, compression processing, in the ear hearing aids. The study was carried out on 154 individuals. Associations between outcomes and demographic variables were seen. Two sets of norms were developed one, for individuals who reported moderately severe and severe difficulties without hearing aids and one for individuals who reported mild to moderate difficulties without hearing aids. Norms for statistical comparison with group data were given in terms of means and standard deviation for each item and templates were given for evaluating responses from single individual.

Stephens (2002) studied the relationship between IOI-HA English version and COSI (Client Oriented Scale of Improvement). He administered IOI-HA to 161 individuals and most of them also completed COSI. Very few questions were not completed (<2%). Analysis indicated two subscales of IOI-HA, one is the 'benefit'

subscale and the other one is the 'residual problems' subscale. Both elements of the COSI correlated with the benefit subscale, but only the residual measure of COSI related to the 'residual problems' subscale.

Dreschlerf & Festen (2002) had come up with the results of IOI-HA Dutch version. They analysed 505 responses of hearing aid users. Descriptive as well as inter-item correlation was done and they found high internal consistency which was shown by Cronbach's alpha coefficients. Significant correlations were found between IOI-HA factor 2 and the hearing handicap and disability inventory and subscales of the Amsterdam inventory for hearing disability and handicap.

Test-retest reliability of the IOI-HA was also observed and it was found that the IOI-HA is a realistic and reasonable tool which can be used in measuring features related to hearing aid usage, therefore it is found to be a valuable and reliable tool (Kramer, Coverts, Dresehler. Boymans. & Pesten (2002).

The Arabic version of IOI-HA was developed at the end of 2003 and the norm for this version was developed later by Mustafa in 2004. 106 individuals took part in the study and he found that the mean score was between 2.3 and 2.7 which indicate that most of the patients were not happy with the hearing aids. In comparison with other versions of norm the mean scores were less.

Go (2006) Translated IOI-HA to Filipino version as a part of masters dissertation submitted to Hong Kong University and also developed its normative. Results were obtained from 170 participants. Most of them had higher scores in all

items of the inventory with the mean score ranging from 2.88 to 4.47. He also found a significant inter-item correlation among all items except for the items 5 and 6 which did not correlate with the other six items. This study also illustrates perceived improvements from a hearing aid program.

Klumpp & Espmark (2007) reported that IOI-HA is a natural inventory which is able to be used internationally and can be used to differentiate satisfied and non satisfied hearing aid users. They also found that the psychometric properties were similar across languages and cultures.

Smith, Noe & Alexander (2009) evaluated the psychometric properties of the IOI-HA in the English version and established a normative for veteran sample. There were 131 participants with the mean age of 74.3. Factor analysis showed veteran sample had identical subscale structure as reported in the original sample. The internal consistency was good for the total score and even they found good test-retest reliability. They developed group and individual norms for both the hearing difficulty categories. The study concluded that the properties of IOI-HA questionnaire for the veteran sample are similar to the previous versions.

Gasparin, Menegotto & Cunha evaluated the psychometric properties of the Portuguese version of the IOI-HA and found that the mean value ranged from 3.43 to 4.67. This again indicates that the participants were satisfied with their hearing aids. They also found moderate levels of internal consistency and many items were correlated to each other.

Dillon, Hickson & Lloyd (2010) reported the factors related to the hearing aid fitting outcomes on the IOI-HA questionnaire in Australian hearing aid users. The study aimed at finding about factors that can help a clinic to improve the outcomes. There were 1653 participants where most of them were fitted with bilateral hearing aids (78%). Regression analysis was done and they found that there were a number of factors that, in total, explained variance 57% in the IOI-HA scores. Higher satisfaction, attributes of aid, comfort or clarity of sound, comfort with loud sounds and satisfaction in listening situations of conversation with one person, in small groups and outdoors was associated with higher mean scores.

Arakawa, Picolini, Sitta, Oliveira, Bassi & Bastos (2010) evaluated the user satisfaction with hearing aids using Portuguese translated IOI-HA version. The study was carried out on 18 individuals and they found that the mean scores ranged from 3.8 to 4.4 which indicate high level of satisfaction with the hearing aids for the participants. They concluded that IOI-HA was effective to evaluate the satisfaction of users, easy to apply, understand and require less time to complete it.

Liu, Chen, Han & Zhang (2011) developed the normative for of the Chinese version of IOI-HA. The questionnaire was mailed to 1502 hearing aid users in china who received their hearing aids from different clinics. In the 1049 responses analysed they found that the mean scores for each item ranged from 3.55 to 4.16 and a score of 4 and 5 has maximum frequency. This indicated high levels of self reported outcomes and they concluded that IOI-HA can be used to measure the hearing aid outcomes effectively.

Hamarcu (2010) used IOI-HA-TR which is the Turkish version of IOI-HA to evaluate the satisfaction rate and the factors affecting it. Out of the selected participants 70% had moderate, 22 % had severe, 6% had profound and 2% had mild degree of sensorineural hearing loss. They found that 80% of them used the device for more than four hours a day and 64% reported significant benefits from the hearing aids and 68% reported that the symptoms disappeared compared to pre fitting. They also reported that the level of satisfaction was statistically correlated with the level of education. The usage and satisfaction levels were found to be higher even though the group was homogenous.

Hosuk Chu et al (2012) developed Korean version of IOI-HA and he also checked for its reliability and validity. The results showed good internal consistency (Cronbach's $\alpha = 0.83$) and high test-retest disability ($r=0.943$). The validity was checked by confirmatory factor analysis also showed good consistency. They also concluded that the Korean version of IOI-HA is a reliable tool for measuring the outcomes of the hearing aids.

Kozlowski, Ribas, Almeida & Luz (2014) measured the user satisfaction for adults with hearing aids using IOI-HA Portuguese translated questionnaire as a means for self assessment. Reports suggest that the quality of life of most of the patients improved, which was revealed from their high scores. They found high degrees of satisfaction from all the areas which the IOI-HA assessed.

Thunberg Jespersen, Bille & Legarth (2014) revised the earlier IOI-HA Danish version, which was problematic because the item 5 of the earlier was not

semantically clear. They obtained the psychometric properties of the revised version. The results revealed good internal consistency which was not there for the previous version. Furthermore, it possesses psychometric properties equivalent to those studies of other translations.

Rachana & Rajalakshmi (2014) translated the IOI-HA in to Hindi and checked the hearing aid outcomes of Hindi speaking population. Also, they assessed the factors that can contribute towards the hearing aid outcomes and developed a normative for that population. They found that the duration as well as type of hearing loss and duration of hearing aid had associated with questions of IOI-HA. Questions 3, 4 and 5 had association with duration of problem; duration of hearing aid use had association with question 1, 2 & 3. Age gender and degree of hearing loss had no association with questions and most of the questions had strong correlation with each other.

From the above mentioned studies it is clear that IOI-HA is a reliable and valid tool which can be used to measure the outcomes of hearing aids. It is not time consuming and is already available in many languages. The questions have good internal consistency and inter-item correlations were also found. From the literature it is clear that the performance measures vary from benefit to satisfaction and it is not possible for the audiologist to use variety of tools to measure the outcomes which will be time consuming. In this case IOI-HA is the best option an audiologist can have because it provides more information and less time consuming.

In India, the scenario is little different from the other developing countries in terms of language. Because India is a multilingual country and if we need to compare the hearing aid outcomes then it is necessary to translate IOI-HA in to the regional languages

. This will help us to compare the results across the country and uniformity can be maintained. It has already been translated to Hindi (Rachana & Rajalakshmi, (2014) which is the national language of India. The present study is an effort to translate IOI-HA in to Malayalam which is a regional language spoken in the southern part of India.

Chapter III

Method

A total of 120 male and female Malayalam speaking subjects were recruited for this study with the age range as follows.

- 5 to 17 years (children, 40 individuals)
- 18 to 55 years (adults, 40 individuals)
- Greater than 55 years (elderly adults, 40 individuals)

All participants were from reputable hearing clinics in Kerala as well as from All India Institute of Speech and Hearing (AIISH), Mysore. Apart from IOI-HA questionnaire, demographic details such as age, gender, type of hearing loss, degree of hearing loss and duration of hearing aid use was obtained.

Translation process

In the first phase English version of IOI HA was translated in to Malayalam by three individuals who were well versed in the academic discipline and had Malayalam language as their first language. Later reverse translation was done for each of 3 set of Malayalam translated questionnaires by three different individuals who were expert in both languages. In the last phase of translation, a linguist who was proficient in both Malayalam and English was asked to evaluate each of translated questions and choose the best questions from each set which can deliver same meaning as original questions. Suitable modifications were done with the help of a linguist and an audiologist.

Subjects

The participants fulfilling the following criteria were selected for the study.

- *Native languages (Malayalam)* –The participants selected were native Malayalam speakers. Only literate participants/caregivers were selected for the study, as it was necessary for the participants to fill the questionnaire themselves/caregivers.
- *Hearing Loss* – Participants having mild to severe sensorineural, conductive or mixed hearing loss were taken for the study.
- *Hearing aid* - Participants using digital BTE hearing aid were selected.
- *Minimum period of use of hearing aid* – Participants who were using the hearing aid for at least 3 months were considered.
- *Maximum period of use of hearing aid* - There was no maximum time for the use of hearing aid by participants as the period of hearing aid use were considered as experience and the participants was compared accordingly.

Procedures

Filling out the questionnaire

Malayalam translated version of the IOI-HA questionnaire was given to the participants which contained 3 sections. The first section was the demographic data which was to be filled by the participants/caregivers and the second session contained the features of hearing aid which was filled by the audiologist. The third and the final section had the eight questions which represent the outcome domains such as daily use, benefit, residual activity limitation, satisfaction, residual participation restriction, impact on others, quality of life and perception of their hearing difficulty. These were

filled by the client. All participants were given information about the nature of the study and were also informed about the confidential nature of the study.

Scoring

Each question had 5 options. The participants were asked to tick the most suitable / appropriate option out of five for all eight questions. For the first seven questions the left most response, indicates the poorest outcome, and was scored as 1 and the right most response, denotes the most favorable outcome, was scored as 5. A score for each question & the total score was considered for the analysis. The questionnaire was given to participants in a one to one interview and was asked to fill the first and third section of the questionnaire.

Statistical analysis

Descriptive analysis was done for each items of the IOI-HA Malayalam translated version which includes frequency distribution and Mode. Spearman's correlation was done to identify the inter-item correlation and Chi square test was done to find the association with demographic data. All statistics were performed using SPSS version 21.

Chapter IV

Results & Discussion

The aim of the present investigation was to translate and validate IOI-HA to the Malayalam speaking population. Further, the association of age, gender, duration of use and factors related to hearing aid use were investigated. The data was collected from 120 participants from 3 different age groups with an age range of 5 to 17 (children), 18 to 55 (adults), above 55 (older adults) with each group containing 40 individuals each. The translated questionnaire was administered to all the participants. Each item was scored from 1 to 5 indicating worst to best respectively and a higher score indicates better outcome. The SPSS software (version 21.0) was used to do item-wise analysis.

The results of the study are presented in the following domains:

1. To develop norms for IOI-HA Malayalam speaking population by means of response to each question
2. The association of items with each other in the Malayalam translated version
3. The relation between demographic factors such as age, gender and other factors such as type of hearing loss, degree of hearing loss and duration of hearing aid use which can affect the outcome.

Descriptive analysis was done to develop the norms for the Malayalam version of IOI-HA. The response distribution of each question's response was obtained using the descriptive statistics for the participants.

4.1 Frequency distributions and mode values of IOI-HA Malayalam version

The summary of frequency distributions and mode of IOI-HA Malayalam version across the age groups is shown in *Table 4 and Table 5*

Table 4

Frequency distributions of the IOI-HA items of Malayalam version across age groups

Item	Children					Adults					Older adults				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Use			2	15	23			2	17	21				19	21
Ben		2	2	21	15		2	1	25	12		1	2	23	14
RAL		1	8	17	14		2	14	14	10		1	7	20	12
Sat			3	25	12		2	7	23	8		2	7	20	11
RPR		2	30	6	2	6	12	15	5	2	7	2	12	15	4
Ioth		3	5	20	12		3	7	18	12		1	11	19	9
QoL		1	2	14	23		1	5	30	4			7	23	10

Use=hours of use: Ben=benefit: RAL=Residual Activity Inhibition: Sat=Satisfaction:

RPR=Residual Participation Restriction: Ioth=Impact on others: QoL=Quality of

Life:

Table 5 Mode values for each item across age groups

Items	Mode		
	Children	Adults	Older adults
Use	5	5	5
Ben	4	4	4
RAL	4	3	4
Sat	4	4	4
RPR	3	3	4
Ioth	4	4	4
QoL	5	4	4

A higher score (4 and 5) for items one to seven and a lower score (1 and 2) indicates better outcomes as seen from the original questionnaire. According to the results of the study the most common response for the items one to seven is 4 and 5. So, it indicates that the participants are benefiting from the hearing aid in all the domains which IOI-HA has assessed. Studies done in the other languages also showed similar outcomes. Cox & Alexander (2002) for the English version reported a mean ranging from 3.5 to 4.1 and Go (2006) for the Filipino version reported a mean score ranging from 2.88 to 4.47. The Chinese version by Liu Zhang, Liu Chen, Han & Zhang (2011) found a mean score ranging from 3.55 to 4.16 and for the Portuguese version it was 3.8 to 4.4 as studied by Arakawa & Picolini. Only the Arabic version (by Mustafa (2005)) reported little lower mean scores ranging from 2.3 to 2.7.

Figures 1 to 7 show the frequency distributions of each items of the IOI-HA Malayalam version in detail across 3 different age groups. Higher scores indicate better outcome for items 1 to 7.

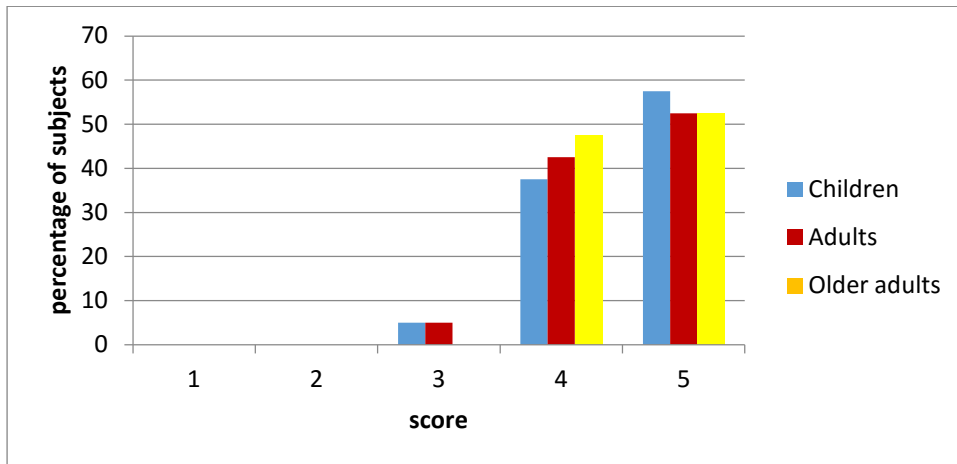


Figure 1 Frequency distributions for item 1 (USE) in percentage

The results of the present study shows that 57% of the children were using their hearing aid for more than 8 hours and 37.5% of them were using the hearing aids for 4-8 hours a day. Whereas 52.5% of adults and older adults were using it for more than 8 hours and 42.5% of adults and 47.5 % of older adults were using it for 4-8 hours a day. In the previous studies also most of the subjects have reported to be using their hearing aids for more than 8 hours a day. 72%, 69 %, and 43.4 % as reported by Turkish population (Serbetcioglu, Mule, Kinkily & Uzunoglu, 2009), Filipino population (Go, 2006)) and the Chinese population Liu Zhang, Liu Chen, Han & Zhang (2011)) respectively. Cox (2003) in his study mentioned that the duration of hearing aid outcome is an indicator of real world hearing aid outcome. That means to say that, the hearing aid is helping the person to cope in the worst listening situations which motivates him to wear it for longer time.

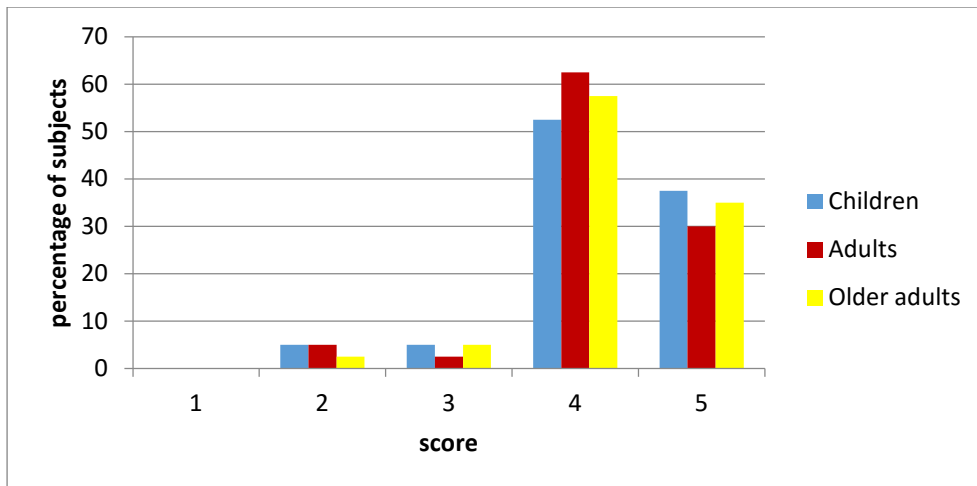


Figure 2 Frequency distributions for item 2 (benefit) in percentage

The second question is about the hearing aid benefit

52% of the children, 62.5% of the adults and 57.5 % of the older adults reported that the hearing aid “helped a lot” and 37.5% of the children and 57.5% and 62.5% of the adults and older adults respectively, reported that the hearing aid “helped very much”. This indicates that the hearing aid is beneficial for the users. These results are in agreement with the results of the previous studies. Cox & Alexander (2002), Serbetcioglu, Mule, Kinkily & Uzunoglu, (2009), Go (2006), Liu Zhang, Liu Chen, Han & Zhang (2011), Kozlowski, Ribas, Almeida, & Luz (2014), Dreschlerf & Festen (2002). In all these studies almost 60- 70% of the participants reported that the hearing aid “helped a lot” or “helped very much”

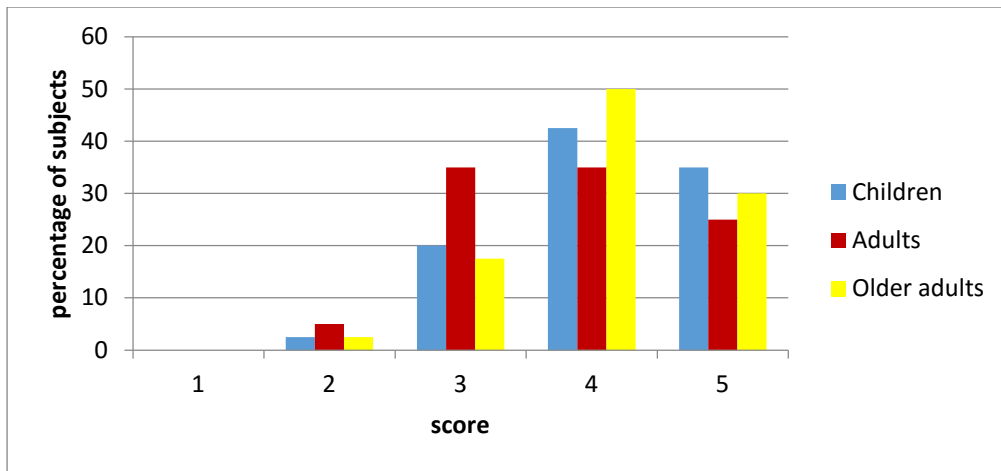


Figure 3 Frequency distributions for item 3 (residual activity limitations) in percentage

The third question is about the residual activity limitation.

77.5% of the children and 80% of older adults reported to have “slight difficulty” or “no difficulty” and 20% of them reported to have “moderate difficulty”. In the adult population 35% of them had experienced “moderate difficulty” and 25% of them had “no difficulty”. Results from the English version (Cox & Alexander, 2002), and Chinese version (Liu, Chen, Han, & Zhang, 2011), showed 55-60% of the participants reporting “slight difficulty” or “no difficulty”. Similar results were obtained in the other studies also. Kozlowski, Ribas, Almeida, & Luz (2014), Dreschlerf, & Festen (2002), Go (2006). At least 50% of participants in all these studies reported of having less residual activity limitation while using the hearing aids which again indicates that the participants are getting good help from their hearing aids.

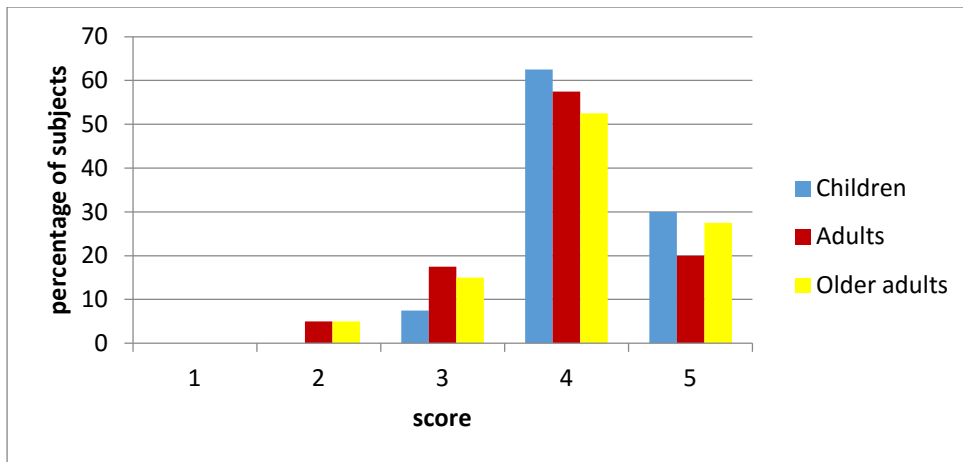


Figure 4 Frequency distributions for item 4 (satisfaction) in percentage

The fourth question reports about the satisfaction with the hearing aid

Most of the participants were satisfied with their hearing aids. 62.5% children, 57.5% adults and 52% older adults considered their hearing aid as “quite a lot worth it”. 30% of the children considered it as “very much worth it” and only 7.5% of them reported that the hearing aids are not meeting their expectation. Similarly, 20% of the adults and 27.5% of the older adults considered their hearing aids “very much worth it”. This result as expected; hearing aid users want some way to cope with their problem and for most of the participants their hearing aid was able to meet their expectations. Only a few percentages of participants were not satisfied with their hearing aids. The results for this item were also correlated with the previous studies. On an average 60-70 % of the participants were reported to be satisfied in the previous studies. Cox & Alexander (2002), Serbetcioglu, Dreschlerf, & Festen (2002) Mule, Kinkily, & Uzunoglu (2009), Go (2006), Liu Zhang, Liu Chen, Han & Zhang (2011), Kozlowski, Ribas, Almeida, & Luz (2014).

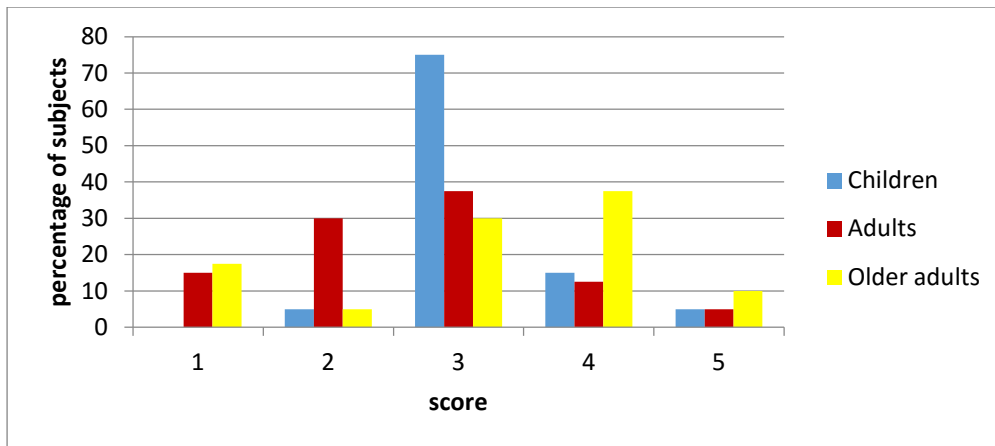


Figure 5 Frequency distributions for item 5 (residual participation restrictions) in percentage

The fifth question concerns about the residual participation

There was variability seen in the responses across age groups. 75 % of the children reported of having “moderately affected” whereas only 37.5% adult and 30% of older adults reported the same. 30% of the adults reported of being affected “quite a lot” and was very much affected for 15% of them. In the older adults group most of them responded to “slightly affected” (37.5%). The results from the present study show that most of the participants experience residual participation restrictions. This was seen more for the children’s group as compared to the other two groups. The study done by Go (2006) and Musthafa (2005) also reported similar findings but, the studies done by Cox & Alexander (2002), Liu Zhang, Liu Chen, Han & Zhang (2011), and Kozlowski, Ribas, Almeida, & Luz (2014) reported participants didn’t experience any residual participation restriction. In the present study most of the questionnaires were administered when the participants came for reevaluation or when they had problem in their hearing aid. So, this can be the reason why most of the participants reported residual participation limitation.

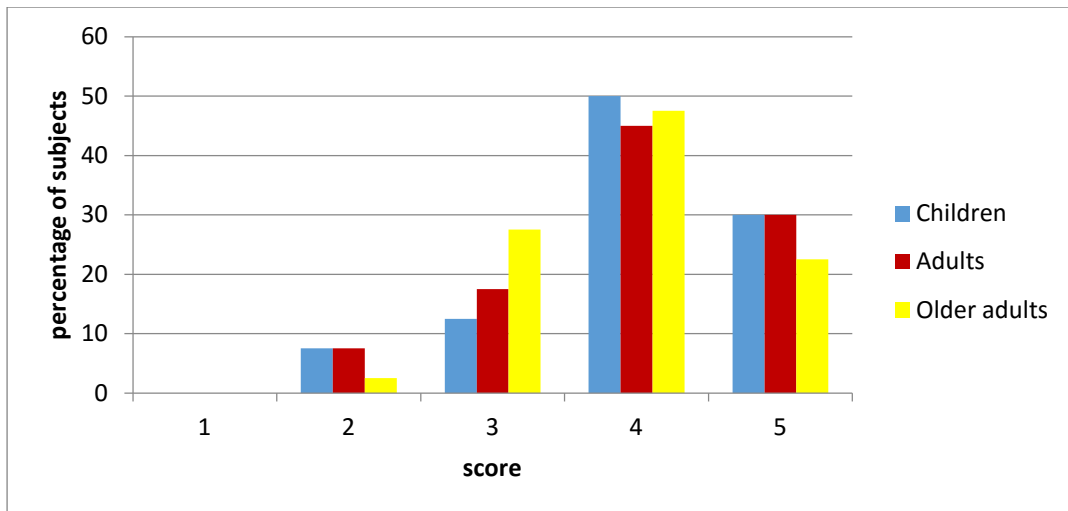


Figure 6 Frequency distributions for item 6 (impact on others) in percentage

The sixth question is about the impact of hearing aid use on others.

Most of the participants (50% children, 45% adults and 47.5% older adults) said that people were slightly bothered by their hearing difficulties. 30% of adults and children said that people are not at all bothered. 27.5% of the older adults and 17.5% of adults reported “bothered moderately”. So, only less than 30% of the participants reported that their hearing difficulties have an impact on others. The communication ability will increase when an individual start using the hearing aids. So, the interactions with other persons will happen without much breaks and thus reducing the impact on others.

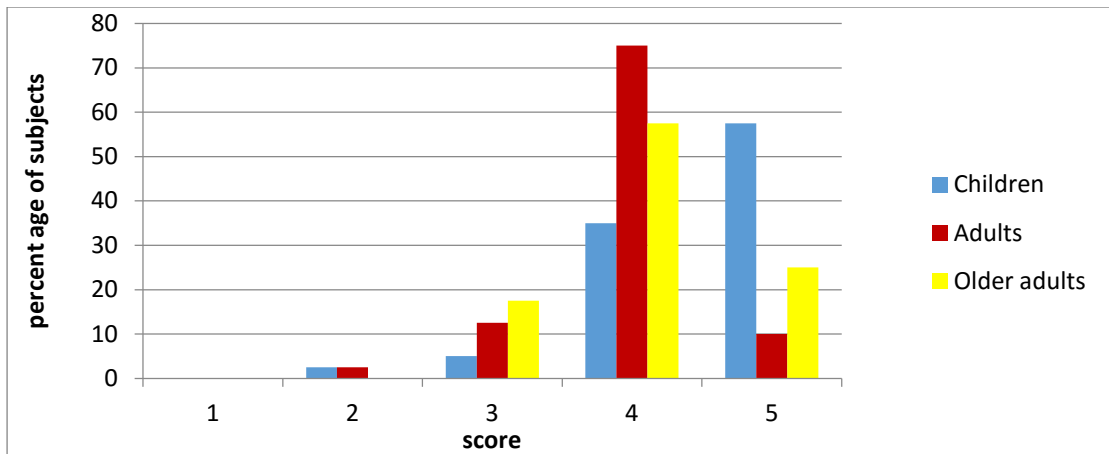


Figure 7 Frequency distributions for item 7 (quality of life) in percentage

The seventh question was about the quality of life.

75% of the adults, 57.5% older adults and 35% of the children reported that life has become “quite a lot better” whereas, 57.5% of the children and 25% older adults said “very much better”. The results indicate that the quality of life of most of the participants has improved after they started using hearing aids. It is because, as people start using hearing aids their speech perception improves across all situations which is directly related to the quality of life.

Overall the descriptive data suggests that the participants consider their hearing aids to be beneficial and desirable in all specific domains. The majority of the responses were towards the higher scores (that is either 4 or 5) for all the domains except for the 5th item. Most of the participants of the present study are of private-pay patients and have spent a significant amount for their hearing aids. So, when they purchase the hearing aid with high cost, the expectations are naturally high. Scores

other than 4 or 5 on any of the item should ideally prompt patient's reevaluation of the fitting program. Sometimes the patient may not demand for it. Even then it is necessary to take the appropriate steps as a clinical standpoint.

The recent version of the IOI-HA has got an 8th item which is the "hearing difficulty". It is considered only to develop normative and is not added with the global score. Patient's category for subjective hearing problems (unaided) can be identified using this. Cox (2003) insists that there should be 2 separate normative, one for those who report moderately severe or severe subjective problems and one for those who report mild to moderate hearing problems. This latter category can be used for the individuals who report no problems without amplification. The clinician can select the appropriate category of norms to use for comparison based on patient's response to item 8.

If an hearing aid user reports mild-moderate subjective hearing problems without amplification then, norms of **Figure 8** should be used and if the he/she reports moderately severe or severe subjective problems without amplification then, norms of **Figure 9** should be used. These norms developed can be used to assess the relative accomplishment of a hearing aid fitting for an individual hearing aid user.

The individual norms are plotted in the **Figure 8 & 9** for Malayalam translated version of IOI-HA.

Figure 8

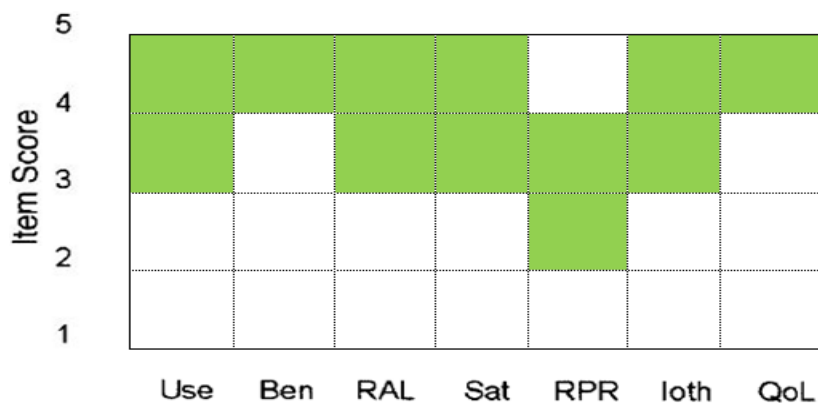
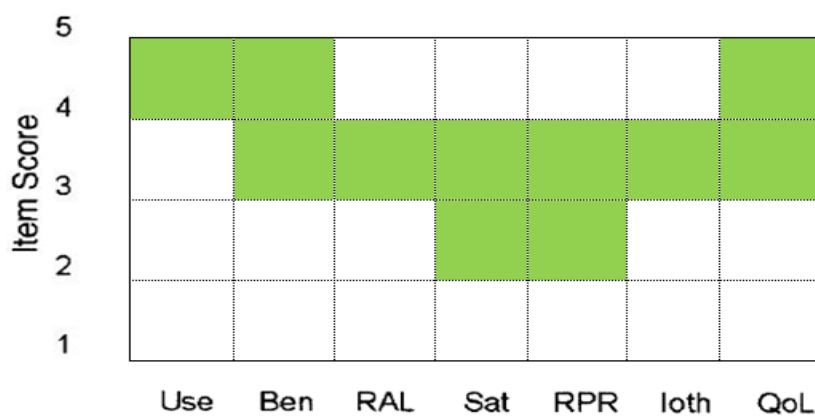


Figure 9



Use=hours of use: Ben=benefit: RAL=Residual Activity Inhibition: Sat=Satisfaction: RPR=Residual Participation Restriction: Ioth=Impact on others: QoL=Quality of life.

Figure 8 & 9 are the templates of norms for individual IOI-HA norms. The shaded areas illustrate the range of the middle 50% of the data for each item of the IOI-HA. Thus 25% of the hearing aid users scored lower and 25% scored higher. Note that a score higher than the shaded items is not possible for some items. This indicates that the top 25% of the individuals all scored 5 (maximum) on these items. The *Figure 8* represents self report hearing difficulty (unaided) to be ‘none’, ‘mild’ or ‘moderate’ group and *Figure 10* for ‘moderately severe’ or ‘severe group’.

The norms in the **Figure 9** suggest that, for a person with moderate hearing problems without amplification, a score less than 3 is considered to be poor treatment outcome except for Residual Participation Restriction. So if the scores are less than the normative value it indicates poor outcome and the treatment measure should be modified. These norms provide a good clinical baseline against which individual performance or other technological or fitting approaches can be evaluated. The normative developed in the present study are similar to that of the English and Chinese version. (Cox & Alexander & Bayer, 2003; Liu, Chen, Han & Zhang, 2011)

2. Association between the questions in the Malayalam version

Spearman's correlation was done to see the association of each items of the Malayalam translated version with each other and with the total score. The data obtained is given in the **Table 6**

	Ben	RAL	Sat	RPR	Ioth	QoL	TOTAL
Use	.518**	.343**	.184**	.210**	.258**	.274**	.487**
Ben		.630**	.391**	.289**	.301**	.255**	.646**
RAL			.752**	.596**	.443**	.421**	.859**
Sat				.657**	.416**	.354**	.759**
RPR					.506**	.440**	.760**
Ioth						.704**	.724**
QoL							.667**

Table 6 *Inter-item correlations for IOI-HA*

*Use=hours of use: Ben=benefit: RAL=Residual Activity Inhibition: Sat=Satisfaction: RPR=Residual Participation Restriction: Ioth=Impact on others: QoL=Quality of Life: ** correlation is significant at 0.05 level*

Item-total correlation ranged from 0.487 to 0.859. Items which have the highest correlation were considered most representatives of the total score of the questionnaire. In the present study question 3 is the most representative of the present study (“Think again about the situation where you most wanted to hear well. When you are using the present hearing aids, how much hearing difficulty do you still have?”). Item 1 (“Think about how much you used your present hearing aids over the past two weeks. On an average day, how many hours did you use the hearing aids?”) had the lowest range in this study that is, 0.487 and this was considered as the least representative of the total items of the questionnaire.

Question 2 (benefit), question 4(satisfaction), question 5 (residual participation), question 6 (impact on others and question 7 (quality of life) were highly significantly correlated with the total score with each item having values 0.646, 0.759, 0.760, 0.724 and 0.664 respectively. Cox & Alexander (2002) reported an inter-item correlation for the English version of IOI-HA ranging from negligible (-0.04) to moderately strong (0.76). All the items were related to some or the other items but, none of them were related to all the items.

Serbetcioglu, Mule, Kinkily & Uzunoglu (2009) studied the inter-item correlation for the Turkish version of IOI-HA and they found strong inter-item correlations between the items and the total score. The item 1 (USE) was found to have lowest correlation level within the items and with the total score. Item 7 (QOL) showed strong item-total correlations. Heuermann, Kinkel, & Tchorz (2009) also reported similar results for the German version. Olusanya (2004) which is the

Nigerian version found significant positive inter-item correlation with all the items which is again similar to the present study. Thunberg Jespersen, Bille & Legarth, (2014) reported that the Danish version of IOI-HA has a wide variation in the correlation coefficients ranging from 0.10 to 0.72. The lowest degree of correlation was found for the item 1(USE) while items 2 (BEN) and 7 (QOL) have got a high inter-item correlation value.

Rachana & Rajalakshmi, (2014) for the Hindi version found inter-item correlations ranged from 0.222 to 0.697 and item 3 (RAL) was found to be the most representative of the total score of the questionnaire. Item 5 (RPR) was moderately correlated and item 1 (USE) was the least correlated whereas, all the other items (2, 4, 6 & 7) were highly significantly correlated to the total score.

In the present study a positive significant correlation was found between all the items. Question 1 (“Think about how much you used your present hearing aids over the past two weeks. On an average day, how many hours did you use the hearing aids”) was positively correlated with all the other items and the highest correlation was observed with question 2 having a correlation coefficient of 0.518. This indicates that more the time of use, more the benefit and satisfaction, less bothered about their hearing difficulties and good interaction with environment which in turn improves the quality of the life. Previous studies also reported that as the number of hours of hearing aid use increases, the quality of life also increases Hickson, Clutterbuck, & Khan, (2010); Rachana, & Rajalakshmi (2014). The individual will prefer wearing the hearing aids for longer duration only when he is comfortable and benefiting from it. This explains the positive correlation.

Question 2 (“Think about the situation where you wanted to hear well, before you got your present hearing aids. Over the past two weeks, how much has the hearing aid helped in those situations?”) showed a strong correlation between item 3, item 4 and item 6 with the correlation coefficient values 0.630, 0.391 and 0.301 respectively. Cox (2003) also found similar correlation. Go (2006) and Dreschlerf, W. A., & Festen, J. M. (2002) reported strong correlation of item 2 with items 3 and 4 but not with item 6. Rachana & Rajalakshmi (2014) could also found a strong correlation of item 2 with items 3, 4 & 7. So when an individual is getting more benefit from the hearing aid in the situations which he encounters in his daily life, he will be satisfied and will be able to carry out his social interactions and this will again improve his quality of life.

Question 3 (“Think again about the situation where you most wanted to hear well. When you are using the present hearing aids, how much hearing difficulty do you still have?”) showed high positive correlation with items 4 and 5. The correlation coefficient was 0.752 and 0.657 respectively. Cox (2003), Olusanya (2004) also found similar positive correlations. We know that the main concern of the hearing aid users will be that they are not able to hear better in situations which they wanted to. So with the hearing aid if they are able to cope up in that situation then, the satisfaction level will improve and they will be able to take part in their residual activities without any difficulties.

Question 4 (“considering everything, do you think your present hearing aids is worth the trouble?”) was showing strong correlation between question 5 and 6 with

the correlation coefficient of 0.697 and 0.416 respectively. Olusanya (2004) and Go (2006) reported a strong correlation between item 4 and item 7. Rachana & Rajalakshmi, 2014 also found that item 4 had strong positive correlation between items 6 & 7. These results indicate that when the hearing aid user is satisfied with his aids then the quality of life improves and the impact of their difficulty on others will be less.

Question 5 (“over the past two weeks, with the present hearing aids, how much have your hearing difficulties affected the things you can do?”) and question 6 (“over the past two weeks, with your present hearing aids how much do you think other people were bothered by your hearing difficulties?”) were also found positively correlated with the question seven with the correlation coefficient of 0.440 and 0.704 respectively. Olusanya (2004), Go, (2006) and Serbetcioglu, Mule, Kinkily & Uzunoglu (2009) also reported similar outcomes.

All the items were correlated with item 7 which indicates that the quality of life will be improved when they are satisfied with their hearing aids.

3. The association of demographic factors such as age, gender, degree of hearing loss, type of hearing loss and duration of hearing loss which contribute on hearing aid outcomes were checked. Chi-square test was performed to find this.

To meet the assumption of performing a chi-square test some cells which had expected count lesser than 5% were merged with the adjacent cells and then performed chi-square test.

Table 7 shows the values of chi-square test

Item	Age	Gender	TOH	DOH	DOU
Use	.269	0.04	4.106	4.106	4.694
Ben	.519	.617	4.602	5124	1.342
RAL	5.180	14.611	9.577*	17.775*	9.321*
Sat	4.243	8.315	4.353	11.727*	8.354
RPR	33.957	2.333	11.938	12.421	4.436
Ioth	1.479	1.627	2.124	2.647	16.825*
QoL	21.069	3.165	5.822	8.268	14.835*

*Ben, benefit: RAL, Residual Activity Inhibition: Sat, Satisfaction: RPR, Residual Participation Restriction: Ioth, Impact on others: QoL, Quality of Life: * correlation significant at 0.05 level.*

The study was conducted on 3 age groups ranging from 5-17 (children's), 17-55(adults and above 55(older adults) with all the groups having 40 individuals each. Chi square was performed to see the association of age on each question. The result shows that none of the items were getting affected by any of the age groups, the p

value was found to be >0.05 for all the items. The chi-square values are given in the table 4.4.

Same results were published in the earlier studies also. Cox, Alexander, Beyer (2003); Serbetcioglu, Dreschlerf & Festen (2002); Mule, Kinkily, & Uzunoglu, (2009); Go (2006); Knudsen, Oberg, Nielsen, Naylor, & Kramer (2010); Liu, Chen, Han & Zhang (2011), Kozlowski, Ribas, Almeida, & Luz (2014); Thunberg Jespersen, Bille & Legarth (2014); Rachana & Rajalakshmi (2014). In the present study the age group 5-17 had better scores compared to the other two groups. The reason can be because of their hearing loss, they are dependent on hearing aids for developing speech and language skills.

The association of items with gender was also checked using chi-square test. The result of the present study tells that gender is not a factor which can affect any of the items. Again the p value was found to be >0.05 . All the versions of IOI-HA except the Chinese version reported similar results. Liu, Chen, Han & Zhang (2011) for the Chinese version found that gender has a role in item 7 (QOL) and item 4 (SAT). They found the female scores were higher than male scores for these two items. This difference can be due to cultural, environmental or technological difference.

We know that different type of hearing loss affect the speech perception in different ways. Chi-square test was performed to find the association between different type of hearing loss and the items. There was no significant difference for type of hearing loss on the items except, for the items 3 and 5 which are the residual activity limitations and residual participation restriction respectively. Only the Arabic

version by Musthafa (2005) reported a possible relation between type of hearing loss and the scores for different items. Among the items, item 1 received high significant association compared to others in the Arabic version where as in the present study only the items 3 (RAL) and 5 (RPR) were associated with type of hearing loss. None of the other versions report any significant association. Majority of the participants (57.5) in the present study were sensorineural hearing loss for whom the interaction with the environment was affected may be because of their poor speech discrimination scores. But, all of them were satisfied with their hearing aids.

The association of degree of hearing loss on different domains of the questionnaire was checked and it was found that the items 3(RAL), 4(SAT) & 5(RPR) had significant association between degree of hearing loss. As we know that as the degree of hearing loss increases, more domains of hearing get affected. Wong et al (2003) reported 14 studies that examined the relationship between degree of hearing loss and satisfaction. Out of which 9 studies didn't report a significant relation where as the remaining 5 studies reported a low to moderate association. Rachana & Rajalakshmi (2014) in their study reported that degree of hearing loss is influencing the impact on others (item 6). None of the other versions of IOI-HA reported a possible relationship between any of the items. Here, in the present study there is an association between degrees of hearing loss to the Residual Activity Limitation, Residual Participant Restriction & Satisfaction. Similar to the type of hearing loss degree of hearing loss was also affecting the individual's interaction with the environment. About 81.7% of the subjects in the present study were severe-profound hearing loss (most of them being sensorineural hearing loss) patients and these individuals will experienced difficulties in understanding speech in the presence of

background noise and thus affects the individual's interaction with the environment even if they use high gain hearing aids. This in turn will affect the satisfaction also.

Another factor that can affect the hearing aid outcome is the duration of hearing aid use. In the present study the participants were divided into 3 groups based on the duration of hearing aid use. That is less than one year, 1-5 years and more than 5 years. 56.7% of them were using their hearing aid between 1 to 5 years and 24.2% of them were using it for more than 5 years. Chi square test was performed and found that the items 3(SAT), 6(IOTH) and 7(QOL) had significant association with the duration of hearing aid use. An individual will continue using his/her hearing aids only when it is helping them in many/some of the listening situations. So, if they are using their aids since months/ years then it is a clear indication that he/she is benefiting from it (Humes, Garner, Wilson & Barlow, 2001). Abrams (2000) says that as the duration of hearing aid use increases there is more benefit that is, as the duration of the hearing aid use is increased, they become more comfortable and dependent on their hearing aids. These findings (experienced hearing aid user report better outcomes) are in agreement with the previous studies (Cox & Alexander, (2000); Hosford-Dunn & Halpern, (2001); Kochkin, (2000); Hickson, Clutterbuck & Khan (2010); Knudsen, Oberg, Nielsen, Naylor & Kramer (2010); Rachana & Rajalakshmi (2014))

Chapter V

Summary and Conclusion

In the present study IOI-HA English version was translated into Malayalam with the help of a linguist. Later, it was validated by a professional audiologist to see whether the Malayalam translated questions were having the same meaning as that of the English version. The finalized questions were given to the participants from reputable hearing clinics in Kerala as well as from All India Institute of Speech and Hearing (AIISH), Mysore. Data was collected from 3 groups which were children (5 to 17 years), adults (18 to 55 years) & older adults (above 55) and all the groups contained 40 individuals each and a total of 120 participants took part in the study.

- Spearman correlation suggested that most of the questions have Strong positive correlation with each other.
- After performing Chi-square test it was found that the degree of hearing loss as well as the duration of hearing aid use had association with the items of IOI-HA. Items 3 & 4 had association with degree of hearing loss and items 3, 6 & 7 had association with duration of hearing aid use.
- Age, gender and type of hearing loss had no association with the items of IOI-HA.
- Norms were developed for Malayalam speaking population.
- From the present study we can infer that most of the Malayalam speaking hearing aid user's are using their hearing aid for more than 8 hours in a day.
- Malayalam speaking hearing aid users are getting good benefit from their hearing aids.

- The satisfaction levels of the Malayalam speaking hearing aid users are high and they are getting fewer disturbances in the most desirable conditions of hearing.
- The residual activity limitations were found to be reduced for the hearing aid users.
- We can also say that people are less bothered about their hearing difficulties and the quality of life has also improved after they started using their hearing aids.

IOI-HA has been translated to more than 30 languages until now. So this translation has led to an easy comparison of performance of the Malayalam speaking hearing aid users to other populations who have assessed their outcome. It is also possible to compare the factors which can contribute to the hearing aid outcomes. So, the seven domains of the IOI-HA can also be used as guidelines in designing a hearing aid rehabilitation program, allowing clinicians to focus on improving their patient's hearing status based on specific domains.

The norms developed can be used to identify the success of the treatment. That is, if an individual falls below the normative value for a particular item then it shows poor treatment outcome.

It is a valid and easy-to-use tool for separating dissatisfied and satisfied hearing aid users.

Implications of the study

- The present study developed a self assessment tool for Malayalam speaking hearing aid users who use digital hearing aids.
- It can help clinician/ audiological practitioner to understand the problems of hearing aid users and provide guidelines to counsel and determine the benefits from the hearing aids.
- It sensitizes the audiologist to understand the listening needs and expectations of the hearing impaired individuals during hearing aid fitting and post hearing aid fitting.
- It tells about some of the possible factors that can contribute for better outcomes.
- This tool can save time for both the audiologist as well as client in the process of best fit.
- The results of the present study can be used to achieve satisfactory level in hearing aid fitting for both clinician and hearing impaired.
- Norms developed can be used to appraise the relative success of a hearing aid fitting for an individual hearing aid user.
- The questionnaire can be used to extensively to evaluate a particular service model or to compare the performance from one clinic to other.
- This tool can be used to distinguish between satisfied and dissatisfied hearing aid users.
- The results can be compared internationally

Future research:

- Questionnaire can be translated in to other regional Indian languages so that, outcomes can be compared across different hearing aid using populations within the country.
- There can be many factors influencing the benefits of hearing aid such as, type of hearing aid, technologies used in the hearing aids, unilateral/bilateral use, age of onset of hearing loss, attitudes, personality, expectations, socio-economic status, dexterity, cost, type of clinic etc. All this can be studied.
- With suitable modifications this can be used to evaluate outcomes from cochlear implant also.
- Influence of the time of administration of IOI-HA can be further investigated.

REFERENCES

- Abrams, H. B. Outcomes Measurement in the Audiologic Rehabilitation of the Elderly.
- Arakawa, A. M., Picolini, M. M., Sitta, E. I., Oliveira, A. N., Bassi, A. K. Z., & Bastos, J. R. M. (2010). Evaluation of User Satisfaction of Hearing Aids (HA) in the Amazon. *Int Arch Otorhinolaryngol*, *14*(1), 38-44.
- Beck, L. B. (2000). The role of outcomes data in health-care resources allocation. *Ear and Hearing*, *21*(4), 89S – 96S.
- Bentler, R. A., & Kramer, S. E. (2000). Guidelines for choosing a self-report outcome measure. *Ear and hearing*, *21*(4), 37S-49S.
- Chu, H., Cho, Y. S., Park, S. N., Byun, J. Y., Shin, J. E., Han, G. C., ... & Jung, J. Y. (2012). Standardization for a Korean adaptation of the international outcome inventory for hearing aids: study of validity and reliability. *Korean J Otorhinolaryngol-Head Neck Surg*, *55*(1), 20-25.
- Cook, J. A., & Hawkins, D. B. (2007). Outcome measurement for patients receiving hearing aid services. *The Laryngoscope*, *117*(4), 610-613.
- Cox R, Alexander G (2002). The International Outcome Inventory for Hearing Aids (IOI-HA): Psychometric properties of the English version. *International Journal of Audiology*; *41*(1)30-36.
- Cox R.M., Stephens D. & Kramer S.E. (2002). Translations of the international outcome inventory for hearing aids (IOI-HA). *International Journal of Audiology*, *41*(1), 3–26.

- Cox RM, Alexander GC, Beyer CM. (2003) Norms for the International Outcome Inventory for Hearing Aids. *Journal of American Academy of Audiology*, 14:403–412.
- Cox, R. Í., & Alexander, C. G. (2002). The International Outcome Inventory for Hearing Aids (IOI-HA): psychometric properties of the English version. *J Audiol*, 41, 30-5.
- Cox, R. M., & Alexander, G. C. (1995). The abbreviated profile of hearing aid benefit. *Ear and hearing*, 16(2), 176-186.
- Cox, R. M., & Alexander, G. C. (2001). Validation of the SADL questionnaire. *Ear and Hearing*, 22(2), 151-160.
- Cox, R. M., & Alexander, O. C. (1999). Measuring satisfaction with amplification in daily life: The SADL. *Ear and Hearing*, 20,306-320
- Cox, R., Hyde, M., Gatehouse, S., Noble, W., Dillon, H., Bentler, R., & Hallberg, L. (2000). Optimal outcome measures, research priorities, and international cooperation. *Ear and Hearing*, 21(4), 106S-115S.
- Cox, R., Hyde, M., Gatehouse, S., Noble, W., Dillon, H., Bentler, R., et al. (2002). Optimal outcome measures, research priorities, and international cooperation. *Ear and Hearing*, 21, S106-15.
- Dhananjay R. and Rajalakshmi K. (2014). International Outcome Inventory for Hearing Aids (IOI-HA) in Hindi – Adaptation from (IOI-HA) English. Unpublished dissertation submitted to University of Mysore as a part of fulfilment of Masters in Audiology.

- Dillon, H., James, A., & Ginis, J. (1997). Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *Journal of American Academy of Audiology*, 8, 27-43.
- Dreschlerf, W. A., & Festen, J. M. (2002). International Outcome Inventory for Hearing Aids (IOI-HA): results from The Netherlands. *International Journal of Audiology*, 41, 36-41.
- Go, N. A. (2006). The international outcome inventory for hearing aids: a translation into Filipino with normative data. *HKU Theses Online (HKUTO)*.
- Heuermann, H., Kinkel, M., & Tchorz, J. (2009). Comparison of psychometric properties of the International Outcome Inventory for Hearing Aids (IOI-HA) in various studies Comparación de las propiedades psicométricas del Cuestionario Internacional de Resultados para Auxiliares Auditivos (IOI-HA) en varios estudios. *International journal of audiology*.
- Hickson, L., Clutterbuck, S., & Khan, A. (2010). Factors associated with hearing aid fitting outcomes on the IOI-HA. *International Journal of Audiology*, 49(8), 586-595.
- Jerger JF. (2007) Do hearing aids really improve quality of life ? *Journal of American Academy of Audiology*, 18:96
- Kiessling, J. (2001). Hearing aid fitting procedures-state-of-the-art and current issues. *Scandinavian Audiology*, 30: Suppl, 52: 57-59.

- Klumpp, M. (2009). En granskning av det internationellt använda frågeformuläret International Outcome Inventory for Hearing Aids (IOI-HA).*rapport nr.: Uppsats.*
- Knudsen, L. V., Öberg, M., Nielsen, C., Naylor, G., & Kramer, S. E. (2010). Factors influencing help seeking, hearing aid uptake, hearing aid use and satisfaction with hearing aids: A review of the literature. *Trends in Amplification, 14*(3), 127-154.
- Kozlowski, L., Ribas, A., Almeida, G., & Luz, I. (2016). Satisfaction of Elderly Hearing Aid Users. *International Archives of Otorhinolaryngology.*
- Kramer, S. E., Goverts, S. T., Dreschler, W. A., Boymans, M., & Festen, J. M. (2002) International Outcome Inventory for Hearing Aids (IOI-HA): results from the Netherlands. *International Journal of Audiology, 41, 36-41.*
- Liu, H., Zhang, H., Liu, S., Chen, X., Han, D., & Zhang, L. (2011). International outcome inventory for hearing aids (IOI-HA): Results from the Chinese version. *International journal of audiology, 50*(10), 673-678.
- Mustafa, M. M. (2005). Norms for the Arabic international outcome inventory for hearing aids. *The Internet Journal of Otorhinolaryngology, 4*(1).
- Noble, W., Tyler, R. S., Dunn, C. C., & Bhullar, N. (2009). Younger-and older-age adults with unilateral and bilateral cochlear implants: speech and spatial hearing self-ratings and performance. *Otology & neurotology: official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otology and Neurotology, 30*(7), 921.

- Olusanya, B. (2004). Self-reported outcomes of aural rehabilitation in a developing country. *International journal of audiology*, 43(10), 563-571.
- Perez, E., & Edmonds, B. A. (2012). A systematic review of studies measuring and reporting hearing aid usage in older adults since 1999: a descriptive summary of measurement tools. *PloS one*, 7(3), e31831.
- Saunders, G. H., Chisolm, T. H., & Abrams, H. B. (2005). Measuring hearing aid outcomes-Not as easy as it seems. *Journal of Rehabilitation Research and Development*, 42(4), 157.
- Serbetcioglu, B., Mule, B., Kinkily, G., & Uzunoglu, S. (2009). Results of factorial validity and reliability of the international outcome inventory for hearing aids in Turkish. *J Int Adv Otol*, 5, 80-86.
- Smith, S. L., Noe, C. M., & Alexander, G. C. (2009). Evaluation of the International Outcome Inventory for Hearing Aids in a veteran sample. *Journal of the American Academy of Audiology*, 20(6), 374-380.
- Stephens, D. (2002). The International Outcome Inventory for Hearing Aids (IOI-HA) and its relationship to the Client-oriented Scale of Improvement (COSI): El Inventario Internacional de Resultados para Auxiliares Auditivos (IOI-HA) y su relación con la Escala de Mejoría Orientada hacia el Cliente (COSI). *International journal of audiology*, 41(1), 42-47.
- Thunberg Jespersen, C., Bille, M., & Legarth, J. V. (2014). Psychometric properties of a revised Danish translation of the international outcome inventory for hearing aids (IOI-HA). *International journal of audiology*, 53(5), 302-308.

Uriarte M., Denzin L., Dunstan A., Sellars J. & Hickson L. (2005). Measuring hearing aid outcomes using the satisfaction with amplification in daily life (SADL) questionnaire: Australian data. *Journal of American Academy of Audiology*, 16(6), 383–402.

Appendix A

Demographic data

തീയതി:

To be filled by the Participant

പേര്:..... വയസ്സ്:.....

ലിംഗം: സ്ത്രീ പുരുഷൻ മൊബൈൽ:.....

മാതൃഭാഷ:..... വിദ്യാഭ്യാസം:

തൊഴിൽ:..... വാർഷിക വരുമാനം:

ശ്രവണസഹായിയുടെ ഉപയോഗം: ഒരു ചെവിയിൽ

രണ്ട് ചെവിയിലും

To be filled by an Audiologist

Hearing Loss	Right	Left
Degree of hearing loss		
Type of hearing loss		
Puretone average		

Type of hearing aid	Right	Left
BTE model name		
BTE- analog/ semidigital/ digital		
Number of channels		
Overall Gain given		
Duration of the hearing aid use		

Audiologist Signature

Participant Signature

APPENDIX

International Outcome Inventory for Hearing Aids (IOI- HA)

1. നിലവിലുള്ള നിങ്ങളുടെ ശ്രവണസഹായികൾ കഴിഞ്ഞ രണ്ടാഴ്ചക്കാലമായി എത്രത്തോളം ഉപയോഗിച്ചു എന്ന് ചിന്തിക്കുക. ശരാശരി ഒരു ദിവസം എത്ര മണിക്കൂർ നിങ്ങൾ ശ്രവണസഹായികൾ ഉപയോഗിച്ചു?

ഒട്ടുമില്ല പ്രതിദിനം ഒരു മണിക്കൂറിൽ താഴെ പ്രതിദിനം 1 മുതൽ 4 മണിക്കൂർ വരെ പ്രതിദിനം 4 മുതൽ 8 മണിക്കൂർ വരെ 8 മണിക്കൂറിൽ കൂടുതൽ
2. നിങ്ങൾക്ക് നിലവിലുള്ള ശ്രവണസഹായികൾ ലഭിക്കുന്നതിന് മുമ്പുള്ള കൂടുതൽ മെച്ചപ്പെട്ട ശ്രവണം ആഗ്രഹിച്ചിരുന്ന ഒരു സന്ദർഭം ചിന്തിക്കുക. കഴിഞ്ഞ രണ്ടാഴ്ചക്കാലമായി അത്തരം സാഹചര്യങ്ങളിൽ ശ്രവണസഹായി എത്രത്തോളം ഉപകരിച്ചിട്ടുണ്ട്.?

ഒട്ടും ഉപകരിച്ചില്ല നേരിയ തോതിൽ ഉപകരിച്ചു മിതമായ രീതിയിൽ ഉപകരിച്ചു തികച്ചും ഉപകരിച്ചു വളരെയധികം ഉപകരിച്ചു
3. നിങ്ങൾ മെച്ചപ്പെട്ട ശ്രവണം ആഗ്രഹിച്ചിരുന്ന ഒരു സന്ദർഭം ചിന്തിക്കുക. നിലവിലുള്ള ശ്രവണസഹായികൾ ഉപയോഗിക്കുമ്പോൾ അത്തരം സാഹചര്യത്തിൽ ഇപ്പോഴും എത്രമാത്രം പ്രയാസങ്ങളാണ് നേരിടുന്നത്?

വളരെയധികം പ്രയാസം സാമാന്യമായ നിലയിൽ പ്രയാസം മിതമായ പ്രയാസം നേരിയ തോതിലുള്ള പ്രയാസം ഒട്ടും പ്രയാസമില്ല
4. എല്ലാ കാര്യങ്ങളും പരിഗണിക്കുമ്പോൾ നിലവിലുള്ള ശ്രവണസഹായികൾ ബുദ്ധിമുട്ടുകളിൽ ഗുണകരമാണോ?

ഒട്ടും ഗുണകരമല്ല നേരിയ തോതിൽ ഗുണകരം മിതമായ രീതിയിൽ ഗുണകരം തികച്ചും ഗുണകരം വളരെയധികം ഗുണകരം
5. കഴിഞ്ഞ രണ്ടാഴ്ചക്കാലമായി നിലവിലുള്ള ശ്രവണസഹായി വെച്ചിട്ടും കേൾവികുറവ് എത്രമാത്രം നിങ്ങൾ ചെയ്യുന്ന കാര്യങ്ങളെ ബാധിച്ചിട്ടുണ്ട്?

വളരെയധികം ബാധിച്ചു തികച്ചും ബാധിച്ചു മിതമായി ബാധിച്ചു നേരിയതോതിൽ ബാധിച്ചു ഒട്ടും ബാധിച്ചില്ല
6. നിലവിലുള്ള ശ്രവണസഹായികൾ ഉപയോഗിച്ചിട്ടും കഴിഞ്ഞ രണ്ടാഴ്ചക്കാലമായി നിങ്ങളുടെ കേൾവികുറവ് മറ്റുള്ളവരെ എത്രമാത്രം അലട്ടിയിട്ടുണ്ടെന്നാണ് നിങ്ങൾ കരുതുന്നത്?

വളരെയധികം അലട്ടി തികച്ചും അലട്ടി മിതമായി അലട്ടി നേരിയ തോതിൽ അലട്ടി ഒട്ടും അലട്ടിയില്ല
7. എല്ലാ കാര്യങ്ങളും പരിഗണിക്കുമ്പോൾ, നിലവിലുള്ള ശ്രവണസഹായി നിങ്ങളുടെ ജീവിതാനന്ദത്തിൽ എത്രമാത്രം മാറ്റം വരുത്തിയിട്ടുണ്ട്?

വളരെ മോശം മാറ്റമില്ല നേരിയ പുരോഗതി നല്ല പുരോഗതി വളരെയധികം പുരോഗതി
8. ശ്രവണസഹായികൾ ഉപയോഗിക്കാതിരിക്കുമ്പോൾ എത്രമാത്രം കേൾവി പ്രശ്നങ്ങളാണ് നിങ്ങൾക്ക് ഉണ്ടാകുന്നത്?

അതികവിനം കഠിനം മിതം കുറച്ച് ഒട്ടുമില്ല

