International Outcome Inventory for Hearing Aids (IOI-HA) in Hindi – Adaptation from (IOI-HA) English

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May 201

Certificate

This is to certify that this dissertation entitled **"International Outcome Inventory for Hearing Aids (IOI-HA) in Hindi – Adaptation from (IOI-HA) English"** is a bonafide work in part fulfillment for the degree of Master of Science (Audiology) of the student with Registration No. 12AUD007. 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.

Mysore,

May 2014

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Certificate

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

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Declaration

This dissertation entitled **International Outcome Inventory for Hearing Aids (IOI-HA) in Hindi – Adaptation from (IOI-HA) English** is the result of my own study under the guidance of Dr. K Rajalakshmi, professor in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore, **Register No:** 12AUD007

May, 2014

Dedicated to

My Parents

Family

Srushti

And

My Guide

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अज्ञानतिमिरान्धस्य ज्ञानाञ्जनशलाकया ।

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CHAPTER I

INTRODUCTION

An audiologist is concerned about fitting a hearing aid to an individual with a hearing loss, apart from diagnosing the type and severity of the hearing problem. While making a decision about the hearing aid, the audiologist considers the following test procedures (1) pure tone threshold (2) Speech Detection threshold (SDT) or Speech Identification Scores (SIS) in laboratory situation as ideal. But we need to recognize that there are many domains of real life situational outcomes that cannot be assessed in laboratory. These real life situations only affect the hearing aid benefit in real life. People don't take hearing aid because they are hearing impaired, it is because they cannot carry out their daily activities as they want to, or because they cannot participate in their family/social or cultural lives in the way that they want to. In other words, people seek hearing aids because they experience activity limitation or participation restriction or both. Even when audiologist are able to simulate real world conditions during measurement, it is usually found that laboratory outcome measures do not closely resemble the client's impression of real life outcome in simulated situation.

Outcome measurement is a fundamental principle of quality assurance in the health care sector. It has been asserted that ' 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 et al, 2005). Thus outcome measures have the possible benefit of allowing clinicians to demonstrate that intervention works. Nevertheless, the use of outcomes measurement is not restricted to this. Beck (2000) remarks the important role of such measures in improving clinical development. A clinic that often measures outcomes

can detect areas that require perfection, establish performance yardsticks, monitor performance over period of time, and evaluate the impact of system alteration.

In audiology, a number of self-report outcome tools have been developed to facilitate this process. Different measures assess different outcomes. For example, client satisfaction can be assessed using the Satisfaction with Amplification in Daily Life (SADL; Cox & Alexander, 2001), benefit from hearing aids can be assessed using the Abbreviated Profile of Hearing Aid Benefit (APHAB; Cox & Alexander, 1995), changes in relation to individual client's goals can be assessed with the Client-Oriented Scale of Improvement (COSI; Dillon et al., 1997), and changes in the functional effects of hearing impairment can be assessed using the Hearing Handicap Questionnaire (HHQ; Noble & Gatehouse, 2004). There are also measures that assess more than one type of outcome, named multi-dimensional measures, and the most well-known of these is the International Outcome Inventory – Hearing Aids (IOI-HA; Cox et al, 2000).

Unfortunately and partly due to the large number of scales existing, it is often challenging to compare straightway the results from one research study to another or from one clinic to another, as different outcome measures have been used. These comparisons are even more difficult to make when one views findings from different countries.

Assessing customer satisfaction is a crucial part of modern patient-oriented health services. In an attempt to provide some uniformity to outcome measures, an international group of notable audiologists banded together to develop the International Outcome Inventory for Hearing Aids (IOI-HA). The IOI-HA is a brief self-report instrument measuring individual customer's satisfaction with hearing aids. The IOI-HA is a seven-item questionnaire designed to evaluate the effectiveness of the hearing aid treatment. The seven items of the questionnaire

cover a broad range of subjective factors that well complement the objective audiological measures used to evaluate hearing aid fitting success. Each item represents a different outcome domain and has five response alternatives, where each response ranges from the worst to the best outcome, and where higher scores indicate a better outcome.

The IOI-HA is a questionnaire addressing the main dimensions of fitting outcome: (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. Kramer, Goverts, Dreschler, Boymans & Festen (2002) found that the IOI-HA consisted of two factors where factor one was represented by items 1, 2, 4, and 7 (daily use, benefit, satisfaction, & quality of life, & quality of life) and factor two represented by item items 3, 5 and 6 (residual activity limitations, residual participation restrictions,. The items in factor one could be summarized as the satisfaction variables, whereas the remaining items, factor two, more reflected issues such as residual participation restriction. One other question as 8th question was added by Cox in 2003 in questionnaire which is used to compare as normative data say about the severity of hearing problem but used as to sum the responses.

If the measurement of outcome is part of the quality improvement process, then the aim of taking such measures must surely be to develop ways to improve outcomes for clients. Researchers have felt that a better comprehension of factors that influence outcomes would help succeeding in this aim. Therefore in this the authors examined the possible influence of the following variables on IOI-HA scores: client age, gender, new versus return clients, funding source for amplification, hearing loss configuration, fitting (unilateral/bilateral), style of hearing aid, degree of satisfaction with listening in different environments, and satisfaction with different hearing aid attributes.

One of the aims when developing the inventory was to facilitate cooperation among researchers, and the inventory has been translated into many languages. 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. It was developed by Cox et al, (2000). It has been translated to more than 24 languages today (Cox, Stephens & Kramer, 2002).

NEED FOR THE STUDY

In India there are very few measurement scales to evaluate the extent of the individual's needs and expectations that are fulfilled by using the hearing aid 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 are standardized for the 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.

AIMS OF THE STUDY

1. This study will help in collecting data from the Hindi speaking population and help in standardization of IOI-HA questionnaire in Hindi. It can be used to check the effectiveness of the hearing aid fitting.
2. This study also investigates the factors that contribute to better outcomes.

3. It also identifies those factors which provide better outcomes and use them for effective counselling.

CHAPTER II

REVIEW OF LITERATURE

One of the first published self-reports of hearing aid outcome was the Scale of Self-Assessment of Hearing Handicap (High, Fairbanks, & Glorig, 1964). Effectiveness of hearing

aids are measured with the help of self-report outcome measures with known psychometric properties. This effectiveness with amplification can be measured across several dimensions, including handicap reduction, acceptance, benefit, and satisfaction. By keeping each one of these dimensions in focus several different self-report measures of hearing aid outcome have been developed over the past two decades. Humes and Humes (2004) have reported that benefit and satisfaction are the most significant components of a self-report measures which can be used to evaluate patients experience with hearing aids. Hearing aid benefit can be measured either objectively or subjectively, objectively by comparing aided and unaided measures of speech recognition scores and subjectively through the use of self-report measures. Objective tests are completed using a pre-defined external standard; they are almost exclusive test that take place within the laboratory. This objective measures give only best condition results but real life have worst condition in the form of noise and factor which affect speech perception. Therefore, self-report measures of outcome are a useful mode of determining real-world benefits of hearing aid performance. Another way to look at outcome of hearing aid is satisfaction, this satisfaction differs from benefit as they are not necessarily performance based. For example, a patient can have good numbers in benefit measure when aided and unaided tests are done, but report dissatisfaction as measured on a satisfaction scale (Taylor, 2007).

Cox (2003) gave reasons to use self-report measures of benefit and satisfaction

- First, for largely economic reasons, health care is becoming more consumers driven. In this evolving system, the consumer decides what treatment is selected and when it is complete, the major indices of quality of service are self-report of outcome and satisfaction. Consumer-driven health care places an added emphasis on the patient's point of view. Therefore, it is critical to measure the real-world benefit and satisfaction of

hearing aid use.

- A second reason is related to the fact that many of these real-world experiences simply cannot be measured effectively in laboratory conditions. The traditional hearing aid outcome measures that were used to measure speech recognition in quiet and in noise, do not capture the true experiences of hearing aid use in everyday listening situations. In order to quantify the true impact of hearing loss and its associated treatment on activity limitations, lifestyles, etc., self-report measures of outcome should be used.
- Third, there are methods in which real-world listening situations are simulated in laboratory but they do not always resemble the patient's impression of the actual real-life situation. Self-report measures that measures benefit can be grouped into different types.
- Patients can be asked to make a direct assessment or the comparison of with and without the hearing aid. Alternatively, patient's views of their disability can be assessed both before and after the rehabilitation program. The scales have been listed in the chronological order. The various scales that have been used frequently are listed as follows in table 1.

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 and Palmer	1998
GRABP	Glasgrow Hearing Aid Benefit Profile	Gatehouse	1999
IOI-HA	International Outcome Inventory for Hearing Aid User	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 & Tomlin	1988
SADL	Satisfaction with amplification in daily life	Cox & 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 Scale	McCarthy-Alpiner Scale of Hearing Handicap	McCarthy-Alpiner	1983
HHlE- SP	Hearing Handicap Inventory for the Elderly- Spouse	Ncwmao& Weinstein	1986

CPRI	Communication Profile for the Hearing Impaired	Demorest & Erdman	1987
HHIA	Hearing Handicap Inventory for the adults	Newman, Weinstein, Jacobson & Hug	1990
CSOA	Communication Scale for Older Adults	Kaplan, Bailly,	1997

1. **Hearing Aid Performance Inventory (HAPI) Description:**

Walden, Demorest and Hepler (1984) developed Hearing Aid Performance Inventory (HAPI). It is a self-reported scale that measures success with amplification. It consists of 64 items which are organized into 4 subsections according to the listening situations.

- Noisy situation
- Quiet situations with speakers in proximity
- Situations with reduced signal information
- Situations with no speech stimuli

It consists of five-point rating scale which ranges from "very helpful" (1) to "hinders performance" (5). Schum (1992) modified HAPI and developed Shortened Hearing Aid Performance Inventory (SHAPI) which consists of total 38 items and Dillon developed Shortened HAPI (SHAPI) which consists of total 25 items.

Interpretation and scoring:

The scores of all the items are added together and averaged (leaving out the "not applicable" answers). If average score is closer to "1" then the person is getting benefit

Advantages:

The reliability of the HAPI is high (0.96), even though there is high inter subject variability. This scale is helpful to determine self-perceived benefit of those individuals who have been using amplification. The shorted form (SHAPI) reduces administration and scoring time involvement.

Disadvantages:

Common environments such as home and work place are represented several times throughout the questionnaire. This questionnaire focuses only on different listening situations, but other factors may also influence the hearing aid outcome such as social and emotional behavior, listening telephone and use of hearing aid, which has not been administered. Newman and Weinstein (1988) suggested that the items apply to a variety of listening environments; the HAPI may not be applicable to some elderly respondents.

2. **Profile of Hearing Aid Performance (PHAP):**

PHAP was developed by Cox and Gilmore (1990). It was developed to measure aided performance in seven different dimensions. It is a 66 items self-administered inventory. The PHAP is scored using three categories of speech communication and one environment sound category:

- Speech communication under relatively favorable condition,
- Speech communication under unfavorable condition that are not due primarily to background noise,
- Speech communication in noise and Perception of environment

sounds.

Cox, Gilmore, and Alexander (1991) expanded PHAP and developed Profile of Hearing Aid Benefit (PHAB). It consists of 66 items which are divided in seven sub scales including familiar talkers, ease of communication, reverberation, reduced cues, background noise, aversiveness of sounds, and distortion of sounds. The goal of the PHAB is to measure hearing-aid benefit (unaided vs. aided) across those seven dimensions.

Advantages:

The PHAP and PHAB both have 66 items which is very descriptive assessment to measure hearing aid benefit.

Cox and Gilmore (1990) showed good internal consistency /reliability for the PHAP and its subscales which ranges from 0.70 to 0.91. Test-retest correlations range from 0.66 to 0.88.

Disadvantages:

Cox and Rivera (1992) showed PHAB has ceiling effect in three subscales, low internal consistency and low test-retest correlation.

PHAP and PHAB both have 66 items and are too long for clinical use.

3. **Abbreviated Profile of Hearing Aid Benefit (APHAB)**

Description:

APHAB was developed by Cox and Alexander (1995). **It** is s shorthand version of PHAB. **It** consists of twenty five items and divided into four subscales.

- Ease of Communication (EC)
- Reverberations (RV)
- Background Noise (BN)
- Aversiveness of sounds (AY)

The first three of these subscales assesses speech understanding in various everyday environments, and the last assesses negative reactions to more intense sounds (e.g. traffic sound). It consists of a 7-point Likert scale. The responses range from "always" (99%) to "never" (0%).

Interpretation and Scoring:

Interpretation is based on unaided versus aided sub-score differences, as well as subscale patterns.

Cox (1997) showed a difference of 22 points between the unaided and the aided scores is required to be certain of a significant difference between EC, RV, or BN conditions, Globally, the aided scores must exceed unaided scores on all 3 subscales by at least 10 points to establish true benefit from hearing aid use.

Advantages:

The APHAB is widely used due to its brevity and high internal reliability and because its software is readily available and automatically scored.

The graphical representation of APHAB provides a quick way for the audiologist to understand the patient's communication needs and the effect of amplification on those needs.

Disadvantages:

The questions in the subscale "communication in background noise" are not relevant for all the patients.

More research is needed to determine whether normative data are different for patients who use higher performance hearing aid.

The APHAB is firmly anchored in the disability domain and pays little or no attention to the emotional and psychological consequences of impaired hearing or any of the aspects of service delivery that might affect outcome (Gatehouse, 2001).

4. **Client oriented scale of improvement (COSI)**

Description:

The Client Oriented Scale of Improvement (COSI) was developed by clinicians at the National Acoustic Laboratories (NAL) over several years in the early 1990s (cited in Sandlin, 2000). Dillon, James and Ginis (1997) developed norms for COSI over new hearing aid user adults.

It consists of five situations of different listening conditions. There are two types of ratings to evaluate the COSI at the time which are recorded on the same sheet on which the situations were outlined.

E.g. Absolute (final ability): How well do you do in this situation? 1 can bear: hardly ever, occasionally. Half of the time, most of the time, almost always.

Interpretation:

The final assessment may highlight areas that require further improvement or counselling. Because the rehabilitation process is individualized according to patient's needs and desires, the COSI helps clarify exceptions, as well as remind the patient and clinician of original fitting goals.

Advantages:

This questionnaire is quick in measuring hearing aid outcome and also helps to assess patient needs. The COSI method is a statistically valid and more traditional questionnaire.

This questionnaire is very relevant, compatible with normal interviewing technique and showed good test-retest reliability (Dillon, James & Ginis, 1997).

Disadvantages:

This questionnaire uses two different types of rating which can confuse the hearing

impaired individual and can also affect the outcome of hearing aid.

5. **Profile of aided loudness (PAL) Description:**

Mueller and Palmer (1998) developed the profile of aided loudness (PAL). It determines loudness restoration with amplification. There are 12 situations or noises in which the patient rates the loudness and the loudness satisfaction.

The loudness rating uses a 7-point scale as "cannot hear" (0) to "uncomfortably loud" (7). The loudness rating is compared to the ratings of the normed (normal hearing) subjects. The target rating for each item is where 70% of the norm group selected that particular item. The acceptable rating is within ± 1 standard deviation from the target, which establishes the loudness profile rating. For Example: - Medium sounds such as average speech; the target is 4 +/- 1.

Interpretation and Scoring:

There are four possible outcomes.

- Goal of normal aided loudness perception met, patient is satisfied.
- Goal of normal aided loudness perception met, patient is dissatisfied
- Goal of normal aided loudness perception not met, patient is satisfied
- Goal of normal aided loudness perception not met, patient is not satisfied

Disadvantages:

This questionnaire is very lengthy. As it assesses individuals with many different situations and also with different intensity. It uses seven-point rating scale which is a broad range of choices that may decrease the reliability of the questionnaire.

6. **Glasgow hearing aid benefit profile (GHABP)**

Description:

The Glasgow hearing aid benefit profile was developed by Gatehouse (1999). It evaluates the effectiveness of rehabilitation for adults with hearing impairment. The GHABP consists of questions related to different listening situations. It assesses the hearing impaired individuals in different areas i.e. Initial disability, Handicap, Reported hearing aid use, Reported benefit, Satisfaction, Residual disability.

Disadvantages:

This questionnaire is very lengthy. As it assesses individuals with many different situations and also with different intensity.

It uses seven-point rating scale which is a broad range of choices that may decrease the reliability of the questionnaire.

Interpretation:

Questions are examined individually, but in each case higher the number associated with the particular answer the less difficulty.

Advantages:

It takes less time to administer.

Many different parameters (disability, handicap, hearing aid use, reported benefit, satisfaction, and residual disability) are measured at one single point of time.

7. **International Outcome Inventory - Hearing Aid (IOI-HA)**

Description:

The International Outcome Inventory for Hearing Aids (IOI-HA) was developed by Cox el al. (2000). The International Outcome Inventory for Hearing Aids (IOI-HA) is a seven item

questionnaire designed to be generally applicable in evaluating the effectiveness of hearing aid treatments. It consists of seven questions on a 5-point rating scale, the goal of the IOI-HA is to assess benefit, satisfaction, and quality-of-life changes associated with hearing aid use. The IOI-HA bas been normed on 154 adults (Cox, Alexander, & Beyer, 2003).

The international outcome inventory for hearing aids (IOI-HA) was developed as the result of an international workshop on self-report measures in audiological rehabilitation (Cox et al, 2000) which aims to be a tool to be included in different outcome protocol together with more specific outcome measures.

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 the meeting of the International Collegium of Rehabilitative Audiology (ICRA), held in Cardiff, UK in 2001. The audiology specialists decided to translate the IOI-HA into a number of different languages. According to that decision, 24 'official' translations are available by 2014. To date, several countries/areas have finished large scale outcome measurement with the IOI-HA, including the United States, Australia, Germany, Netherlands, United Kingdom, Arabic countries, and Nigeria. The purpose of this research is to present data of the Indian version of the IOI-HA, and examine the effectiveness of the hearing aid service.

The IOI-HA was not intended to replace existing outcome measures but to serve as a useful addendum to existing measures in a research context. It might potentially function as a standalone tool for quality assessment.

The IOI-HA was designed to be used with other self-report tools, like the APHAB

Advantages:

This inventory is easy to administer and takes less time as compared to other profiles.

This questionnaire is available in many different languages and also easily available.

Disadvantages:

Stephens (2002) indicated two subscales of IOI-HA, one of which could be defined as a 'benefit' subscale and the other a 'residual problems' subscale. Both elements of COSI correlated with the 'benefit' subscale, but only the 'residual' measure of COSI related to the 'residual problems' subscale. There were no consistent relationships between the IOI-HA and a range of demographic factors.

Satisfaction inventories:

I. **Hearing Aid User's Questionnaire (HAUQ)**

Description:

The Hearing Aid User's Questionnaire (HAUQ) was developed by Forster and Tomlin, 1988 (cited in Dillon, 2001). It contains questions that are related to hearing aid use, difficulties, and other satisfaction-related issues.

Dillon, Birtles and Lovegrove (1999) reported the primary goal of HAUQ is to detect problems that may affect the person's ability to use and benefit from the hearing aid. Dillon described the questionnaire as:

- Questions 1 and 2 deal with usage of the hearing aid with the categories in question 2 scaled from 1-6.
- Question 3 deals with benefits, with "not at all" scaled as 1, "a little" scaled as a 2 and "a lot" scaled as 3.
- Question 4 deals with problems, with "no" scaled as 2 and "yes" scaled as 1
- Question 5-7 deal with satisfaction, each scaled from 1-4 Question 8 attempts to find client's assessment of weather they have problems that require another appointment

- Question 9-11 are open-ended questions to determine what the clients like and dislike of the services and instruments they have received.

Advantages:

This questionnaire is easy to administer and can be mailed to patients also.

It measures many areas at one time usage, benefit, and satisfaction.

Disadvantages:

Not much questions are there to assess hearing aid benefit.

Little information is available on the HAUQ.

II. Satisfaction with Amplification in Daily Life (SADL)

Description:

Cox and Alexander (1999) developed the satisfaction with amplification in daily life questionnaire (SADL). The SADL is a self-administered questionnaire designed as a clinical measure of satisfaction from the patient's point of view, though unlike the APHAB it is not administered in a two stage process (corresponding to unaided and aided). It is administered after the event and the questions are all configured to have an implicit reference.

SADL questionnaire contains 15 items from which can be formed a global score and four subscales. The four subscales are labelled positive effect, service and cost, negative features, and personal image. Examples of the items are:

- Positive effect: Reduction in how often you ask people to repeat themselves
- Service and cost: Competence of the dispenser
- Negative features: Feedback when the hearing aid is turned up
- Personal image: Does the hearing aid make you seem less capable.

Interpretation and Scoring:

The global score is the mean of the scores for all the completed items. Subscales are scored separately by averaging the item responses. Cox and Alexander, (1999) showed higher the number, the more satisfied the patient is, whether it is on the individual subscale or the global scale.

Advantages:

The SADL is short and does not take much time.

It can be mailed to patient or filled out in the clinic which can save the clinician's time.

Disadvantages:

This questionnaire is not considering much listening conditions.

Hearing Handicap Profile

A. <u>The Hearing Handicap Scale (HHS)</u>

Description:

High, Fairbanks and Glorig (1964) developed the hearing handicap scale. This was the first self-report questionnaire to assess hearing handicap.

The HHS consisted of forty questions which focused on speech perception, localization, telephone communication and noise situations.

This questionnaire was divided in two forms (A & B) that have twenty questions each. The forms are used in pre and post-testing.

This questionnaire uses 5 point rating scale which ranges from "almost always" to "almost never".

Interpretation and Scoring:

Schow and Tannahill (1977) interpreted the scores for HHS i.e. scores of 0 to 20% indicate no hearing handicap, 21 to 40% indicate a slight handicap, 41 to 70% indicate mild-moderate handicap, 71 to 100% indicate severe handicap.

Advantages:

High, Fairbanks and Glorig (1964) showed high internal consistency reliability (0.96) for each forms.

This questionnaire is easy to administer and calculate.

Disadvantages:

High, Fairbanks and Glorig (1964) reported that responses to the questions can be easily falsified and there is no internal means for determining the validity of a response.

This questionnaire does not account for other areas of experience like social and emotional, psychological and vocational domain.

B. <u>Hearing Performance Inventory (HPI)</u>

Description:

Giolas, Owens, Lamb and 'Qbubert (1979) developed Hearing Performance Inventory to assess the problems faced by hearing impaired person in daily life listening situation.

It consist of 158 questions which consists of different domains like understanding speech, intensity, response to auditory failure, social, personal and occupational.

It consists of five-point rating scale (1to 5) where 1 indicating "least difficulty" and 5 indicating "maximum difficulty".

Lamb, Owens and Schubert (1983) designed a revised shorter version of hearing performance inventory, it consists of ninety questions.

C. Hearing Handicap Inventory for the Elderly (HHIE)

Description:

Ventry and Weinstein (1982) developed a Hearing Handicap Inventory for the Elderly. It consists of twenty-five items which was divided into emotional and social subscales. It assesses the effect of hearing impairment on social and emotional behavior in the elderly.

The emotional scale assesses the patient's attitudes and emotional responses to his or her hearing loss. The social scale measures the perceived effects of hearing loss in a variety of social situations.

Newman & Weinstein (1988) showed reduction in perceived social and emotional behavior after one year using a hearing aid and they also concluded HHIE is a valid tool to measure hearing aid benefit.

HHIE has been used in numerous studies to measure the hearing aid benefit. Malinoff and Weinstein (1989) reported HHIE is a good tool to measure hearing aid benefit over time.

There is a three point scale responses system, "yes" (4 points), "sometimes" (2 points), "no" 1 "not applicable" (0 points). The maximum score is 100 and minimum is 0. Higher the score, greater is the perceived handicap.

Ventry and Weinstein (1983) developed a HHIE-Screening. It is a screening version of a Hearing Handicap Inventory for the Elderly (HHIE-S). It consists of ten items which is equally divided into each subscale.

HHIE-Spouse developed by Newman and Weinstein (1986). It is a 10 item scale, derived from the HHIE. It serves as a screening tool for profiling emotional and social aspects of hearing handicap through spouse.

Newman, Weinstein, Jacobson, and Hug (1990) developed Hearing Handicap Inventory for

the Adults (HHIA) by modifying HHIE. It also consisted of twenty-five questions with emotional and social subscales. The difference between the two was that the former had questions that assessed the occupational effects of hearing loss. Newman, Weinstein, Jacobson and Hug (1991) reported good test-retest reliability (r= 0.93 to 0.97)

Interpretation and scoring:

It consists of three point rating scale i.e. "yes" response receive 4 points, "sometimes" receives 2 and "never" receives 0 points. Scores for the total score range from 0 (no perceived handicap) to 100 (significant perceived hearing handicap)

Newman and Weinstein (1989) showed higher the score greater the perceived hearing handicap and lower the score lesser the perceived hearing handicap.

Advantages:

Ventry and Weinstein (1982) showed high reliability (0.94 to 0.95) for HHIE.

They also showed high correlation of 0.87 between the two subscales and high internal consistency for each subscales.

This questionnaire does not take much time to administer.

Disadvantage:

Gatehouse (2001) reported less correlation between scores from the HHIE and speech identification scores, aided scores.

D. McCar·thy-Alpiner Scale of Hearing Handicap (M-A SCALE)

Description:

McCarthy and Alpiner (1983) develop a McCarthy-Alpiner Scale of Hearing Handicap questionnaire.

It consists of thirty-four items which assesses the psychological, social and vocational

effects of hearing loss in adults.

It consisted of two forms one was designed to be answered by the patients and one was answered by a family member. Family members may provide a different perspective of the patients' problem.

Advantages:

It provides a detailed analysis of psychological, social and vocational problem areas.

It can be a useful tool in assessing hearing difficulty of the person.

McCalthy and Alpiner (1983) reported good internal consistency with a Cronbach's Alpha of 0.81.

E. <u>Communication Profile for the Hearing Impaired</u>

Description:

Demorest and Erdman (1986) developed Communication Profile for the Hearing Impaired (CPHI). It was developed to provide systematic and comprehensive assessment communication problems of hearing impaired adults.

The CPHI contains one hundred forty five items which was divided into five subscales that are the communication performance scales, Communication importance, Communication Environment Scales, Communication Strategies Scales, and Personal Adjustment. Each subscale consisted of different question and assesses different areas.

Interpretation & scoring:

Demorest and Erdman (1986) interpreted the that low score may suggest problems in a given area and higher score reflects effective communication.

Advantages:

This scale consisted of many subscales which can help to assess a person with a hearing

impairment in several different areas.

Disadvantages:

This questionnaire is very lengthy to administer as compared to other handicap scales like the hearing handicap scale, hearing handicap inventory for the elderly.

This questionnaire is very costly to purchase.

F. Communication scale for older adults: (CSOA)

Description:

Kaplan, Bailly, Brandt, Busacco and Pray (1997) developed Communication scale for older adults (CSOA). It is a self-assessment scale that evaluates the communication strategies and attitudes of independent, older patients.

It consists of seventy-two items which are divided into two subscales i.e. communication strategies and communication attitudes.

The communication strategies scale assesses actual or perceived communication breakdowns and strategies pertaining to each situation. The communication attitudes scale evaluates the patient's attitude toward his or her hearing loss and self-perceptions as a hearing impaired individual. It also touches on other people's (friends and family) perceptions of the hearing loss.

It consists of two types of rating scales i.e., a 3-point item response and a 5- point item response. On the 3-point scale, the responses are (1) Almost always, (2) sometimes (3) Never. If the patient answers "never", he or she receives a score of 3. The higher the score, more is the communication difficulty. The five-point scale is designed for those older adults who desire more choices.

Interpretation and Scoring

Kaplan, Bailly, Brandt, Busacco and Pray (1997) interpreted that as individual score on

the communication strategies scale that exceeds 0.10 indicates benefit on the 3-point scale, and 0.04 or greater indicates benefit on the 5-point scale.

For the communication attitude scale, a difference of 0.10 on the 3-point scale and of 0.11 on the 5 point indicates benefit.

Advantages:

The CSOA assesses a hearing impaired individual in a large domain i.e. communication strategies and attitude which can be very useful to help the person in the management.

Disadvantage:

This scale is very lengthy as compared to other scales i.e. hearing handicap inventory for the elderly etc.

Vanaja (2000) developed a questionnaire for self- assessment of hearing handicap for Indian population. It assesses the hearing handicap of individuals in various situations such as familiar/unfamiliar, noisy/quiet, with/without visual clue. It consists of fifty questions and a three point rating was used. Rating was used from most of the time (2) to seldom (0). Results showed good correlation of self-perceived scores with the speech identification scores in quiet and noisy condition. It can be very helpful to predict degree of hearing loss.

Wood and Lutman (2004) compared speech recognition performance and self-reported benefit from linear analogue and advanced (digital) hearing aids on hundred first time hearing aid users with mild-to-moderate sensorineural hearing loss fitted monaurally with a behind-the-ear (BTE) hearing aid in a single-blind randomized crossover trial were taken for the study. Aided speech recognition performance in noise was measured at speech levels of 65 and 75dB at a speech-to-noise ratio (SNR) of +2dB for closed sets of single words. Self-rated benefit was measured using the Abbreviated Profile of Hearing Aid Benefit (APHAB) and the Glasgow

Hearing Aid Benefit Profile (GHABP). Quality of life, hearing aid use and user preferences were also assessed. Speech recognition scores with the digital aids were significantly better at 75dB than with the analogue aids. Self-reported benefit (APHAB, GHABP) and improvement in quality of life were generally not significantly different between analogue and digital aids, although aversiveness measured with the APHAB was significantly lower with digital aids, and satisfaction measured with the GHABP was greater. The digital aids were preferred significantly more often than the analogue aids. Overall, they showed advantages for advanced digital over simple linear analog aids in terms of both objective and subjective outcomes, although average differences are not large.

Magni, Freiberger and Tonn (2005) measured satisfaction between analog and digital hearing aid users. 40 subjects were interviewed. 20 were analog hearing aid users (Group 1) and 20 were digital hearing aid users (Group 2). The subjects had mild to moderate sensorineural hearing impairment, and were aged 45 to 95 years old. The hearing aid users completed the International Outcome Inventory for Hearing Aids (IOI-HA - Portuguese version) proposed by Cox, Stephens and Kramer (2002). The results showed that the users of digital hearing aid used the hearing aid longer every day than the analog hearing aid users. The users of Group 2 have fewer difficulties with the amplification at some situations than the users of Group 1. Despite the fact that users of Group1 have presented more deficit than the users of Group 2, the results agree that all the subjects reported satisfaction with their hearing aids.

McCarthy and Alpiner (1983) administered McCarthy-Alpiner scale to sixty adults with hearing-impairment and their family members. The results revealed an overall low level of agreement between the subjects and family members for items representing the psychological, social and vocational parameters. The results support the need for inclusion of family members

in counselling and help to provide a basis for aural rehabilitation planning and management. They concluded that as an important part of the aural rehabilitation process, it is essential that counselling has to be included for family members.

Newman and Weinstein (1986) administered Hearing Handicap Inventory for the Elderly (HHIE) and a modification of the HHIE for spouses (HHIE-SP) on 30 hearing-impaired elderly men and their spouses to measure perception of handicap. The results showed that the emotional and social effects of hearing impairment as perceived by the hearing impaired was generally underrated by the spouses, such that low to moderate correlations between their perception of handicap emerged ($r = 0.27$ to 0.48)

IOI-HA studies

The subsequent studies depict the relevance of the IOI-HA in various studies and it is found be a reliable and valid tool. Along with the Client Oriented Scale of Improvement (COSI) and the Profile of Hearing Aid Benefit (PHAB), IOI-HA has been used to evaluate how effectively the omni-directional hearing aids lead to improvement in speech understanding in noisy environment. The employment of this kind of subjective tools was crucial in deciding what degree of laboratory benefit translates to clinical benefit as per subject's perception (Parving, Christensen, Nielsen & Kondradsson, 2005). (Maki-Torkko, Sorri, & Laukli, 2001) in their study used the IOI-HA reports as subjective measure to see that there is a benefit of combining objective (time recorded memory in the hearing aid) and subjective measures (outcome measures and patient interviews) to assess the hearing aid benefit . Another study by Condie, & Tchorz, (2004) on high-power hearing aids and children, they have used resultant measures to intervene and asses the quality of these pediatric fittings. IOI-HA Dutch version was standardized and

validated by comparing the outcomes of IOI-HA Dutch version with other self-report outcome measures such as the Hearing Handicap and Disability Inventory (HHDI) by Stephens, (2002), the Amsterdam Inventory for Hearing Disability and Handicap (AIHDH) by Kramer, et al, (1995) and the Abbreviated Profile of Hearing Aid Benefit (APHAB) by Cox & Alexander, (1995).

Test-retest reliability of the IOI-HA was also observe and it was found that the IOI-HA is a realistic and reasonable tool which can be used in measuring firm features related to hearing aid usage, therefore it found to be a valuable and reliable tool (Kramer, Goverts, Dreschler, Boymans, & Festen, 2002). McPherson & Wong (2005) suggests that IOI-HA can be a functional tool in assessing the efficacy of low-cost 'over-the-counter" (OTC) hearing aids. They also found from the data obtained from IOI-HA, COSI and PHAP-C that OTC's helps in enhancing the communication skills. Hence, we can conclude from the above mentioned studies that IOI-HA is a valuable and reliable tool and can be used universally for knowing the patient's perception regarding their hearing aid. these self-reporting tools can aid to these kinds of devices for better rehabilitation purpose.

As seen from above literatures

Many factors affect the hearing aid performance. The performance measured varies from benefit to satisfaction. It is not possible for the audiologist to use various outcome measures as it increases the work load and time for the audiologist. This alerts the audiologists to look for those measures which provide more information and less time consuming. Apart from this the situation in developing countries are different. The situation in developed countries is that there is minimal role of language whereas in countries like India, a multilingual country, language as a specific factor plays a dominant role. If we need to compare the performance of hearing aid

users, it has to be in their regional languages and performance should be compared across the country so that uniformity can be maintained. Thus within language environment comparisons can be possible if we have questionnaires which is nationally acceptable and standardized in different Indian languages. So the present study is a preliminary approach or effort in standardizing the IOI-HA to the national language of India.

CHAPTER III

METHOD

Participants

The study was conducted in 5 centres of Delhi and 1 centre of Madhay pardesh state of India on 100 individuals in the age range of 18-75years with a mean age of 53.74 years (SD =1.73) the final group of participants comprised 65 males and 35 females, where mean age of male and female were 54.26 and 52.74 with SD 16.24 and17.32 respectively

Participants Selection Criteria

The participants fulfilling the following criteria were only considered for the study.

1. *Native language (Hindi)*–The participants were native Hindi speakers. Only literate participants were selected for the study, as it was necessary for all participants to fill the questionnaire themselves.
2. *Hearing Loss* – Participants having mild to severe sensorineural, conductive or mixed hearing loss were taken for the study.
3. *Hearing aid* - Participants using digital hearing aids were taken for the study.
4. *Minimum period of use of hearing aid* – Participants who used the hearing aid at least for a period of minimum 3 months were considered to fill the questionnaire.
5. *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 would be considered as experience and the participants were compared accordingly.

Procedure

Procedure was divided into three phases I) translation, II) administration, III) scoring.

Phase I

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

Phase II Filling Out The Questionnaire

Participants were given Hindi translated version of IOI-HA. It had three categories/ sections. First was demographic data which was to be filled by the client. Second section had questions related to the features of a hearing aid, which was filled by the audiologist and the third section had eight main questions representing outcome domains which were: 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.

Phase III Scoring

Each question had 5 options. The participants had to tick the most suitable / appropriate option out of five for all the eight questions. Each question was scored using these options which were later converted into integers of 1-5 for five responses choices. The left most response,

indicated the poorest outcome and was scored as 1, the right most response denoted the most favourable outcome and was scored as 5. For the analysis of the responses of the IOI-HA were considered: a score for each question, the total score, and score considering two factors: factor 1, which reflects the individual's interaction with the HA (items 1, 2, 4 and 7), factor 2, related to the interaction of the individual and it environment (items 3, 5 and 6). The score ranges from 1 (worst result) to 5 (best result) for each item, and the maximum score (amount of all items) is 35 points. The questionnaire was given to participants during an interview or correspondence through post. Participants asked to read the instructions, fill the first three sections of questionnaires themselves and were asked to return it to the researcher.

Statistical analysis

Descriptive as well as statistical analysis of data was administered to find out the frequency of response and the correlation with factors which are represented in the result part of study.

CHAPTER IV

RESULTS AND DISCUSSION

The present investigation aimed at modifying and adapting the IOI-HA to the Hindi speaking population in Indian multilingual situation. Further, the association of age, duration of problem and factors related to hearing aid use were investigated. Data from 100 participants in the age range of 18-75 years were collected in this study. The questionnaire was administered to all the participants. Each item was scored from 1 to 5 for the responses, indicating from left (worst) to right (best), respectively. A higher score is indicative of a better outcome and the results obtained were subjected to item-wise analysis using the SPSS software (version 21.0). The results of the study are being presented under the following domains:

1. Develop norms for IOI-HA Hindi speaking population by means of each question's response.
2. To see the association of questions with each other in the translated version (Hindi).
3. To see the relation between demographic factors and hearing aid use (such as age, gender, duration of problem, degree of hearing loss, duration of use of hearing aid) are considered.

The first domain analysis to develop norms was achieved by descriptive analysis. Descriptive analysis of each question's response was done to see the response distribution across the examined population. Response distribution of each item is displayed in figure 1.

Figure 1 shows that in all items maximum score opted was 4 and 5 except in item 3 where option 3 had same number of response as option 5. As seen from the original questionnaire higher options 4 or 5 shows better outcome. Hearing aid is giving good outcome in all domains which IOI-HA has assessed, in the Hindi speaking population also.

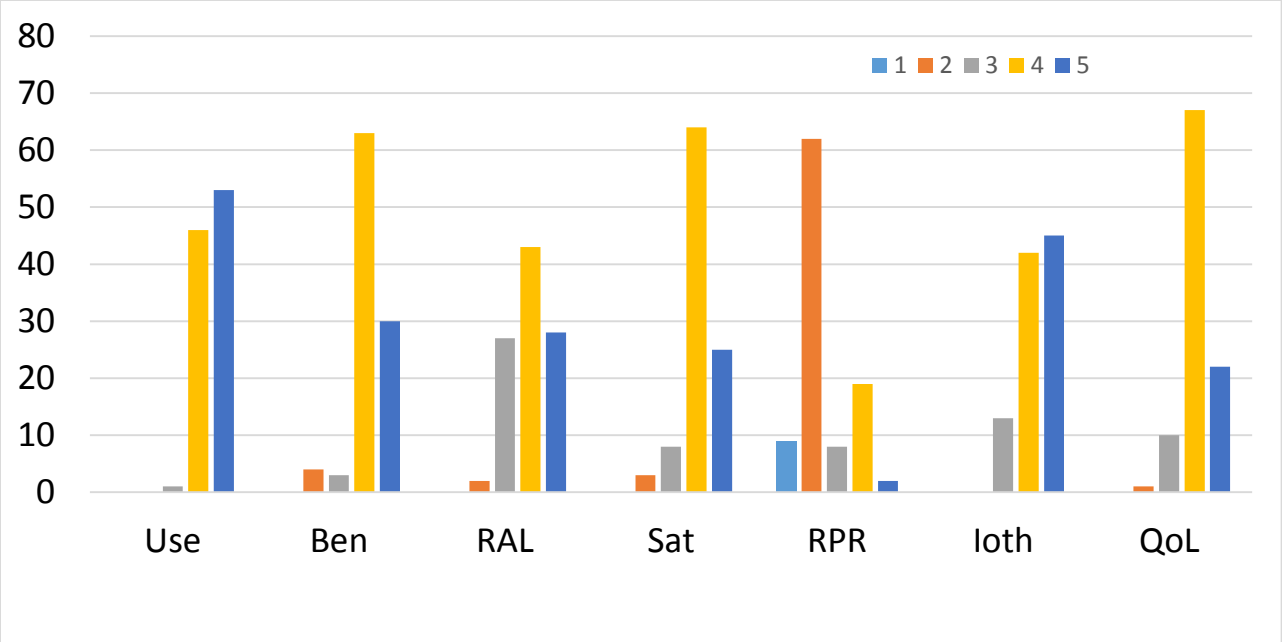

Figure 1. Distribution of responses for each item of the IOI-HA. The X-axis represents the score of the IOI-HA item; the Y-axis represents the percentage of responses correspondence to each score. Use, Use: Ben, benefit: RAL, residual activity limitations: Sat. satisfaction: RPR, residual participation restriction: Ioth, impact on others: QoL quality of Life

The results of the present study shows (figure 2) that 53% persons are using their hearing aid more than 8 hours where as 46 % persons were using hearing aids for 4 to 8 hours in a day. From the earlier study by Cox (2003) it is known that the use time is an indicator of real world hearing aid outcome. Longer the time a person uses a hearing aid, indicates that hearing aid is really helping the person to cope in the worst listening situations which motivates him to wear it for longer time so that he can use hearing aid maximally.

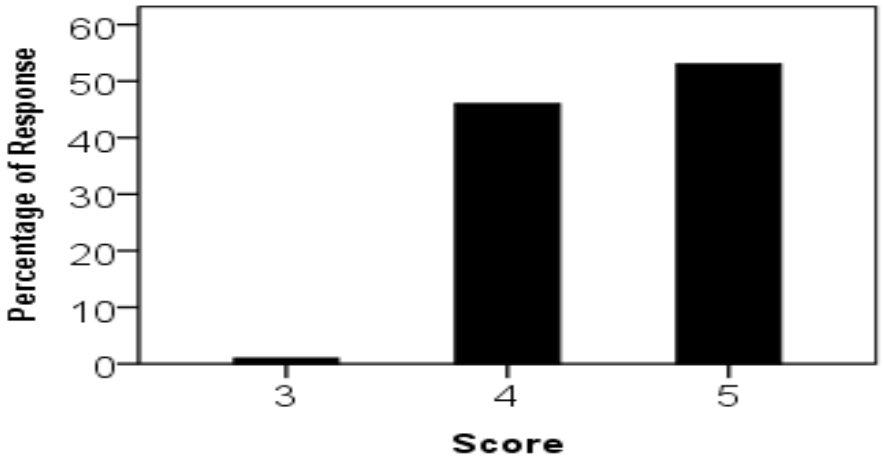

Figure 2. Frequency distributions for the item 1 (USE) in percentage

The second question reports about the hearing aid benefit.

An answer to the 2nd question reveals (figure3) hearing aid benefit. 63% participants indicated that hearing aid "helped quite a lot" whereas 30 % showed "helped very much". Despite the fact that the participants used hearing aids having different technology and different working conditions, more number of participants were getting benefit after wearing the hearing aid which indicates that hearing aid is beneficial to the users.

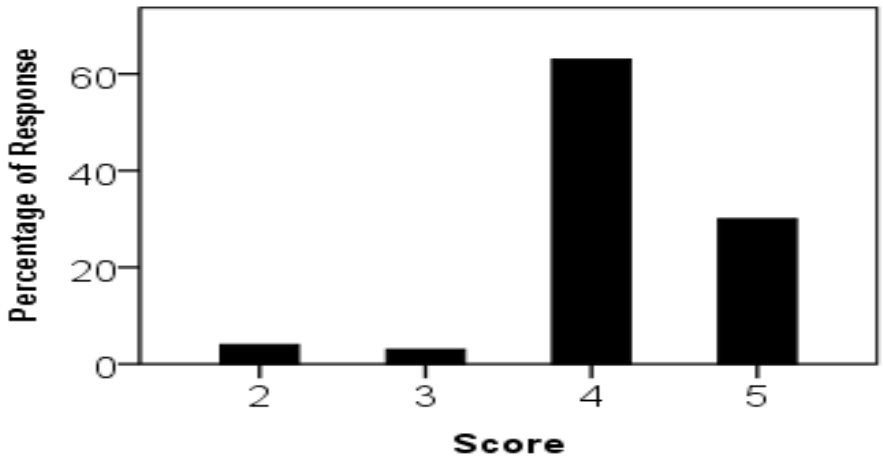

Figure 3. Frequency distributions for the item 2 (benefit) in percentage

The third question concerns about residual activity limitation.

Residual Activity limitations is shown in figure 4 by various answers as “slight difficulty” in 43 % , “moderate difficulty” in 27% and “no difficulty” in 28%. Though the cost of hearing aid is more compared to per capita income in Indian population, the effect of cost on hearing aid use or residual activity limitation was not evidenced. So when a person buys a hearing aid with that high cost the expectation are naturally high and makes the user to think that the hearing aid will make them hear like normal. In spite of the high cost and more expectations, nearly half of the participants reported to get good help from the hearing aid (Bentler Niebuhr &Anderson1993). In the present study only27 % of the subjects reported moderate difficulty.

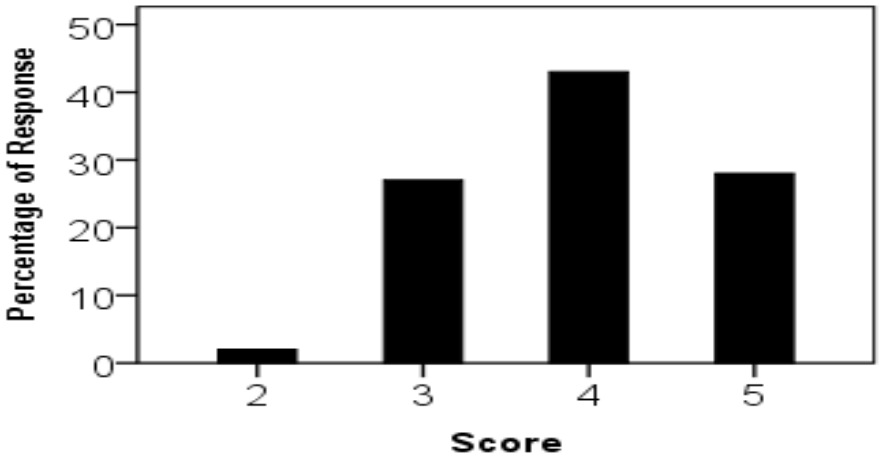

Figure 4. Frequency distributions for the item 3 (residual activity limitations) in percentage

The fourth question is about finding out how the hearing aid has been in fulfilling the expectations of the participants i.e. satisfaction.

By answering the 4th question, 64 % people said their hearing aid was fulfilling their expectation and they were considering their hearing aid as “quite a lot worth it” and 25% were in “very much worth it” categories and only 11% rated it to be below or not meeting their expectation shown in figure 5. This result is as expected; hearing aid users want some way to

cope with their problem and their hearing aid was able to meet their expectations to some extent. Only a small percentage is not satisfied with their hearing aid.

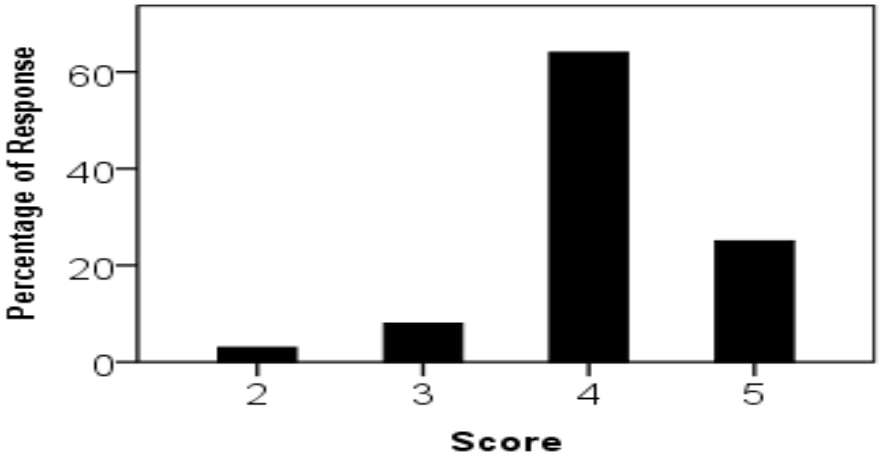

*Figure 5.*Frequency distributions for the item 4 (satisfaction) in percentage

The fifth question concerns about the residual participation.

Item 5th which is checking residual participation restrictions indicates that daily routine was getting affected due to hearing aid in last two weeks in 62% of the participant's shown in figure 6. Most of these participants were given this questionnaire when they came for the revaluation or when they had some problem with the hearing aid which was causing difficulty in hearing. This explains why more than 50% of the participants reported that there is residual participation restriction.

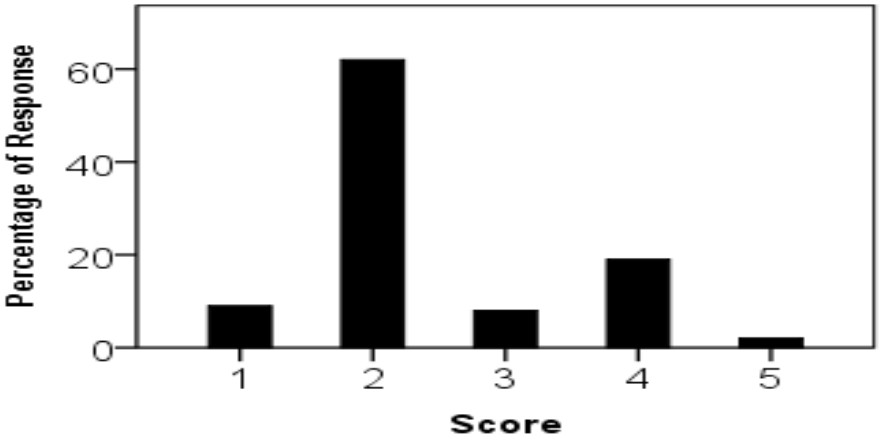

Figure 6. Frequency distributions for the item 5 (residual participation restrictions) in percentage

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

Answering the 6th question 42% participants said that people were slightly bothered and 45% said people were not bothered at all by their hearing difficulties but 13 % said others were moderately bothered, which indicates the impact on others depicted in figure 7. Most of the time when a person starts using a hearing aid their communication ability increases and the persons interacting to them start giving better response to their call which reduces the impact on others after using a hearing aid.

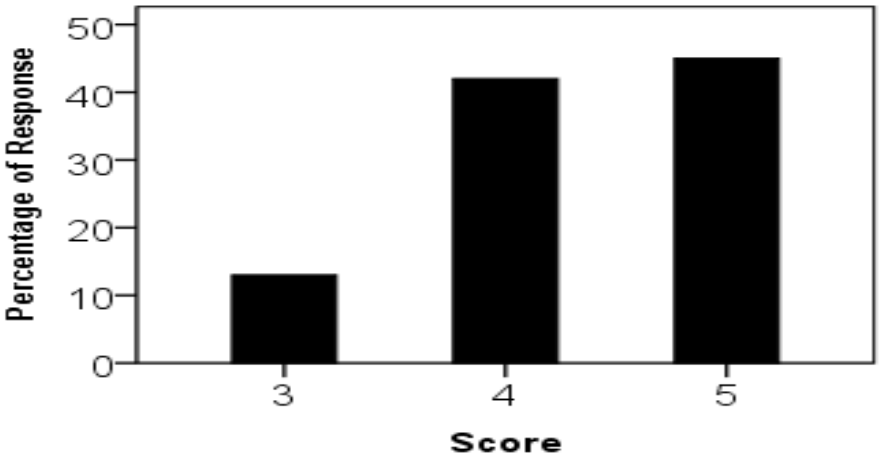

Figure 7. Frequency distributions for the item 6 (impact on others) in percentage

The 7th question is about the quality of life.

For the improvement of quality of life(figure 8) 67 %participants said life has become quite a lot better and 22% said very much better. As people use the hearing aid their perception of speech improves in all situations which are directly related to quality of life from the days when they were not using the hearing aid. This was accordingly depicted in the present study results too.

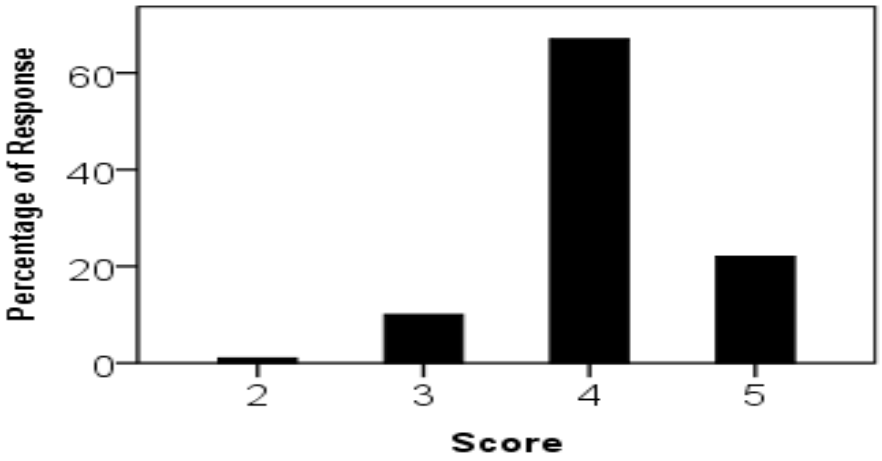

Figure 8. Frequency distributions for the item 6 (impact on others) in percentage

The mean score for each item is shown in Figure 9. All the mean scores fall between 2.43 and 4.52, somewhat above the middle of the scoring range and SD range from 0.522 to 0.595 .The lowest mean was for residual participation restrictions. This seems to be indicative of a subject group that is relatively happy with their fitting outcomes, on the whole. Nevertheless, there is room for improvement in the scores, which is a desirable feature if the inventory is to be useful for discriminating among treatments.

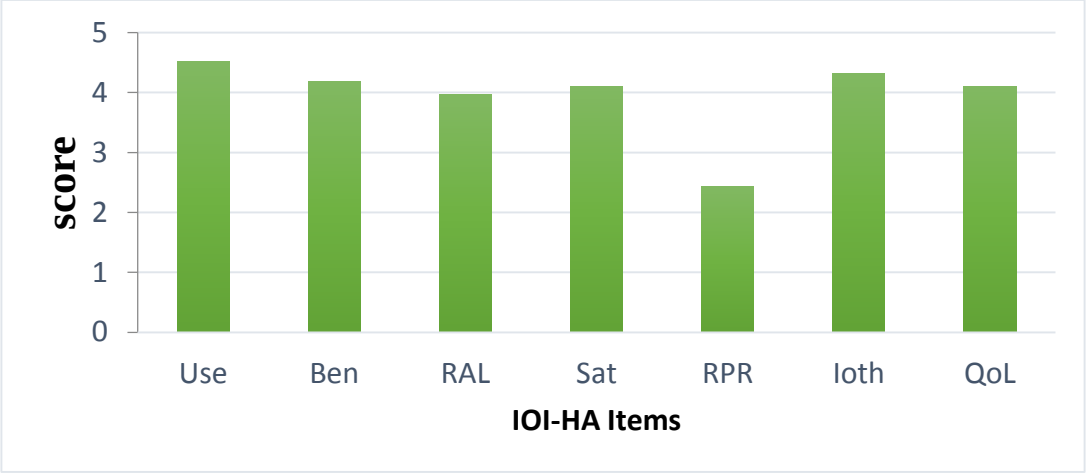

Figure 9. Mean scores for each item of the IOI-HA. The X-axis represents the items of the IOI-HA (Use: daily use; Ben: benefit; RAL: residual activity limitation; Sat: satisfaction; RPR: residual participation restrictions; Ioth: impact on others; QoL: quality of life). The Y-axis represents the mean scores, each item score ranges from 1 to 5, with higher scores indicate better outcomes. The error bars represent one SD.

The individual norms are plotted for Hindi translation of IOI-HA in Figure 10. Panel (a) represents self-reported hearing difficulty (unaided) to be ‘ none’ , mild’ , or ‘moderate ’ group, Panel (b) represents self-reported hearing difficulty (unaided) to be ‘ moderately severe’ or ‘severe ’ group (Cox et al, 2003)

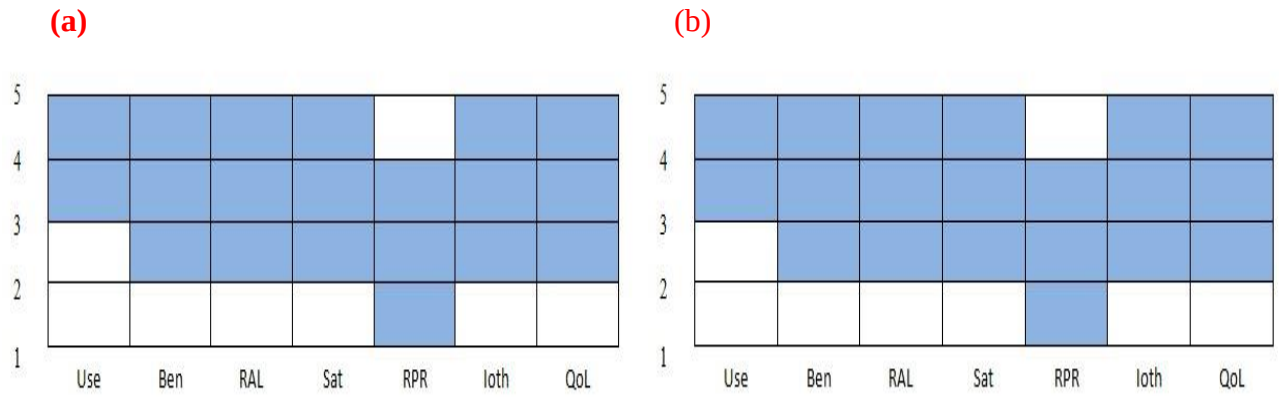

Figure 10. Template of the individual IOI-HA norms. The shaded areas illustrate the range of the middle 50 percent of the data for each item of the IOI-HA. Panel (a): self-reported hearing difficulty to be ‘none’ ,‘ mild ’ or ‘ moderate ’ group; Panel (b): self-reported hearing difficulty to be ‘ moderately severe’ or ‘severe’ group. Use: daily use; Ben: benefit; RAL: residual activity limitation; Sat: satisfaction; RPR: residual participation restrictions; Ioth: impact on others; QoL: quality of life.

In both the group normative the results of present study are different from the results of the earlier studies.

1. To see the association of Hindi translated questions with each other

Spearman correlation was done to see the association of each item with each other and also with total score. The data obtained are given in the table 4.

Table 4. Inter-item correlations for Hindi IOI-HA

	Ben	RAL	Sat	RPR	Ioth	QoL	TOTAL
Use	.156	0.30	0.042	0.021	-0.241*	0.201*	.222
Ben		0.508**	0472**	-0.071	0.297**	0.340**	.663**
RAL			0.513**	-0.102	0.244*	0.314	.697**
Sat				-0.252**	0.344**	0.401**	0.614
RPR					-.146	-.149	.229*
Ioth						0.330*	.482**
QoL							.588**

Ben, benefit: RAL, residual activity limitations: Sat. satisfaction: RPR, residual participation restriction: Ioth, impact on others: QoL quality of Life.*correlation is significant at 0.05 level: ** correlation is significant at 0.05 level

Item-total correlations ranged from .222 to 0.697. Items with the highest correlations were considered most representatives of the total score of the questionnaire developed. Accordingly,

item 3 ("Think again about the situation where you most wanted to hear well. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?") is most representative of the questionnaire. In the lowest range of .222 of the item 1 ("Think about the situation where you most wanted to hear better, before you got your present hearing aid(s).Over the past two weeks, how much has the hearing aid helped in those situations?") was considered least representative of the total items related to outcome of hearing aid. Question 2(benefit), Question 3(residual activity limitations), Question 6(impact on others), Question 7(quality of life) were highly significantly correlated with the total score of each item having value .663, .697, .229, .482, .588 respectively with $p < 0.01$ whereas question 5 representing (residual participation restrictions) moderately significantly correlated with total score having value .229 $p<0.05$.

Question 1 (Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?) was negatively correlated with question 6 having correlation coefficient of -0.241 $p< 0.05$ but positively associated with question 7 with correlation coefficient of -0.201 $p< 0.05$. this result depict that as the duration of use of hearing aid increases people communicating to them starts less bothered about their hearing loss Cox (2003), Go and Ang (2006) got same type of result but it was not significant difference with question 6. In the present study a negative correlation is seen with question 6 that if number of hour of use of hearing aid increases other people are less bothered about their hearing problem because their interaction between them increases and more information flows. It is found in the present study that as the numbers of hours of hearing aid use increases so also the quality of life increases which

signifies that there is a positive sign of better outcome from the hearing aid use. Studies (Fuller and Singh 2006) have explained that hearing aid changes the physiology and also cognitive ability as well as perception of sound in a positive way.

Question 2 (Think about the situation where you most wanted to hear well, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in those situations?) showed a strong correlation with question 3, question 4, question 6 and question 7 with value 0.508,0.472,0.297and 0.340 respectively with all having p value less than 0.01. Similar results were reported by Cox (2003) and Go and Ang (2006) except that in Go and Ang (2006) study did not get any correlation with question 6. This strong correlation can be explained easily by saying that when a person is getting more benefit from his hearing aid his hearing ability in needful situation should be better. If hearing aid is benefiting the person in all situation his satisfaction increases which explains the positive correlation with question 4, 6, and 7.

Question 3 (Think again about the situation where you most wanted to hear well. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?) showed a strong positive association with question 4 and moderate association with question 6 with correlation coefficient 0.531 and 0.244 respectively having $p< 0.05$. For most hearing aid users the main concern is that they are not able to hear better in situations where they were not hearing good earlier. If they are able to cope up that situation with hearing aid they get more satisfied and that is strongly correlated as shown by the results, and same way their 2nd concern is they are not able to communicate if hearing aid does not fill this gap then people are less bothered about their problem. This is relevantly depicted in the

results of the present study.

Question 4 (Considering everything, do you think your present hearing aid(s) is worth the trouble?) was showing strong positive correlation with question 6 and question 7 with value 0.344 and 0.401 respectively but had strong negative correlation with question 5 all having p value less than 0.01. A negative correlation between the question 5 and the question 6 in Indian scenario is more related to the service provider and the hearing problem of a person than a hearing aid because in question 6 only 2 weeks are taken as consideration and the population taken for the present study came to the centre for either aid or other ear related issues, which absolutely deviated their perception toward the hearing aid and that explains the result. Question 6 and 7 signifies the broader meaning within itself which is not getting affected by 2 week period duration. Same type of result was given by Cox (2003) bur no negative relation was shown with question 5. Go and Ang (2006) got only correlation with question 7. This difference can be because of language or culture Yau (1994).

2. To see the association of demographic factors which contribute on hearing aid users outcomes such as age, gender, duration of problem, degree of hearing loss, duration of use of hearing aid are considered.

Table 5 Result of chi-squire test

	Age	Gender	DOP	TOH	DOH	DOU
Use	7.093	1.990	6.687	1.782	6.671	22.509*
Ben	4.291	3.094	7.545	3.944	10.121	6.407
RAL	6.055	1.336	14.524*	2.856	14.864	12.960*
Sat	9.725	4.310	22.502*	6.299	13.226	9.144
RPR	7.135	2.043	16.089*	14.105	14.314	7.268
Loth	4.667	2.251	5.047	7.380	13.734*	2.716
QoL	2.127	3.841	5.154	4.012	8.539	10.538

Ben, benefit: RAL, residual activity limitations: Sat. satisfaction: RPR, residual participation restriction: Ioth, impact on others: QoL quality of Life: DOP, duration of problem: Toh, Type of hearing loss: DOH, degree of hearing loss: DOU, duration of use of hearing aid *correlation is significant at 0.05 level.

Participants age ranged from 18 to 75 years having an average age of 53.74 years with SD =1.73 which was later subdivided into 3 different groups 18-35 (15% of total participants), 35-50(23% of total participants) and 50-75(62% of total participants). There were two reasons to divide the total population into different groups- 1st in these stages of age deterioration of hearing starts. 2nd for better statistical analysis ordinal scale of data is required. Chi square test was done to see the association of age on each question, result shows that none of the questions were getting affected by any of the age groups , all were having p >0.5. Chi square value is given in table 1. Same results were published in earlier studies also (Kremer, 2002) (Cox, 2003) and Lui et al (2011). In the present study 50-75 age groups had better scores when compared with other groups. The reason for this being because of their hearing loss, they find the hearing aid more useful compared to other groups.

To see the association of gender on each parameters of questionnaire, analysis was done with help of Chi squire test and the results indicated that gender is not a factor which affected any of the parameters of the questionnaire, showing p value>0.05. Study done by Lui et al (2011) in Chinese version got the role of gender on the item on quality of life and satisfaction. This difference can be because of two reasons; one, the small sample (35%) with the comparison of males and the second reason being language, culture, environmental or technological difference can cause this mismatch of the results.

Different type of hearing loss causes different levels of perception. To see the association of type hearing loss with each questions Chi-square test was done. None of type of hearing loss showed any significant difference on each of the questions i.e. $p>0.05$. The results of the present study offers more support to the results of earlier studies by Cox (2002).

As we know that as the degree of hearing loss increases, more domains of hearing get affected. So the association of degree of hearing loss on different domains of the questionnaire was checked and results show that only question 6 had significant association $p<0.05$ and other six questions had no significant association with degree of hearing loss $p>0.05$. Previously no study has reported it as an active factor which can influence the score of IOI-HA scores. But in the present study it can be seen that the association of degree of hearing loss is influencing the impact on others. It could be due to the fact that people of India accept and adapt themselves towards their own hearing loss and also towards a hearing impaired person.

Duration of the problem causes the deprivation of auditory perception which in turn affects the outcome of the hearing aid. In this study also the association of duration of

problem was seen by doing chi-square test on each item of questionnaire and the results indicate that question 3,4,and 5 had significant association by degree of hearing loss having $p<0.05$. Other questions were not associated with the duration of problem $p>0.05$. Earlier studies had not seen the relation between these two. The present results can be justified on the basis that as the duration of problem increases due to auditory deprivation, the expectation of hearing aid increases and slight benefit from hearing aid encourages them to appreciate the hearing aid.

Hearing aid outcomes also get affected by the fact that from how long a participant is using the hearing aid. In this study duration of use of hearing aid was divided into three groups as used the hearing aid for less than one year (24%), used the hearing aid for one to five years (61%) and used the hearing aid for more than five years (15%). Association of all these groups was seen on each item of questionnaire with the help of chi squire test and the results showed that question 1(use) and question 3(RAL) were significantly affected by the duration of use of hearing aid. Any person with hearing impairment only uses their hearing aid if their hearing aid is helping them in many/some listening situations. If they are using hearing aid from many months or years, it is a clear indication of its helpfulness in those situations where they wanted to hear well (Humes, Garner, Wilson, & Barlow2001). More importantly as the duration of their hearing aid use increased, they become more comfortable with it and more dependent on it and they start using it for longer durations. As the duration of hearing aid use increases there is more benefit (Abrams 2000).

From the analysis of the overall pattern of responses of participants, it can be inferred that the participants rated question no's 1 through 7 with the exception of question

no.4 as. 5. However, for question no.5, they rated score 2 as the more frequent score, depicted in figure 11.

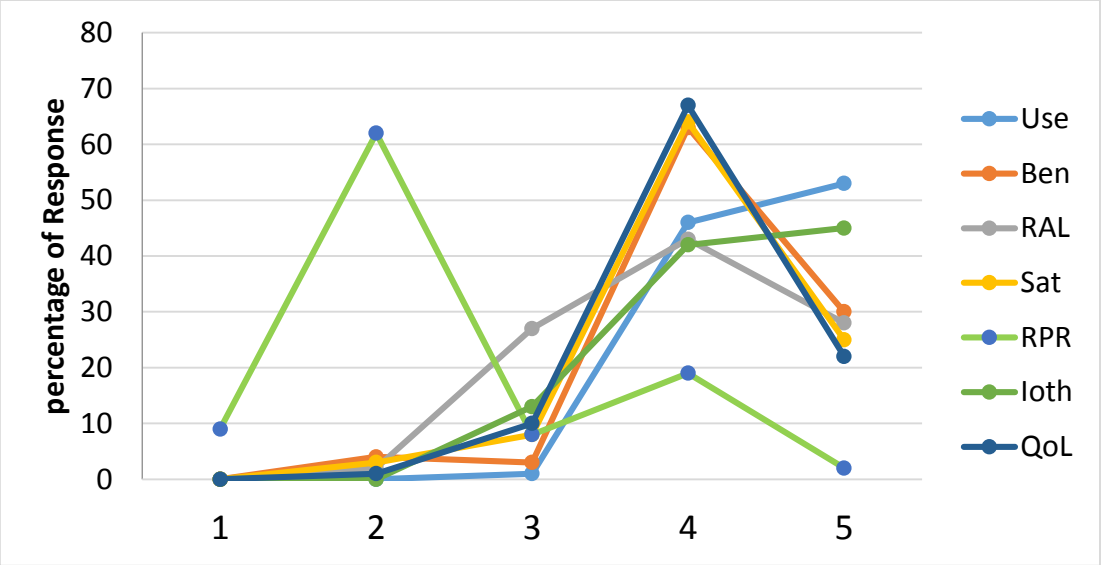

Figure 11. Trend of Item score distribution for Hindi IOI-HA, Use, Use: Ben, benefit: RAL, residual activity limitations: Sat. satisfaction: RPR, residual participation restriction: Ioth, impact on others: QoL quality of Life

CHAPTER V

Summary and Conclusion

In the present study first translation of English version of IOI-HA was done with help of a linguist. Later validation of questionnaire was done by a professional audiologist to see whether Hindi translated questions were having the same meaning as that of English version. After finalizing the questions, questionnaire was given in 5 private hearing aid dispensing clinics of Delhi and one clinic of Madhya Pradesh and asked to be filled in by the hearing aid users to collect data. Data was collected from a total of 100 individuals, age ranging from 18-75 years. The group consisted of more number of males than females.

1. After chi square test it was found that duration as well as type of hearing loss and duration of use of hearing aid had association with questions of IOI-HA, question 3, 4 and 5 had association with duration of problem, duration of use had association with question1,2,3.
2. Age, gender and degree of hearing loss had no association with questions. Spearman correlation suggested that some questions were having moderate relation where as some questions had strong correlation with each other.
3. From these statistical analysis, norms of IOI-HA are drawn. The analysis has helped to extract the factors which are more important for the Hindi speaking hearing aid user.
4. From this study we can say that Hindi speaking hearing aid users are using their hearing aids for more than 8 hours in a day on an average.
5. Hindi speaking hearing aid users are getting good benefit from their hearing aids.

6. Hindi speaking hearing aid users are getting very less disturbance in most desirable conditions of hearing. The satisfaction level is also high from their hearing aids.
7. From our study we also say that people are less bothered about their hearing problem and their quality of life has also improved after they stared using their hearing aids.

In an attempt at making the Hindi speaking hearing aid users' outcomes comparable with the other users of hearing aids in the world, a small step in the form of translating IOI-HA into Hindi was taken up. It is known that IOI-HA is already converted into 24 languages. The translation of this has led to the easy comparison of the performance of the Hindi speaking population with other populations who have assessed their outcome from the hearing aids with IOI-HA. It is also possible to compare the distributed factors in different language speaking populations to have an idea of the factors which contribute to the hearing aid outcomes (Saunders, Chisolm & Abrams, 2005).

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 for knowing Hindi speaking hearing aid user.

IMPLICATIONS OF THE STUDY

1. Present study has developed a self-assessment tool for Hindi speaking hearing aid users who use digital hearing aids.
2. It can help clinician/ audiological practitioner to understand the problems of hearing aid users and provide guidelines to counsel and determine the benefits from hearing aids.
3. It sensitizes the audiologist or clinician to understand the listening needs and expectations of the hearing impaired individuals during hearing aid fitting and post hearing aid fitting.

4. This tool can save time for both the audiologist as well as client in the process of best fit.
5. The results of the present study can be used to achieve satisfactory level in hearing aid fitting for both clinician and the hearing impaired individuals.

Future research:

- Questionnaire can be converted to different Indian languages to compare the data across populations speaking different Indian languages.
- Other factors which influence the outcomes such as type of hearing aid, technologies used in hearing aids and the contribution of speech spectrum of the language to hearing aid use can be studied.
- With slight modification this can be used to evaluate the outcome of cochlear implant.

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Appendix

(a)

International Outcome Inventory for Hearing Aids in Hindi (IOI-HA)

1. विचार करें की पिछले दो सप्ताह में आपने अपने वर्तमान श्रवण यन्त्र (हियरिंग ऐड) का कितना उपयोग किया है| औसतन एक दिन में आपने कितने घंटे श्रवण यन्त्र का उपयोग किया?
   - □ कभी नहीं
   - □ एक दिन में एक घंटे से कम
   - □ एक दिन में एक से चार घंटे
   - □ एक दिन में चार से आठ घंटे
   - □ एक दिन में आठ घंटे से ज्यादा

2. विचार करें की श्रवण यन्त्र मिलने से पहले किस परिस्थिति में आपको बेहतर सुनने की सबसे अधिक इच्छा थी, पिछले दो सप्ताह में श्रवण यन्त्र ने उस परिस्थिति में आपकी कितनी सहायता की है?
   - □ बिलकुल भी सहायता नहीं की
   - □ थोड़ी सहायता की
   - □ मामुली सहायता की
   - □ काफी सहायता की
   - □ बहुत ज्यादा सहायता की

3. फिर से उस परिस्थिति का विचार करें जहां आपको बेहतर सुनने की सबसे अधिक इच्छा थी। अब जब आप अपना वर्तमान श्रवण यन्त्र उपयोग करते हैं तो आपको उस परिस्थिति में अभी कितनी कठिनाई होती हैं?
   - □ बहुत ज्यादा कठिनाई
   - □ काफी कठिनाई
   - □ मामूली कठिनाई
   - □ थोड़ी कठिनाई
   - □ बिल्कुल भी नहीं

4. सब कुछ ध्यान में रखते हुये आपको लगता है कि वर्तमान श्रवण यन्त्र आपके परेशानी के लिये सुयोग्य है।

- □ बिल्कुल भी सुयोग्य नहीं
- □ थोड़ा सुयोग्य
- □ मामूली सुयोग्य
- □ काफी सुयोग्य
- □ बहुत ज्यादा सुयोग्य

5. पिछले दो सप्ताह में आपके वर्तमान श्रवण यन्त्र के साथ आपकी सुनने की समस्या ने आपके काम को कितना प्रभावित किया है।

- □ बहुत ज्यादा प्रभावित किया
- □ काफी प्रभावित किया
- □ मामूली प्रभावित किया
- □ थोड़ा प्रभावित किया
- □ बिल्कुल भी नहीं प्रभावित किया

6. विगत दो सप्ताह से अधिक आपको कितना लगता है की अपने वर्तमान श्रवण यन्त्र के साथ आपकी सुनने कि समस्या ने दुसरों को परेशान किया हैं?

- □ बहुत ज्यादा परेशानी
- □ काफी परेशानी
- □ मामूली परेशानी
- □ थोड़ी परेशानी
- □ बिल्कुल भी नहीं

7. सब कुछ विचार करते हुए बतायें की आपके वर्तमान श्रवण यन्त्र ने जीवन के आंनद को कितना प्रभावित किया है?

- □ और भी बुरा
- □ कोइ परिवर्तन नहीं
- □ थोड़ा बेहतर
- □ काफी बेहतर
- □ बहुत ज्यादा बेहतर

8. जब आप श्रवण यन्त्र नहीं पहनते हैं तो आपको सुनने में कितनी परेशानी होती है?

- □ गंभीर
- □ मध्यम गंभीर
- □ मध्यम
- □ थोड़ा
- □ बिल्कुल भी नहीं

(b)

International Outcome Inventory for Hearing Aids in Hindi (IOI-HA)

Demographic data दिनांक :-

To be filled by an Participants

नाम :-_____ उम्र :-_____

लिंग :- महिला ☐ पुरुष ☐ दूरभाष/मोबाईल संख्या :-_____

भाषा :-_____ शिक्षा :-_____

व्यवसाय :-_____ मासिक आमदनी / आय :-_____

समस्या की प्रकृति :- समस्या की अवधि :-_____

श्रवण यन्त्र का उपयोग सिर्फ एक कान में ☐ दोनो कानों में ☐

To be filled by an Audiologist

Hearing loss	**Right**	**Left**
Degree of hearing loss		
Type of hearing loss		
Pure tone average		

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

Audiologist signature participant signature