

**HEARING AIDS SERVICES -  
NEEDS AND TECHNOLOGY ASSESSMENT FOR  
DEVELOPING COUNTRIES**

**Report  
of a  
WHO/CBM WORKSHOP**

held at  
**Christoffel-Blindenmission Head Office  
Bensheim, Germany**

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## EXECUTIVE SUMMARY

The meeting was organised by WHO with support from Christoffel-Blindenmission (CBM), and was hosted by CBM at their head office in Bensheim, Germany. 24 persons attended of whom 10 came from developing countries.

The purpose of the meeting was to determine the problems and needs for the provision of hearing aids and hearing aids services in developing countries.

The current situation in the world was reviewed, focusing on developing countries, with reports from countries in the six WHO regions, including information from a questionnaire survey. Sessions were then held on three main topics:- *What services do we need?*, *What technology do we need?*, *Training and development*.

Each session commenced with an introduction by an expert in that topic and was followed by a set of concurrent workshops which produced draft conclusions and recommendations for discussion and finalisation in the plenary sessions. The final recommendations made under the three headings are summarised as follows:-

### What services do we need?

- Awareness of the problem should be raised in all sectors of the population. For WHO, this could be by holding a world health day on communication difficulties. "Better Hearing Ambassadors" should be appointed to advocate hearing aid use.
- Hearing aids and hearing aids services should be provided as the components of a hearing health system which is only implemented as a complete package.
- Because there is strong evidence that hearing disability will worsen if diagnosis and rehabilitation is delayed, services should be targeted for early intervention beginning with the youngest possible according to age of presentation and services available. Priority should be given to fitting hearing aids to infants and children with mild, moderate and severe but not profound hearing impairment. Where resources are scarce, unilateral hearing loss should not be a priority.
- Provision of hearing aids and services should be implemented according to the level of development of the country concerned. Services should start at the primary level with referral for specialist advice in outreach satellite programmes and centres.
- Accurate epidemiological data and cost/benefit analysis of disability reduction should be used in programme development and evaluation.
- Development of strategies should be community driven and coordinated between all sectors, and government and non-government organisations. Governments should be encouraged to take responsibility for ensuring access to hearing aid provision and accrediting distributors.
- Audiological Services should be developed by an interdisciplinary approach and progressively extended throughout a country.
- All services should be culturally appropriate and provide equitable access for all.

### What technology do we need?

- Behind the ear ( BTE) hearing aids should be the type generally available, with body-worn and bone-conduction aids available for special situations. Solar-powered rechargeable power sources should be utilised where appropriate.
- Other amplification devices and improved accessibility for hearing-impaired persons should be introduced where appropriate.

- Hearing aids and spares should be of one international quality but suitable for different environments; for importation, they should be regarded as medical instruments in order to avoid import tax.
- Local, in-country assembly of hearing aids should be encouraged if determined to be cost-effective. Second-hand hearing aids should only be utilised following factory refurbishment and where a warranty is provided.
- Every country should have at least one functional ear mould laboratory and outreach services. Instant ear-mould technology should be considered at the primary level, with a multi-stage approach at other levels. Training for ear-mould production, and a standard list of laboratory materials and equipment should be developed under the auspices of WHO and other appropriate agencies. Governments should coordinate bulk purchase of these items.
- Hearing aid manufacturers should be encouraged to provide assistance with training for and setting up of maintenance and repair facilities within developing countries, prior to starting distribution of hearing aids. Guidelines to reduce or prevent the need for repairs should be developed.

### **Training and development**

- Training of all health workers should include topics on audiology and hearing health care. Primary health workers training should include hearing and vision screening, and primary ear care and primary eye care. Appropriate PHC and CBR workers should receive additional training to assess hearing problems, fit and follow-up a prescribed hearing aid and make an ear mould impression. Guidelines on best practice for hearing health should be developed for health workers.
- Training should be given at secondary level for technicians in hearing aid repair, earmoulds and audiology respectively. At higher levels, graduate audiologists should be trained to work in cooperation with ENT specialists. Appropriate career development and in-country or regional training programmes should be developed.
- WHO should gather and disseminate epidemiological data on the burden and socio-economic consequences of deafness and hearing impairment, coordinate the standardisation of normative values and research, and help establish bench-marks for best practice.
- WHO should encourage and coordinate partnerships between organisations working for the hearing-impaired.
- WHO should convene a working group to develop detailed technical requirements for appropriate and affordable hearing aids, ear moulds and services as components of a total hearing health system package for developing countries, according to the recommendations of this workshop. These requirements should subsequently be discussed at a meeting with representatives of Associations of Hearing Aid Manufacturers.

## **ABBREVIATIONS OF TECHNICAL TERMS**

BERA	Brain-stem electric response audiometry
BTE	Behind the ear (hearing aid)
BW	Body worn (hearing aid)
CBR	Community-based rehabilitation
CIC	Completely in the canal (hearing aid)
dBHL	Decibel hearing level
ENT	Ear, nose and throat
GNP	gross national product
ITE	In the ear (hearing aid)
ITC	In the canal (hearing aid)
MOH	Ministry of Health
NGO	Non-governmental organization
NGDO	Non-governmental development organization
ORL	Oto-rhino-laryngology
PBD	Prevention of blindness and deafness
PDH	Prevention of deafness and hearing impairment
PHC	Primary health care <i>or</i> primary health centre
PTS	Permanent threshold shift
TTS	Temporary threshold shift

## **SESSION 1: WHAT IS THE CURRENT SITUATION?**

### **1.1 WHAT IS THE SIZE OF THE PROBLEM?**

#### **(A) Introduction to the meeting and epidemiology of hearing impairment**

As mortality rates fall and life expectancy increases in many developing countries, attention is being paid to decreasing disability and thereby improving quality of life. In addition, disability and handicap retard the development of affected individuals and society as a whole. This particularly applies to deafness and hearing impairment. In infants and children they retard and diminish language development and educational progress; in adults they cause occupational difficulties (seeking, obtaining, learning and holding employment), and they cause social difficulties and stigmatisation at all ages.

It has been estimated that there are 120 million persons in the world with disabling hearing impairment<sup>1</sup>, which is approximately 2.1% of the global population (see Annex 4 for hearing levels and definitions of disabling hearing impairment currently recommended by WHO). In the WHO regions this figure comprises approximately 8 million in the African Region, 20 million in the Americas Region, 25 million in the South-East Asian Region, 27 million in the European Region, 8 million in the Eastern Mediterranean region and 32 million in the Western Pacific Region<sup>2</sup>. It appears likely that the absolute numbers and prevalences of deafness and hearing impairment are increasing, especially in developing countries. However, accurate figures are not yet available, and are urgently needed especially for developing countries.

Despite this increasing burden, deafness and hearing impairment are generally not seen as significant problems in most developing countries, and the solutions are thought to be too complex and expensive. This may be one reason why manufacturers of hearing aids have concentrated on the developed world where they can produce sophisticated items with a high cost and high margin. Until now the developing world has not stated clearly and specifically what is needed. The opportunity arising from this meeting will be to determine the needs for hearing aids and hearing aids services in the developing world and present these to manufacturers in a way to convince them of the advantages of addressing those needs.

However hearing aid manufacturers were not invited to this meeting because it was felt that first it was necessary for the needs to be defined by an independent group of experts who had knowledge and experience of the problems and needs in developing countries and what would and would not be possible. This would avoid any possibility of bias or partiality. Subsequently, a meeting would be sought with associations of hearing aid manufacturers, at which all were represented, in order to ascertain whether they wished to take up these challenges.

#### **(B) Scope, Format, Outputs and Outcomes of the meeting**

The scope of the meeting was the current situation and needs for hearing aids and hearing aid services, and the problems of their provision, in developing countries. These aspects were covered from epidemiological, audiological, social and educational perspectives. The meeting addressed issues on determination of technological specifications for appropriate and affordable devices for developing countries, and locations and processes for production, delivery and maintenance; it also identified requirements for programme development including awareness-raising, prescription and follow-up, training, infrastructure, and evaluation.

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<sup>1</sup> **Prevention of Hearing Impairment, Resolution of the 48th World Health Assembly**, (12 May 1995), World Health Organization, Geneva, WHA 48.9

<sup>2</sup> Obtained from: Global Prevalence of Hearing Impairment. Alberti, P. Unpublished Document prepared for the 1995 World Health Assembly Resolution on Prevention of Hearing Loss

The chairperson and rapporteur appointed for the whole meeting were Professor Agnete Parving and Dr Ronald Brouillette respectively.

Initial presentations reviewed knowledge and understanding of current knowledge in this field. Individual workshops were then held, grouped according to service needs, technology needs, and training and development needs (see box 1 for workshop subjects).

With regard to the **format of the meeting**, Session 1 consisted of a plenary at which all participants were present. Sessions 2, 3, and 4 each consisted of an introductory plenary presentation on the overall topic for that session followed by a group of workshops, running concurrently. Thus each participant attended only one of the workshops for that session. A list of possible discussion topics was proposed for each workshop (see annex 2), but it was left to each workshop to decide finally on what it should discuss. Each workshop was asked to produce draft recommendations in its particular subject area. A facilitator was appointed for each workshop.

At the end of each group of workshops for a particular session, all participants came together for a plenary session at which each workshop presented their findings<sup>3</sup> and draft recommendations and there was a general discussion.

For session 5 of the meeting, all the recommendations were put together in a draft document, and were discussed, line by line, in a plenary session.

The outputs of the meeting included conclusions and practical, do-able recommendations, intended for all players, about what needs to be done. Eventual outcomes of this meeting could include a plan or framework for action for countries, organizations and manufacturers; methods on how to assess needs and a determination of those needs. This could include who to target, what technology is needed that is appropriate and affordable, how and where it should be produced, the means of delivery, training needs at 1°, 2°, 3° levels; the bringing together of users, service providers, manufacturers and donors; future directions in research, development, cooperation and how to maximise resource mobilisation.

In this report, edited versions of the presentations are given followed by the main recommendations produced by the workshops and discussed in the plenary session.

### **(C) Estimates of people needing hearing aids and hearing aids services**

The normal hearing pathway consists of sound source, transmission medium, transducer (ear), and analyser (brain). The pathway may be disrupted by problems with one or more of these components. Hearing aids help to reduce disability and increase accessibility for the hearing impaired. However, they are still often cumbersome, expensive and not always effective. Box 2 shows current estimates of hearing

#### **SESSION 1: WHAT IS THE CURRENT SITUATION?**

- 1.1 Background to the meeting
- 1.2 Scope, Outputs & Outcomes of the meeting
- 1.3 Presentation: What is the size of the problem?
- 1.4 Presentation: How do we assess needs?
- 1.5 Presentation: Where are we now?

#### **SESSION 2: WHAT SERVICES DO WE NEED?**

- Workshop 2.1: Raising awareness
- Workshop 2.2: Services for individuals.
- Workshop 2.3: Development of programmes

#### **SESSION 3: WHAT TECHNOLOGY DO WE NEED?**

- Workshop 3.1: Hearing aids
- Workshop 3.2: Production and delivery
- Workshop 3.3: Earmoulds
- Workshop 3.4: Maintenance
- Workshop 3.5: Other amplification devices

#### **SESSION 4: TRAINING and DEVELOPMENT**

- Workshop 4.1: Primary level training
- Workshop 4.2: Secondary & tertiary level training
- Workshop 4.3: Research, development and technical cooperation
- Workshop 4.4: Resource mobilisation

#### **Box 1: Structure of the Meeting**

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<sup>3</sup>Additional notes on the detailed deliberations of the workshops are available from WHO (PBD) on request.

aids sales. Even though the largest burden of disabling hearing impairment is found in developing countries (which are all located in the group "rest of the world"), the coverage in this group is 15 times less than in the developed countries of Europe and over 20 times less than in North America. Even in the developed world, market penetration is low and may be decreasing.

With regard to estimating the current hearing aid need world wide, there are at least 250 million potential users (persons with a hearing loss in the better ear of greater than 29dB HL). The average useful life of a hearing aid is approximately 5 years so that if all fittings are monaural, the annual need would be about 50 million units. Including binaural fittings could increase the annual market to approximately 70 million units per year. The approximate costs to health programmes can be estimated. If 5% of a country's population need an aid, 1% would need an aid each year. If the cost of this aid were \$150, this would add \$1.5 to the annual per capita health care cost; battery, fitting and ear mould costs could be \$0.5 and continuing battery costs \$1, total \$3 per person per year. For them to be a financially viable option in developing countries there would need to be further reductions in these costs. Reduction of costs could occur through local manufacturing,

Region	Pop-ulation 1995 <sup>3</sup> (millions)	Unit sales <sup>4</sup> (millions)	Sales per capita (total population)
North <sup>1</sup> America	292	1.8	1/162
Europe <sup>2</sup>	557	2.4	1/232
Rest of the world	4867	1.4	1/3476

1: USA and Canada

2: Europe excludes Eastern Europe, the Russian Federation and the former Soviet Socialist Republics

3: Source: Demographic Data for Health Situation assessment, WHO/HST/HSP/96.3

4: Source: Amplifon CRS (Research and Studies Centre)

### Box 2: Estimates of global sales of hearing aids, 1995

elimination of tariffs on hearing aids and spare parts, use of one stage ear mould technology and lower operating costs especially for batteries. The need for hearing aids can be reduced by primary prevention of conditions causing deafness and hearing impairment, and also the provision of acoustically accessible environments in, for example, classrooms, restaurants, offices and other public buildings and by improving public address systems. Study of psycho-social and physical aspects of the anthropology of hearing loss may assist in targeting interventions.

## 1.2 HOW DO WE ASSESS NEEDS?

Hearing Impairment and deafness continue to be major global problems which affect people in all countries. The impact of hearing impairment is greater in children in that it prevents the acquisition of language; in adults it prevents reaching economic potential while in the elderly it leads to loneliness and neglect. In some cases of conductive hearing loss, medical and surgical treatment can give good results whereas for sensori-neural and mixed hearing loss the possibilities are limited to aural rehabilitation (including use of amplification), and special education.

It used to be considered useless to place a hearing aid on a child or adult with only fragmentary responses. Today, the child who responds to only one or two frequencies on the audiometer can benefit from properly selected hearing aids. At present, the cost of hearing aids and batteries is extremely high in developing countries. Hearing aid delivery systems there must be based on the real needs of the people alongside competing necessities such as food, shelter and good drinking water.

This chapter discusses individual and community needs for amplification and how to assess these needs, and prioritisation and cost-effectiveness of intervention strategies.

### I. INDIVIDUAL ASSESSMENT:

#### (a) Audiological procedures for children

The presence, quality and quantity of hearing loss must first be measured. Identifying infants with hearing loss can be done through using a high risk register or newborn hearing screening. However definitive results in this age group may not be available. When the child is old enough, both ears should be checked for otoscopic findings, degrees, configuration, type and cause of hearing loss, and the clarity of speech, most comfortable level and the threshold of discomfort should be determined. Medical clearance may be needed before hearing aids are fitted. In developing countries where sophisticated procedures are not available the following guidelines could be used:

Losses through the speech frequencies greater than 75-80 dB may require the use of body aids because of feedback problems associated with ear level instruments. For losses less than 75-80 dB, ear level hearing aids may be appropriate. The choice between monaural, binaural and pseudo-binaural (Y-Cord fitting) must be justified. Hearing sensitivity, discrimination in quiet and in noise, and the tolerance level should be measured for the actual hearing aid selection or, if available, the desired calculated gain should be verified with real ear measurements.

(b) Audiological Assessment Procedures for Adults

Audiological evaluation should include pure-tone and speech audiometry, procedures for determining tolerance thresholds, with possible evaluation of cochlear and retro-cochlear pathology, vestibular function, middle ear integrity and auditory processing.

Box 3 shows the relationship between amplification need and sensitivity of the better ear by pure-tone average and speech reception threshold<sup>4</sup> but excluding individuals with sharply falling high frequency loss and/or unilateral hearing loss.

Type	No.	Bin-aural	Mon-aural	Y-Cord
Body Worn	200	-	160	40
Behind-the-ear	250	5	240	-
In-the-ear	4	-	-	-
Canal	8	2	4	-
Total	462	7	404	40

**Box 3: Hearing aids dispensed at the Kumasi Hearing Assessment Centre, Ghana**

An unaided speech audiometry score of more than 70% indicates an ear is a good candidate for amplification, whereas below 50% indicates amplification can provide only a partial understanding of speech. Individuals with a dynamic range of less than 25 dB indicates a poor candidate for hearing aids.

Box 4 shows the numbers and types of hearing aids dispensed at the Kumasi Hearing Assessment Centre in Ghana.

c) Assessment of social needs of children and adults

Development scales, which describe what behaviours a child should exhibit at a particular age, can show that a hearing aid has helped avoid the detrimental effects of sensory deprivation and language delay during critical periods of development.

The case history documents the clients communication difficulties and previous amplification. For

<sup>4</sup>Hodgson, W.R. (1977); Clinical measures of hearing aid performance. In: W.R. Hodgson and R. Skinner (eds.), Hearing Aid Assessment and Use in Audiologic Habilitation, The Williams and Wilkins Co, Baltimore.

example, the Hearing Handicap Scale of High, Fairbanks and Glorig (1964)<sup>5</sup> assesses when communication difficulties occur for the individual and if individual needs amplification. Some examples of questions are:

- 1) Can you understand a person when you are seated beside her/him but cannot see his face?
- 2) Can you carry on a conversation if you are seated across the room from someone who speaks in a normal tone of voice?
- 3) Can you hear warning signals, such as automobile horns, railway crossing or emergency vehicle sirens?

d. Assessment of educational needs of children and adults

Most, but not all, children with severe hearing losses and some with milder losses are identified before school entry. The needs of the child depend on the degree of hearing loss and his or her motivation. For a hearing-impaired child with normal intelligence, the acquisition of verbal language and speech and educational placement would be determined by the amount of residual hearing he/she has, the use of usable hearing through amplification, the age at which amplification is provided and the quality and intensiveness of language and speech training. Children in school should have an assessment of their educational level; lowered achievement levels and need to repeat grades compared to normal hearing peers, and better performance in low verbal areas like mathematics, as compared to high-verbal areas like social studies, indicate that hearing must be assessed for possible amplification.

Hearing Loss in dB	Need for Amplification
0-25 25-40	No need Part-time need
40-55 56-80	Frequent need Area of greatest satisfaction
80 +	Great need with partial help

**Box 4: Amplification according to hearing loss in the better ear**

**II. COMMUNITY AND NATIONAL ASSESSMENT**

Deafness is a hidden handicap but may become noticed if many members of the community are affected. The needs of the community can be assessed through discussion and observation with community groups and opinion leaders relating to screening for hearing loss and aural rehabilitation. The amount and level of need can also be determined through questionnaire surveys to sample opinion of the population and through Community-based rehabilitation programmes. In Ghana, outreach screening programmes identify pre-school and school children with hearing problems who are referred to the Kumasi Hearing Assessment Centre for further evaluation and management.

At the national level, political will and a decisive action plan on prevention of hearing impairment at all levels is needed. A national co-ordinator should be designated to manage administrative and planning procedures and a national committee created under the ministries of health, education and social welfare to act as the focal point in needs assessment and management, including procurement and distribution of hearing aids and setting standards for their dispensing. A national audiological society would also be helpful to advise government on the needs and services for the hearing-impaired. In Ghana, plans are far advanced to obtain Government support for making ear care a national health priority.

<sup>5</sup> High, W.S., Fairbanks, G. and Glorig, A. (1964), Scale for self-assessment of hearing handicap. Journal of Speech and Hearing Disorders, 29: 215-230.

### III. PRIORITISATION AND BENEFITS

The most cost-effective way of dealing with the problem of deafness and hearing impairment is prevention at the primary level. Tertiary prevention, using amplification is not so cost-effective since the price of hearing aids is extremely high. At present, the cost on the international market of a fairly average pair of hearing aids is more than an African or Asian peasant would pay for his house. The cost of batteries, if they are available, represents at least a week's food for the family. Resources are scarce in many developing countries and the percentage of GNP allocated to health in general, and that for hearing aids in particular, is limited because of more pressing priorities. Thus prevention of profound deafness by immunisation and the early treatment of otitis media in children may be thought a better use of scarce resources.

Nevertheless, every country should find a way of providing hearing aids to its people because provision of hearing aids has important benefits for the hearing-impaired. With children there is a benefit in better language development and improved school progress. In children and adults there is a social benefit through improvement in oral communication and an enhancement of social interaction, especially in the family. On the economic front, hearing aids help the adult hearing-impaired to reach their full occupational and economic potential.

Despite these socio-economic benefits, the majority of people in developing countries who need hearing aids cannot afford them at current prices. Hearing aids in these countries are almost always the product of manufacturers in advanced countries. They were designed to be used, repaired and serviced in these countries and not for the hot and humid environments in Africa. There is also a stigma attached to hearing impairment, which is not present with visual impairment, which leads some people to reject the use of hearing aids if they cannot afford the invisible but expensive in-the-canal type.

Solar-powered body worn aids have been in use for the past four years; it is to be hoped that such an approach may extend to behind-the-ear and in-the-ear hearing aids at affordable prices for the large markets in Africa and beyond.

There should also be a national policy on the procurement and distribution of hearing aids. Bulk purchases of limited models of hearing aids and their accessories would reduce costs. Taxes on hearing aids should be waived. Research should be conducted in the use of cassava starch and other locally-available material for making earmoulds in developing countries.

### CONCLUSION

Hearing impairment and deafness is such a crippling disability and our efforts at helping the deaf are so expensive and time-consuming that primary prevention is the best way of dealing with this problem. Since there will always be deaf people in every country tertiary prevention in the form of aural rehabilitation has several advantages over special education in terms of socio-economic benefits to the victims and to society at large. Before establishing a comprehensive system of hearing aid delivery, it is important to determine and assess the individual and community needs and also consider socio-economic benefits and cost-effectiveness of the intervention strategy.

Audiological needs can be assessed first by obtaining medical and hearing evaluation, establishing hearing aid candidacy and utilising procedures for hearing aid evaluation. Social needs can be assessed by using interviews and hearing handicap scale while educational needs can be assessed by case history, school records etc. Community needs can be assessed by using interviews and the questionnaire. The role of CBR officers in hearing aid delivery at the local level is important.

Even though the use of hearing aids improves the quality of life of the victims, the present high cost of these instruments coupled with the non-availability of repair service has made their use unattractive to policy makers in developing countries. The need is for massive delivery of hearing aids which are appropriate and within the price range of rural communities in developing countries. Research should be encouraged into BTE and ITE solar-powered hearing aids which are cost-effective. Responsibility for provision of hearing aids and their back-up facilities rests with governments in developing countries who must decide when and how these services should be implemented. Service-providers must continuously and vigorously pursue government subvention and support to provide for a Hearing Aid Culture that will be sustainable, cost-effective and beneficial to the hearing-impaired in our countries. Our assessment so far confirms the urgent need of this service.



### 1.3 WHERE ARE WE NOW?

A questionnaire was sent out to various centres in developing countries around the world to gather data on the country and centre regarding the situation and resources for deafness and hearing impairment and provision of hearing aids.

The complete findings are tabulated in Annex 6 together with the questionnaire (annex 5).

Eleven countries replied from four of the six WHO regions. In terms of ENT specialists available the range was 1 per 23,000 to 1 per 1,800,000 population. The only African country represented, Ghana, had the poorest staffing ratios. All countries had ENT/audiology departments ranging from 3 (Ghana) to 2000 (China). Staffing ratios for audiological technicians were considerably worse than for ENT specialists for all countries.

Seven of the 11 countries conducted training for testing hearing of children and adults, courses ranging from 2 weeks to 3 years. Six countries give training in fitting hearing aids and making ear moulds.

All the centres had pure tone audiometry, a sound-treated room and otoscopes in the clinic and some also in mobile units. Up to four countries did not have some of the other testing facilities such as a hearing aid test box, insertion gain, and testing for children under 3 years old (behavioural testing).

As might be expected from its total population, China had the largest numbers of persons with different levels of hearing loss (approximately 23 million). In Thailand, in the whole country, 4.9% of children and 13.6% of adults were reported to have disabling hearing loss. Most other countries did not quote percentages so these figures could not be compared. The majority of centre patients had flat audiograms or steep high frequency hearing loss curves..

The percentage of patients at centres that could be fitted with a BTE model for an average 40 - 80 dB HL ranged from 20 to 70%. Most of the centres also fitted hearing aids to some of their patients with worse hearing levels.

All countries possessed earmould laboratories although some only had one or two. Seven countries reported access the same day. All centres had hard acrylic earmoulds available, and the majority had varying proportions of availability of soft acrylic and other silicon based earmoulds. Only a minority reported using universal (non custom-made) moulds. The time between taking an impression and obtaining the completed earmould ranged between 1 day to 2 weeks.

What was considered to be an affordable cost for a hearing aid ranged between US\$10 (Thailand) and US\$1000 (S Korea), average US\$165. If the 2 highest estimates were not counted the average affordable cost dropped to US\$41. A warranty lasting between 6 months to 5 years was thought desirable if the cost was an extra \$10. Cost of an earmould ranged from \$ 2 to \$20, average \$7.

Batteries were only supplied free by the government of one country (Costa Rica) although in 3 others charities supplied free batteries, and in 5 more at an affordable price. The cost of batteries varied from \$0.5 to \$5 except in Ghana where they were free. All countries used Zinc-air batteries, and the majority of countries used alkaline batteries for body-worn aids. Mercury and rechargeable batteries were less commonly available.

With regard to maintenance, 2 centres had no access, but only 1 of the rest had access on-site, and 5 had access locally. 2 centres sent their equipment overseas. The picture was similar for access to calibration, although more centres had access to local calibration. Frequency of calibration varied between 3 months to 5 years.

## 1.4 REPORTS FROM REGIONS

### 1.4.1 AFRICA REGION

The Africa Region comprises about 10% of the world's population and in this region are some of the poorest countries in the world. Prevalence data for hearing impairment and deafness in this region are very scanty and the few studies that have been done have mostly concerned children. Prevalence rates for severe to profound deafness, estimated at 4/1000, appear to be higher than in the more developed regions. A recent review<sup>6</sup> from this region conservatively estimated that more than 1.2 million children aged 5-14 years had severe bilateral deafness. About 20/1000 children have hearing impairment; the major cause is chronic suppurative otitis media whereas the commonest cause in more developed regions is middle ear effusion.

It is therefore almost impossible to predict accurately the numbers of hearing aids that would ideally be required in this region if supply could be made available. The South African Deaf Association states that 10% of the population have some degree of hearing impairment in either one or both ears and that 2% would benefit from a hearing aid.

The major problem in this field is the shortage of personnel with suitable training. A recent listing<sup>7</sup> of sub-Saharan African countries excluding South Africa showed that 29 out of 35 countries have any ENT Specialists and in many there are only 1 or 2 for the entire country. 31 countries have Schools for the Deaf but many only have 1 school for the entire country. Only 18 countries have Speech therapists or Audiologists.

Even if an affordable reliable hearing aid were available, there would still be the following enormous practical problems to establish a hearing aid programme (see box 5)

- Other social problems which take precedence (E.g. starvation and warfare)
- Creating awareness that something can be done for deafness and hearing impairment
- Identification of deaf patients in the face of inadequate financial resources.
- Supply and fitting of hearing aids if they must have individual earmoulds.
- Maintenance of hearing aids in working condition when the average patient cannot afford batteries.
- Reliable supply of batteries
- Inadequate numbers of technicians to set up a maintenance and repair programme

#### **Box 5: Practical problems in establishing a hearing aid programme in Africa**

- A simplified practical definition of hearing impairment and deafness that can be used by all those concerned with the problem.
- A simple test to detect hearing loss and quantify it that requires neither technology based equipment nor skilled technicians.
- Cheap robust, simple hearing aids that require neither sophisticated fitting nor maintenance.

#### **Box 6: Needs for deafness and hearing impairment in the African Region**

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<sup>6</sup>McPherson B, Swart SM. Childhood hearing loss in sub-Saharan Africa: a review and recommendations. *Int J Pediatr Otorhinolaryngol.* 1997 May 4;40(1):1-18.

<sup>7</sup>Directory of ENT Specialists and Schools for the Deaf in the Africa Region. WHO: Africa Regional Office, Brazzaville, 1995.

A comment by a delegate at the recent Primary Ear Care Workshop<sup>8</sup> sums up the problem: "Why are we even bothering to think about supply of hearing aids - not only are they not usually available but even when they are there are no facilities for their maintenance. We should be concentrating our efforts right from the start on teaching deaf patients a sign language that will enable them to communicate." The problem with this approach is that there is no universal sign language appropriate for this region., the deaf are not concentrated into identified areas so they would use sign for communicating with the hearing and there are no teachers of sign language available to the majority of the deaf.

Taking these problems into consideration, the needs for this region are summarised in box 6. These needs can be expanded as follows:-

(1) Practical definition of hearing impairment and deafness

*Normal Hearing* - able to understand and repeat a whispered voice 1 metre from the ear.

*Hearing Impairment* - not able to hear a whispered voice but able to understand and repeat a loud voice 1 metre from the ear.

*Deaf* - not able to hear a conversational voice but able to understand and repeat a loud voice 1 metre from the ear.

*Totally Deaf* - not able to understand even a loud voice 1 metre from the ear.

(2) Requirements for an affordable, appropriate hearing aid - see box 7

Thus, in this system, a patient complaining of a hearing problem is assessed with a simple voice test by an experienced Primary Health Care Worker and is allocated to one of four hearing levels. If hearing impaired or deaf the patient is referred to a hearing aid distributing centre with a note of his/her hearing level. At this centre a dispenser - who does not need to be a skilled electronic technician or a trained acoustician - activates the appropriate aid by inserting a battery, tests it in a simple test box that confirms the output gain to check that it is working, fits it into the ear and conducts the simple voice test to confirm benefit and tells the patient to return when it no longer works. On return the battery is changed, the aid is tested again and is re-issued if it works. If it does not work it is discarded and a new aid is issued.

- cheap enough to be regarded as disposable (i.e. not worth the cost of repair).
- has a unique battery that will last a year,
- battery requires a special tool to extract i.e. it cannot be used for other devices
- individualised ear mould fitting not required
- in a sealed unit with no adjustable controls
- available in a range of two or three output gain levels, prescribed according to the simplified definition and test given above.

**Box 7: Requirements for an affordable, appropriate hearing aid.**

How do we get such an aid? I would suggest that we draft appropriate specifications and that these be given to the large electronic manufacturing companies to work on with the expectation that there would be a production run eventually amounting to tens of millions if they can produce an ideal model. Digital watches can be manufactured that cost around 10 dollars with batteries that last for more than a

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<sup>8</sup> 1st Cape Town International Workshop on Primary Ear Care, University of Cape Town, South Africa, 12 - 14th March 1998 (supported by WHO African Regional Office and WHO Geneva)

year - it should be possible to do the same with a hearing aid.

## 1.4.2 AMERICAS REGION: Latin America

### Introduction

Pastor Ernst J. Christoffel, the founder of Christoffel-Blindenmission (CBM), had a caring interest in deaf people and their needs. The home he founded in Turkey was a place for blind, deaf and physically disabled people. However CBM has been formally involved in the education/rehabilitation of deaf children since 1973.

CBM currently has 89 projects being developed in this area in 55 countries: 39 schools for the deaf, 35 residential schools and 15 various type programmes. There are also CBR programmes involved in the rehabilitation of deaf children. The total number of deaf children/youth enrolled in the educational programmes is approximately 9,300. The educational philosophy is oral in 11%, mixed programmes or total communication in 26%, and 3% offering separate oral and sign language programmes; 60% did not report their philosophy.

There is a direct relation between philosophies, methodologies and hearing aids. Programmes that use sign language only, vocational programmes and residential schools very often do not stress oral rehabilitation. In these projects hearing aids may be of secondary importance or not present at all.

Most of the schools/clinics in Latin America have access to an audiologist/speech therapist, either on staff, or network with nearby hospitals or clinics. However highly developed services in audiology and speech therapy, all types of hearing aids (imported), and sophisticated examinations are usually only accessible to the middle and upper classes and in larger cities.

Some schools receive hearing aids that are donated by the community, but these are usually for mild to moderate hearing losses, used by the elderly and totally inappropriate for profoundly deaf children. Ear moulds are made at dealer's shops or their representatives. There is no ear mould lab in most of the projects for the deaf in Latin America. In the schools supported by CBM, 40% of deaf children make regular use of hearing aids, mostly behind the ear type; no schools use the body worn type anymore. This is a tendency all over Latin America. Questions regarding solar rechargeable hearing aids concern what happens if the battery is left a long time without being recharged, if the battery can stay too long out in the sun, and whether, in the absence of sun, this battery can be recharged electrically, and whether the cord can be replaced

It has been stated that very simple and very basic hearing aids are needed. However the notion that "any hearing aid is better than nothing" may not always be true, since the wrong type of hearing aid may damage a child's hearing e.g. "TTS (Temporary Threshold Shift) over a wide range of frequencies was found after 4 hours of hearing aid use by a 15 year-old student with severe sensorineural hearing loss. The student was using real-ear insertion gain 10-20 dB greater than those recommended..."<sup>9</sup>. Repeated TTS's may lead to a PTS (permanent threshold shift) which could damage hearing.

Training of educational staff. Teachers need to be trained so that they can value, stimulate and check hearing aids, and offer auditory training (sometimes called sound lab). They in turn should offer

- The philosophy of education
- Price of hearing aids
- Problems with ear moulds
- Price of batteries
- Lack of repair services
- Lack of accessibility due to geographical constraints
- Lack of professionals to evaluate, dispense and adopt hearing aids
- Inadequate hearing aids (gain input and model)
- Poorly fitted hearing aids
- Problems with adapting and follow-up procedures

#### **Box 8: Problems with the use of hearing aids**

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<sup>9</sup>Macrae, John H. Temporary Threshold Shift caused by hearing aids use. Journal of Speech and Hearing Research, vol. 36, 365-372, April 1993.

counselling to parents, either in schools, clinics or CBR programmes.

To dispense hearing aids without the proper training of the staff and family involvement is a waste of effort and money.

### **Brazil**

Brazil had its first national Campaign on Prevention of Deafness in 1997<sup>10</sup> and found that there are 250,000 people with "total" deafness (0.16% of the population); 1.4% of the population of 157 000 000 is deaf; 40% of the population has some degree of hearing impairment; US\$40 000 000 is spent on hearing aids per year. There are 16,000 audiologist/speech therapist and 5,500 ENT doctors members of the Brazilian Society of ENT. In Brazil, for example, a hearing aid for a deaf child would cost between US\$800 and US\$2,000. Government programmes distribute free hearing aids, but the waiting time is 8 - 12 months; the hearing aids are usually not adequate and they end up being discarded or thrown away. The federal government of Brazil has recently budgeted funds for the distribution of hearing aids, but this has not yet been implemented.

There are 41 universities/colleges in Brazil that offer the course called "Fonaudiologia+Audiology/Speech Therapy. It is a four and half years programme and some universities also offer a master's/doctoral programme in the area. Concordia School for the Deaf in Porto Alegre, Brazil, - a CBM project linked to the Luthern University of Brazil, ULBRA - offers this as a regular university course, in common with many other countries in Latin America.

## **1.4.3 EASTERN MEDITERRANEAN REGION**

### **Jordan**

One of the main causes of deafness in this region is genetic due to intermarriage. Sometimes there may be as many as five or six persons needing hearing aids in one family.

### **Clinical Services**

In the capital city of Amman there are many hearing aid dealers selling overpriced hearing aids.. For those who can afford them almost everything is available at private audiology clinics. There are in-the-canal hearing aids, neonatal screening using oto-acoustic emissions, and the latest FM systems. Unfortunately even the public sector clinics concentrate on complicated research rather than providing efficient basic services. The one exception is H.E.A.R., the audiology department at the Holyland Institute for the Deaf which is providing services for the poorer sector of the Jordanian and Palestinian communities. H.E.A.R. runs regular outreach clinics as part of an established CBR programme.

### **Level of Technology**

The level of technology used in this region is quite high compared with many other developing countries. This is due to the wealthy minority being able to buy in this technology from overseas and the private sector has responded to this. The poorer majority have seen what is available and want it too, regardless of the cost and they are often unwilling to consider cheaper alternatives. The basic needs of the majority have been neglected in favour of modern sophisticated techniques for the privileged few. Nearly all of the hearing aids fitted are of the behind the ear type and batteries for these are readily available. The audiology clinics have modern equipment for hearing assessment and there are one or two laboratories making good quality earmoulds. Maintenance is not so well established and very few repairs are done to

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<sup>10</sup>*Fundacao Otorhinolaringologia. Semana Nacional de Prevencao da Surdez. (National Prevention of Deafness Week) Relatorio Final. Sao Paulo, 1997.*

the required standard or by qualified staff.

### **Training**

Jordan has its own BSc course in Audiology at a private university. However, nearly all its graduates leave to go to work in the private sector, for higher salaries, in the Gulf or Saudi Arabia. There are qualified audiologists in Jordan but their competency varies. Jordanians and Palestinians are very keen to receive training at all levels but there is nothing available in Arabic. There is also a desperate shortage of well trained technicians for earmoulds and hearing aid repair.

### **Other Countries in the Region**

**Saudi Arabia** has sophisticated hearing aid services in private hospitals for those who can pay for them. They are staffed by expatriate audiologists many of whom are Jordanian. **The Gulf States** have a few private services but many people go overseas to Europe or USA. **Iraq**, and **Yemen** do not have a single audiology / hearing aid centre to my knowledge. **Syria** also has only a few private dealers (usually opticians that have decided to sell some hearing aids as well) and some ENT specialists carrying out Auditory Brainstem Response testing. **Gaza** has some good clinical services being established at a school for the deaf and CBR centres. Their main difficulty is obtaining reasonably priced hearing aids which at present must be bought from Israel. **Palestine**, like Jordan has one or two private clinics for the rich minority. **Egypt** has some services in Cairo but not enough to meet the needs of its population.

## **1.4.4 EUROPEAN REGION**

### **Background**

European services directed towards hearing-impaired people are characterised by major diversity. Audiology is considered an interdisciplinary science, dealing with: diagnostics; hearing aid fitting and rehabilitation. This definition is not generally accepted throughout Europe, which may be the explanation for the differently organised services, comprising either national hearing services or private services, or a mixture of public/private services.<sup>11</sup>

In some countries hearing aids may be purchased without costs for the patients. However, in most European countries the hearing aids are paid partially by social security/insurance/state/local authorities and partially by the patient, irrespective of hearing level, whereas in some countries reimbursement from the state can only be obtained at a specific hearing level (e.g.  $\geq 45$  dB for the average of 1, 2, and 4 kHz).

### **Staff involved in the audiological services**

Academic staff involved in the European services differ widely, with a preponderance of ENT-physicians. However, most ENT-physicians, specifically in Southern Europe have only very limited audiological training.

Some "audiologists" are university-trained as part of a specific training within audiology, such as in Israel - however, in most countries "audiologists" have graduated from the medical faculty and specialised, either as physicians working within audiology or as ENT-physicians with another training (1-2 years) on top of the ENT-specialisation. In a few countries "audiologists" are usually trained within physics or engineering, meaning that they are predominantly trained within the technical field. In some countries medical doctors and general practitioners, who are university-trained, offer audiological services - however, most of them have very limited audiological training. It should be mentioned that audiology is a medical speciality in the U.K., Sweden, and Italy.

Psychologists may also be involved in the audiological field, most of them having a university training, however, no specific training within audiology. Their competence lies within behavioural science.

Various staff trained at a non-academic level are involved in the audiological services. Those

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<sup>11</sup>Specific details are available from Austria, Belgium, Denmark, Finland, France, Great Britain, Hungary, Ireland, Israel, The Netherlands, Norway, Poland, Portugal, Rumania, and Spain.

performing diagnostics and hearing aid fitting have their major interest within audiology, and are often trained at college or intermediate level. Hearing aid dispensers working within the commercial field have only limited training within audiology, and audiology technicians have also very varied training, often working as ear mould technicians, producing ear moulds. Also involved in the European audiological services are speech and hearing therapists, whose training varies, as some have graduated at a university level and some at college level.

#### Technology available in Europe

Within Europe all kinds of modern acoustic equipment for diagnostic purposes and hearing aid technology are available, which means that hearing-impaired people may be provided with either traditional hearing aids or programmable hearing aids, or digital signal processing hearing aids. The multi-microphone hearing aids, which have just been marketed, are also available.

In deaf subjects cochlear implants are fitted, and in some countries middle ear implants are used. In all countries assistive listening devices may be provided.

#### Organisation of services

From the information obtained from Europe four models of services can be derived:

- (1) Services provided by ENT-physicians with some supporting personnel, but only very limited training in audiology.
- (2) Audiological services offered from hospital centres by ENT-physicians, specialised within audiology. The centres have supporting personnel, such as audiology assistants, technicians, ear mould technicians, and speech and hearing therapists. The training in audiology within all staff groups is substantial, allowing interdisciplinary collaboration on a high quality level.
- (3) The services comprise separate entities emphasising the diversity of tasks with an emphasis on the technical side of audiology.
- (4) The services are offered by separate entities with staff educated at university level as audiologists, performing the various tasks within the entity.

Audiological services in the majority of the former Eastern Europe are performed by ENT-specialists.

#### Conclusion

The hearing services in the European region are characterised by major differences, both in organization, training of staff, and costs involved. The services established are based on the national attitudes towards hearing-impaired people and the economical capacity in each sovereign country - thus being highly different throughout Europe.

#### Reference

Proceedings from European Conference on Audiology 19-23 March 1995. Eds.: R. Schoonhoven, T.S. Kapteyn, & J.A.P.M. de Laat. CIP-gegevens Koninklijke Bibliotheek; Den Haag, 1995.

The information has been obtained from a survey concerning the organisation and audiological services in Europe performed by the European Federation of Audiological Society (EFAS), 1994.

### **1.4.5 SOUTH-EAST ASIAN REGION**

#### **Bangladesh**

Bangladesh is an economically poor and technologically backward developing country in the South-East-Asia region. There is a maximum technological need there to fight the menace of hearing impairment. More information about the situation in Bangladesh relating to hearing aids and hearing aid services is given in the introduction to section 3.

The National Center for Hearing and Speech for Children (NCHSC) of the Society for Assistance to Hearing Impaired Children (SAHIC) at Dhaka (established with the partnership of Andheri Hilfe e.V. Bonn, Germany) has purpose built air- conditioned and sound proofed rooms, equipped with for hearing assessment testing including BERA (brain stem electric response audiometry),

Oto-Acoustic Emission and vestibulometer. There is a hearing aid laboratory with hearing aid analyzer under the supervision of a Hearing Aid Technician, trained for two months in U.K. through the Commonwealth Society for the Deaf. An ear mould lab can prepare about 20 pairs of hard acrylic ear moulds for body worn and behind the ear hearing aids in a day. All chemicals and small fittings must be imported which sometimes causes dislocation of services. There is also an ENT out-patients department with six post-graduate trained ENT specialists and a well equipped operating theatre currently used for day surgery. There are no facilities available for bone conduction hearing aids nor for cochlear implants.

The total number of patients advised to use hearing aids by NCHSC recently was 22,097 but the total number of hearing aids provided or sold by NCHSC and business center is only 10522 indicating that less than 50% of the needy patients did not, or could not obtain the services of hearing aids. This is partially due to high cost, which the majority of the people cannot afford, and partly due to ignorance about hearing impairment and its remedy. NCHSC only provides free hearing aids, which they received as a donation, to children below the age of 15 years and on compassionate ground to adults. NCHSC and SAHIC are not capable of fulfilling even 10% of the country's needs for identification of hearing impairment, fitting of hearing aids and/or any other methods of amplification of sound. Recently the Government of the Peoples' Republic of Bangladesh has made a positive step and withdrawn the import restriction on any devices used by disabled people and made the items tax exempt.

Besides this center, there are few more assessment centers for hearing impairment and private fitting of hearing aids in the country. These centers are neither sound proof nor fully equipped, so their findings and fittings may not be accurate.

Area of the country:	144,000 SQ. Km.
Total population:	125 million
Children adult population ratio:	48:52
Per capita annual income:	\$ 300
Literacy rate:	36 %
Total qualified doctors:	25,000
Doctor/population ratio:	1:5000
Total ENT specialist:	222
ENT specialist/population ratio:	1:563,063
Total audiologists:	2
<b>Total audiological technicians:</b>	<b>32</b>
Total hearing aid technicians:	1

**Box 9: Current situation in Bangladesh**

## Indonesia

The National Health programme in Indonesia has 7000 Primary Health Centres (PHC) in 27 provinces. The referral system above the PHC includes district and provincial hospitals and six top referral hospitals in Jakarta, Bandung, Yogyakarta, Surabaya, Medan and Ujung Pandang.

During 1994 - 1996 combined surveys on ear and eye health care were done in seven provinces of Indonesia with 19,375 population sample. This survey is coordinated by the Directorate General of Community Health MOH, supported by the Central Bureau of Statistics, Ministry of Social Affairs, WHO, Indonesian ORL and Ophthalmologist Societies, Medical Faculty Univ. of Indonesia, Faculty of Community Health Univ. of Indonesia, NGO's and Jakarta Centre for Ear Care and Communicative Disorders.

Ear wax	3.6
Conductive & SNHL	3.0
Benign CSOM	3.0
Presbycusis	2.6
Severe/profound bilat loss	0.4
Ototoxicity	0.3
Acute Otitis Media	0.3
Congenital hearing loss	0.1
Mastoiditis	0.1

After the study a National Programme for the prevention of deafness was developed and called an *Effort on Ear Health Care and Prevention of Deafness*. A programme manual and handbook

of Ear Health Care and the prevention of deafness programme was produced and distributed to PHC doctors and paramedical staff. A two-week training course to upgrade PHC doctors and paramedical skills in ear care and prevention of deafness has been held and a workshop for professionals in the field of hearing services has been organized. A community based pilot project is being run to upgrade PHC services through sending ENT doctors to PHC twice a week, currently in a Jakarta slum area. Another community programme has been developed this year in cooperation with the Indonesian Navy to send ENT surgery to outlying islands.

In Indonesia there are 400 E.N.T doctors for the population of 210 million (coverage is 1 : 500,000) and most are working in big cities. There are no graduate audiologists; a small number of ENT doctors work as audiologists and there are some audiometrists and hearing aid technicians. Hearing International Japan (HIJ) is supporting a project to upgrade manpower development in hospitals in Jakarta and elsewhere.

Hearing aids are very expensive for most Indonesian people since all the hearing aids are imported from USA, Europe, Japan, Singapore, Australia etc. Most hearing aids are conventional types. A programmable hearing aid is very rare. A hearing aid distributor or counter are found in a few cities. Survey data showed that 9 of 29 provinces have hearing aid services. Data from our centre in 1997 showed that of 394 patients (most of them children) had delayed speech, 268 (68%) have bilateral severe hearing loss and required hearing aids; only 141 wore hearing aids. Since 73% of our clients are children under 5 years old and most of them have congenital deafness, the hearing aid types and their proportion are: body worn, BTE, ITC/ITE 42 %, 48% and 10% respectively. Most of our clients have bilateral deafness but only use a hearing aid in one ear for economic reasons.

### Box 10: Prevalence (%) found in Provincial surveys in Indonesia

## Nepal

The Project "Support to the Deaf and Hard of Hearing People of Nepal" run by the Nepal Ear Foundation from October 1994 to June 1998 provided particularly children with appropriate hearing aids and related technology, and developed an Operational Research Protocol.

The target population for delivery of hearing aids was: 1) children studying in Schools for the Deaf; 2) Children studying in Special Classes (Deaf Units) in regular schools in the Ministry of Education (with support from DANIDA), 3) Hard of hearing children attending the Tribhuvan University Teaching Hospital; 4) Persons attending Mobile Ear Surgery Camps whose hearing cannot be restored by surgery (such camps are conducted by organisations such as IMPACT Nepal, Britain Nepal Otology Services, Welfare

Society for the Hearing Impaired, Nepal Red Cross, Lions Club, etc) and 5) Hard of hearing persons identified by disability organisations such as Nepal National Association for the Deaf and Hard of Hearing and its branches.

Under this Project more than 16,000 persons were screened for hearing impairment and about 2,600 persons provided with hearing aids. All technicians for the Project were trained locally. All activities such as screening of persons for hearing impairment, ear mould manufacture and hearing aid fitting were done in various parts of the country by the **Mobile Ear Care Clinic**, a team consisting of doctors, audiology technicians and ear mould technicians. A mini-bus was used to transport the personnel, hearing aids, batteries, equipment for screening patients, raw materials for ear mould and equipment to manufacture ear mould. Follow-up visits were carried out by the audiology technicians at regular intervals to replace used batteries and to sort out problems associated with ear mould fittings and the hearing aids if any.

In addition to delivery of hearing aids, an **Operational Research Protocol** was implemented in a small group to look into various aspects of hearing aid delivery such as cost effectiveness, user satisfaction, duration (hours/day) of the hearing aid worn by the users, battery life, etc. Special questionnaires were developed, field tested and administered before delivery of hearing aids and thereafter during follow up visits. The data is now being analysed. Information from the Operational Research Protocol should provide useful guidelines both nationally and internationally for future rehabilitation for hearing impaired people and should be extremely useful particularly to other developing countries planning to provide hearing aids to the hard of hearing.

#### 1.4.6 WESTERN PACIFIC REGION

##### China

A 1.5 million **sample survey** in 1987, found 23,093,100 hearing disabled people in the mainland of China (2.04% of population, hearing loss more than 40 dB HL on average at 0.5K, 1K and 2K hz, at the better ear). Male: Female = 102:100. The age distribution of the disabled was: elders ( $\geq 60$  y): 54.83% , adults (15-59 y): 37.69%, children (0-14 y): 7.48%. Hearing disability was classified into four levels: see box 11. Geographically, the highest area (24.17%) was south middle, the lowest (15.35%) was north east. The prevalence in the countryside (22.99%) was higher than cities (19.19%) and towns (18.25%). Presbycusia (44.88%), otitis media (14.34%), infectious disease (high fever, 7.10%), drug ototoxicity (3.7%) and heredity (2.26%) were the main causes.

This investigation showed that 52.68% of hearing disabled people (over 12 million) need hearing aids. But unfortunately, only 1.67% of them (towards 400,000) had them fitted. Even in large cities such as Shanghai, Beijing and Tiajing, the fitting rate only reached 7.3%.

The situation of hearing aids **services** varies in different areas of China. Hong Kong is a special administrative area, the services are relatively perfect. The local government sponsors not only one hearing aid for one deaf person for five years, but also cochlear implant devices for candidates, reaching 30 people per year.

Grade of Hearing	% of total with hearing impairment	Numbers (millions)	Prevalence
D1 ( $\geq 91$ dBHL)	15.7	3.6	0.3
D2 (71-90 dBHL)	21.0	4.9	0.4
H1 (56-70 dBHL)	29.6	6.8	0.6
H2 (41-55 dBHL)	33.7	7.8	0.7
41 dBHL or greater	100	23.1	2.0

**Box 11: Hearing impairment in China according to Grade (1987 study)**

On the mainland, audiology and aural rehabilitation have been developing rapidly in recent years. In 1987, the Federation of Disabled People of China was founded. Since then, aural rehabilitation has been embodied into governmental action. In 1996, "The Law to Protect Disabled People" was legislated. In 1995-1996, the Audiology Development Foundation of China (ADFC) and ADFC (Hong Kong) were founded with the aim of advancing hearing rehabilitation strategies in China. During the period of 1991-1995 and 1996-2000, "China's Five-year Program for People with Disabilities" has been and is being implemented. Hearing aids services have been developed as an important part of the program.

**Hearing aids** are produced by Chinese manufacturers, and also assembled or imported from almost all hearing aids companies in the world. Danavox, Oticon, Siemens and Starkey have established factories in China.

Hearing aids services are provided by national or provincial hearing centres, university hospitals (ENT departments), ADFCs and hearing aids companies. They have quite good equipment and services, but compared with such a large amount of deaf people, especially in remote and/or rural areas, their work is still in its infancy. Markets for hearing aids are quite chaotic at the present time; department stores, electronic stores and pharmacies sell hearing aids as well and most shop assistants never receive any training. They sell hearing aids like radios without any scientific fitting procedure and people get no benefit but rather makes them strongly dislike hearing aids. For deaf children, this may be harmful to their precious residual hearing.

Purchasing ability also limits the use of hearing aids. Hearing aids almost always have to be paid by deaf people or their relatives, except for some donations from charitable societies. In general, one basic BTE hearing aid costs a worker twice the monthly salary. Many hearing-impaired people can not afford it, even if they want to have one.

Social and cultural influences should not be ignored. When sensory neural hearing loss is diagnosed patients or parents ask to be treated with medicines or surgery instead of hearing aid. This wastes energy and money, and may lose opportunities for rehabilitation.

All **types of hearing aids** (from body worn to CIC, analog to fully digital) are supplied through the market. Power sources and maintenance are also available from hearing aids companies. Ear moulds have become more popular. Real ear measurements, sound field audiometry and functional gain measurements are being used in several centres but only a very few coastal cities have these facilities. However, inland areas are extremely short of basic technology for hearing aids.

In China, only a few professionals possess modern skills up to now. Most hearing aids fitting procedures are not performed scientifically. An investigation reported in 1992 that only 25% of hearing aids were correctly fitted.

**Training.** Ten years ago, there were no systematic audiology and speech pathology courses in the educational system. This hindered the development of hearing and speech sciences in China. However, the university of Hong Kong established its department of speech and hearing sciences in 1988, offering a Bachelor of Science (BSc) degree, a 4-year undergraduate program accredited by the Royal College of Speech Therapist in Britain. The Master of Science (MSc) in Audiology is a 2-year course, first started in 1996 and modeled after courses in North America. Since 1991, the Nanjing Medical University has set up Audiology and Speech Pathology courses (36 hours respectively) for undergraduate students. The courses are very useful for their future practice. In 1996, the China-Australia Audiology Training Program was held in Beijing at the Capital University of Medical Science in cooperation with Australian Hearing Services and Macquarie University. Eight postgraduate students received 2-year training. They will play significant

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| <ol style="list-style-type: none"><li>1. Raising awareness for the whole of society, spreading scientific knowledge of the prevention and treatment of hearing loss.</li><li>2. Facilitating epidemiological studies, helping investigations to reach international standards.</li><li>3. Seeking multiple collaborations and financial or instrumental support through various channels.</li><li>4. Pushing appropriate legislation for the hearing aids market, protecting the civil rights of hearing impaired people.</li><li>5. Enhancing education and training quality, reinforcing basic and operational research</li></ol> |
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**Box 12: Needs for programme development for deafness and hearing impairment in China**

roles in audiologic development.

WHO has sponsored workshops for the prevention of deafness and hearing impairment three times in China (1993, 1995 and 1997). One hundred and fifty participants attended the meetings. The workshops had important effects in raising awareness and updating knowledge of ear care. A number of short training courses have been conducted in several provinces. They are good for spreading basic knowledge of the prevention and management of hearing loss.

Despite this progress, the quantity of audiologists cannot satisfy the needs of society. Even in Hong Kong, there are only about 20 audiologists, an inadequate number to provide hearing health services to the estimated 390,000 hearing impaired people in Hong Kong. Training quality is another problem. Participants in some courses come from different specialities such as ENT doctors, audiometricians, nurses, deaf school teachers, social workers and shop assistants. It is quite difficult to deal with persons from different backgrounds on a short course and reach the training goals. There is no standard teaching material, and a lack of equipment and financial support. In addition, the training and ear care programs are usually separated. Some participants cannot link the knowledge gained from their training with their own work.

## **SESSION 2: WHAT SERVICES DO WE NEED?**

### **(Introduction to the session)**

#### **Raising Awareness.**

Public awareness about deafness and hearing aids could be improved. However, most people (parents, professionals, and governments) know something about the communication problems associated with a loss of hearing but very few know what to do about that loss of hearing and how to go about getting a hearing aid. Without any further information on these devices unrealistic expectations are soon created.

The field of audiology and the role of audiologists dealing with people who do not hear well needs to be promoted in the developing as well as in the developed world. As well as the general public, other professionals working with deafness need this information, such as ENT specialists, teachers, health workers, CBR workers, speech and language therapists, social workers etc. There are many professionals involved with a deaf or hard of hearing child. They can only succeed if they work together as a team and know who and when to refer to the audiologist.

Before setting up hearing aid services, the local culture and attitudes need to be considered. For example, in a large deaf community (such as in the Arab Bedouin communities), deafness is not considered to be a handicap. Everyone is bilingual in spoken and sign language so there are no communication problems. Deafness is so common (probably due to a very high rate of consanguinity) that it is not seen as a disability. In this situation a hearing aid service would not achieve anything. The acceptance of deafness and hearing loss and the attitudes towards hearing aids varies between cultures. There can be different interpretations of the disabilities and handicaps involved and the local methods of communication need to be considered.

#### **Services for individuals**

In an ideal world it would be possible to provide hearing aid services for all those in need. But in reality priorities have to be given to those who would benefit most. When setting up an audiology service it is usually the severe and profound hearing losses that are brought forward first as they are more easily identified. Yet it is those with mild and moderate hearing loss who can gain the most benefit from a hearing aid. Similarly it is widely known that it is best to fit a hearing aid as early as possible to hard of hearing children but assessing such pre-school cases is not easy and takes a high level of skill and far too often mistakes are made. Therefore should these very young children take priority?

In Europe, hearing aid services have often been seen as part of the medical services, usually in or near the ENT department. However, in the developing world they are often linked with the education and rehabilitation services. Either model is possible as audiology and hearing aids are the link between the two. Therefore services could be located in a hospital, university department, school or CBR centre. The exact location will depend on the size of population, availability of transport, access to the community.

Often they can be integrated into the existing infrastructure in the health or education sector.

Fitting the hearing aid, teaching the wearer how to use it and much of the necessary follow up can be done anywhere without the need for sophisticated and expensive equipment. With the right training it can easily become part of a CBR worker's role. Doing as much as possible of this in the local community will also help spread much needed awareness.

Services need to be accessible to everyone - regardless of their language, background or economic status. At present most training in audiology is conducted in English and most hearing aids are vastly overpriced and only available in the private sector to those who can afford it.

### **Development of Programmes**

Before a hearing aid is fitted an accurate hearing assessment is required and a suitable hearing aid prescribed. After the fitting both adults and children will need help in learning to use their hearing aids. Hearing aids are useless without batteries and an earmould, and hearing aids break down and need repair. Supplies must be available either locally or from overseas and funding needs to be found for these. Therefore a comprehensive, sustainable service involving all of these is needed. Funding for the project running costs must be found as well as for equipment and facilities

In Jordan, a hearing aid may cost around US\$150, with an annual expenditure about US\$60 for batteries, earmoulds and repairs. However, these things need not be so expensive. If hearing aids could be bought in large enough numbers (as is done by the UK National Health Services), prices should be reduced dramatically. Companies need to be persuaded to develop hearing aids and equipment for the huge untapped market in the developing world. The majority of hard of hearing people need a very basic amplifier to meet their needs. It is only the minority that can really benefit from sophisticated modern technology.

Training for this field is a huge need but becomes very expensive when trainees are sent to Europe or USA for a year or more. Local training courses are desperately needed where groups of trainees can be trained in their own language, to work within their own culture. Only then can more of the target population be reached.

## **SESSION 3: WHAT TECHNOLOGY DO WE NEED?**

### **(Introduction to the session)**

Hearing impairment is a universal tragedy compelling many people to be disabled especially in the developing countries. The management of the problem is quite different amongst the developed and developing countries due to different levels of technological achievements. Even amongst the developing countries there is difference of technological attainments causing visible difference in the management of hearing impairment. Developed countries have overcome this problem to a great extent with the introduction of technological and scientific development in the identification of the problem, prevention, and early detection, medical and surgical treatment of ear disease and provision for hearing aids and rehabilitative programs. The least developed countries are lacking in all respects, so that a large number of hearing impaired, especially children, are becoming hearing disabled which adds misery to themselves and their families and hinders national progress.

The situation in Bangladesh serves as an example of the sorts of problems that developing countries face (further details of the situation in Bangladesh are given in section 1.4.5). Devices to detect and assess hearing impairment and hearing aids themselves are not manufactured or assembled in Bangladesh and all of these items must be imported from abroad, which is very costly and leads to interruptions in availability. There is no after sales service available, so all repair, maintenance and calibrations are done either by bringing technician from abroad or by sending the machines abroad which is costly and cumbersome. In the absence of these services and non-availability of spare parts in the country, equipment often fails or gives faulty readings. The high price and lack of repair facilities means most people cannot afford them and are afraid to buy in case they soon go out of order. There is a similar situation regarding power sources for hearing aids. This situation can be changed only through transfer of technology for machines and equipment required for detection of hearing impairment and for fitting of hearing aids along with the technology for their maintenance and repair.

No national survey has yet been done in Bangladesh to determine the exact size of the problems so that the total number of hearing impaired in the country who need hearing aids is not known. It can be

presumed that the number will relate to the prevalence of diseases and factors causing hearing impairment such as use of oto-toxic drugs by unqualified but authorized medical practitioners, malnutrition due to poverty, increase of noise pollution in the urban areas and increase in the overall expectancy of life and inaccessibility to scientific medical care for all.

There are only two audiologists available in the country, both trained overseas (University of Manchester, UK). Since they are government employees, their services are utilized in the field of ear, nose, throat specialty as none of the government medical institutions in the country has an audiology department or audiological services. There are 32 locally trained audiological technicians in the country of which 13 are working in the National Center for Hearing and Speech for Children (NCHSC) at Dhaka and its Sub-Center at Chittagong (further information about this centre is provided in section 1.4.5). Children must get priority for provision of hearing aids. There is only one hearing aid technician with limited training working in the NCHSC. There is not a single trained Speech Therapist in the country though their services are essential for providing language therapy to the pre-lingual hearing impaired children. There is acute shortage of trained teachers for hearing impaired children. There is a gross discrepancy between total numbers of persons advised by NCHSC that a hearing aid is needed and the numbers actually purchased. This is partially due to high cost, which the majority of people can't afford, and ignorance about hearing impairment and its remedy, which is directly related to the high illiteracy rate. On many occasions superstition dictates to them to hide the hearing impairment from the Society due to fear of social embarrassment and differential treatment.

The technological needs of third world countries including Bangladesh are likely to be similar in respect of equipment, instruments and trained manpower. Manufacturing/assembling/reconditioning of hearing aids, establishment of hearing aid laboratories with facilities for hearing aid analysis and minor repair of hearing aids, ear mould laboratory with facilities to prepare hard and soft ear moulds for body worn as well as behind the ear hearing aids, in one or two stages, with an uninterrupted supply of chemicals at a cheaper rate. Re-conditioning of the hearing aids may be done when the technology is available in developing countries but quality and durability must be maintained. After sales service (with 2-3 years warranty), availability of spare parts for repair and calibration must be ensured

Adequate numbers of trained personnel are essential and can be achieved by close co-operation and partnership between developed, less developed and under developed countries of the region/globe. Local training of technicians must occur in developing countries including those categories mentioned above and also for maintenance and repairs of equipments in the countries where there is no direct agency of the manufacturing company to give after sales service.

These situations can be avoided or reduced by an affordable national program of prevention and early identification of hearing impairment, identification of those hearing impaired who can be helped with surgical or medical treatment, and/or with hearing aids. The aim is to make available appropriate, affordable, reliable, durable and acceptable hearing aids, their fittings and after care as well as ready availability of affordable power sources for hearing aids i.e. cheap disposable or rechargeable batteries.

## **SESSION 4: TRAINING and DEVELOPMENT** **(Introduction to the session)**

None of what has so far been discussed here is useful, unless it can be provided to the population who require this service. We need to think hard and plan well. Having updated on knowledge of the current situation, size of the problem, technology needed and services required we also should plan for Training and Development, including research and resource mobilization.

A good training program will set the pace and quality in the delivery system. Partnership between individuals, programs, countries and regions will have to be not only promoted but also sustained and enriched. All partnerships have to be nurtured after establishing them. There is a need for a core group to anchor the training in the different regions. Partnership created among similar groups offers additional opportunity to a successful delivery of services. Partnership among Developing Countries is one such example.

Training and the availability of the different instruments have to be simultaneous for it to be useful. The coordinating group will probably play a decisive role as to how successful the outcome of the training will become. This whole task will demand the utmost from professionals involved in training the trainers and establishing the training program. Operational Research and Development is a key area on which a lot will depend. The course content and details have to be worked out.

Training background, information and ability levels will influence the training course and methodology. Time spent in researching into this will offer greater opportunity of success. This has to be kept dynamic with constant updating to prevent an obsolete and "watered-down" service, becoming available as new technology or technology appropriate to a Developing Country.

<b>WORK AREA →</b>	<b>Screening</b>	<b>Diagnostic</b>	<b>Amplification provision</b>	<b>Educational/vocational training</b>
	<u>Instruments</u> <ul style="list-style-type: none"> <li>● screening audiometer</li> <li>● freefield audiometer</li> </ul> <u>Test room</u> <ul style="list-style-type: none"> <li>● sound proof</li> <li>● airconditioning</li> </ul>	<u>Instruments</u> <ul style="list-style-type: none"> <li>● clinical audiometer</li> <li>● freefield audiometer</li> </ul>	<u>Hearing aids</u> <ul style="list-style-type: none"> <li>● Ear mould</li> <li>● ear mould material</li> <li>● ear mould laboratory</li> <li>● Batteries</li> <li>● Hearing aid</li> <li>● Hearing aid manufacturer</li> </ul>	<ul style="list-style-type: none"> <li>● Utilising the mode of communication with the hearing aids</li> <li>● Special school (segregated)</li> <li>● Integrated education (regular schools)</li> <li>● Vocational training centres</li> </ul>
<b>PERSONNEL →</b>	<ul style="list-style-type: none"> <li>● audiology technician</li> <li>● audiologist</li> <li>● CBR workers</li> </ul>	<ul style="list-style-type: none"> <li>● ENT specialist</li> <li>● Audiologist</li> </ul>	<ul style="list-style-type: none"> <li>● Hearing aid repair technician</li> <li>● Ear mould technician</li> </ul>	<ul style="list-style-type: none"> <li>● Teachers</li> <li>● CBR workers</li> <li>● Vocational instructors</li> </ul>
<b>TRAINING &amp; UPDATE →</b>	Yes	Yes	Yes	Yes

### **Box 13: Work areas for training**

There are four different professional groups, handling the four different work areas (see box 13). Therefore a team approach is necessary to be able to build up a delivery system. To have it all under one roof makes it comfortable for the hearing impaired and the deaf; however it may be more practical to consider the screening diagnostic and amplification programme in one place and education in another place, due to the difference in the duration of professional time spent in the two groups.

A few individuals who have enough knowledge and Instructors Level expertise in all the four areas will need to be identified in order to bridge and cement the different professionals in the team to form a Training group. This core group of experts will have to plan the course and establish the training program and train the trainers to later leave it in the hands of the trainers in each region. The training has to be specific and related to the type of service planned in the delivery pipeline for that region.

The training should be kept simple enough to cut across the different cultural and socio-economical groups. Goals and deadlines have to be set and recorded to ensure that much is achieved

within a reasonable time.

## **SESSION 5: RECOMMENDATIONS**

### **WORKSHOP 2.1 RAISING AWARENESS**

- 1     **Events.** It is recommended that events to raise awareness be implemented in all sectors of the population. These could include annual public awareness campaigns such as a "Better Hearing Week" or "Deaf Awareness Week", which could be integrated into existing health and education promotional campaigns, and a WHO-established "Day on Communication Difficulties" or "Day on Hearing Loss / Deafness". These events could highlight the benefits of Hearing aids.
- 2     **Media.** It is recommended that awareness be raised in the media by publicising stories of students, workers and others who successfully use hearing aids.
- 3     **Advocacy.** It is recommended that "better hearing ambassadors" be created. These could include celebrities who would publicly wear their hearing aids and advocate hearing aid use.
- 4     **Needs.** It is recommended that needs for hearing aids should be identified in order to encourage hearing aid markets.
- 5     **Older Persons.** It is recommended that promotion of hearing aids should be incorporated into the International Year of Older Persons (1999).
- 6     **Teachers.** It is recommended that awareness should be raised amongst teachers of the effects of hearing loss in students and the need to refer them to appropriate agencies.

### **WORKSHOP 2.2 SERVICES FOR INDIVIDUALS**

- 7     **Target age groups.** There is strong evidence that the handicap of hearing disability worsens if diagnosis and rehabilitation is delayed. It is recommended that the following groups should be targeted for early intervention and should begin with the youngest possible according to age of presentation and the services available:  
*Neonates, preschool children, school children, working adults, older people*
- 8     **Target laterality.** It is recommended that individuals with bilateral hearing loss should be fitted with bilateral aids; where resources are scarce, unilateral hearing loss should not be a priority.
- 9     **Level of Hearing Impairment.** It is recommended that priority should be given to infants and children with mild, moderate and severe hearing impairment for provision of hearing aids. If resources are available, children with a profound impairment should be given a trial of hearing aid and aided if the trial shows benefit.
- 10    **Type of Hearing Loss.** It is recommended that hearing aids should be fitted without regard to the type of hearing loss (i.e. whether conductive, sensori-neural, or mixed).
- 11    **Referral.** It is recommended that a subject should be referred to audiology services and to ENT services, as required and where available.
- 12    **Follow-up support.** It is recommended that lifelong support should be provided to an individual who has been provided with a hearing aid.
- 13    **Special groups.** There is evidence that hearing aids can provide significant benefit to a deaf/blind individual, but less benefit to a hearing-impaired individual who is also severely mentally-handicapped, because of difficulties with diagnosis and rehabilitation. It is recommended that the

former group has a higher priority for hearing aids than the latter group, and that the former group has no less a priority than for individuals who have the same level of hearing impairment without blindness or mental handicap.

### **WORKSHOP 2.3 DEVELOPMENT OF PROGRAMMES**

- 14 **Government Responsibility.** It is recommended that Governments should be encouraged to take responsibility for ensuring access to hearing aid provision.
- 15 **Strategy Development.** It is recommended that policies for future development of strategies should be community driven, well articulated and well coordinated between NGOs and all sectors of government (Education, Health, Employment, Social Services, etc.)
- 16 **Programme foundations and assessment.** It is recommended that programmes should be based on sound epidemiological data. Evaluation and dissemination of outcomes is essential in all programmes.
- 17 **Cost benefit component.** It is recommended that cost benefit analysis of disability reduction due to hearing health interventions should be a component of any programme development.
- 18 **Service Development.**
  - (1) It is recommended that audiological services should be developed on an inter-disciplinary team approach.
  - (2) It is recommended that a service that is introduced into one part of a country, should be progressively extended to all other parts of the country.
- 19 **Service Delivery.** It is recommended that services should be delivered in a culturally appropriate manner and provide equitable access for urban and rural populations of all ages.
- 20 **Screening.** It is recommended that hearing and vision should be screened together by PHC/CBR workers and should be integrated into other screening programmes.

### **WORKSHOP 3.1 HEARING AIDS**

- 21 **Hearing Health system.** A hearing aid should be regarded as only one component of a Hearing Health system that includes the ear mould, batteries, maintenance, repair, instruction and rehabilitation. It is recommended that hearing aid manufacturers should provide for a defined period the entire Hearing Health system package and that these issues be discussed in the recommended meeting with associations of hearing aid manufacturers (also recommendations 29, 33 and 62)
- 22 **Hearing aid provision in 3 situations in developing countries:**

Situation 1: Where supply and services are available (this would probably only be in the most affluent part of a developing country),

It is recommended that hearing aid **provision should remain in private practice** and governments should...

- have responsibility for controls on suppliers to ensure they take responsibility for back-up services
- have responsibility for providing evidence-based education on expectations for hearing aids

- not have responsibility for a cochlear implant programme, but encourage a privately funded programme if feasible.

Situation 2: Where supply is available but services are poor or not available,

It is recommended that...

- Governments should establish **services with a central facility and satellite facilities**. Centres may vary in different countries and may be at national, regional or district level. The centre-satellite model should spread eventually from a single set-up in the country to one in every district.
- the **responsibilities of the centre** should include...
  - training for local centre and satellite staff
  - diagnosis
  - supply, fitting and instruction
  - repair and replacement
- the **facilities of the centre** should include...
  - competent staff, clinical equipment and facilities, test boxes, repair laboratory
- **satellites** should...
  - be community-based
  - have a staff member trained in hearing aid care, preferably the same individual responsible for primary ear care (which would include ability to use an otoscope)
  - be the primary contact when hearing aid problems are experienced
  - have simple flow charts for trouble-shooting
  - be able to undertake simple maintenance
  - be linked to a centre for referral of either patient or hearing-aid
  - (in more sophisticated satellites) do ear-mould replacement fitting and hearing aid replacement

Situation 3: where there are no supplies and no services

It is recommended that...

- the primary target should be individuals with a hearing level in the range 30-80 dBHL in the better ear. For individuals with hearing level >80 dBHL in the better ear alternative modes of communication, such as signing, should be considered.
- the priority should be infants, pre-school, and school children followed by adults, and elderly.
- rechargeable batteries (including by solar power) should be used where appropriate
- bone conduction aids (vibration) should also be made available

23 **Types of hearing aids.** It is recommended that hearing aids should be available as follows for the following categories of hearing loss:-

MILD: Target group - children, Behind the ear hearing aids should be used with a universal mould, bone conduction (vibration) should be used for discharging ears

MODERATE: Target group: all; order of priority should be pre-school, school, working adults, elderly; Behind the ear aid with trial of universal mould, followed by individualised mould; bone conduction aid for special situations; occasional use for body worn aids

SEVERE: target group: all; priority as for moderate; Behind the ear aid with individualised mould; occasional use of bone conduction or body worn aid

PROFOUND: trial of hearing aid, plus signing

Body worn aids are not acceptable and not practical in the work situation.

- 24 **Power Sources.** It is recommended that zinc/air batteries be used at present, and rechargeable and solar powered batteries should be further investigated.
- 25 **Cost contribution.** It is recommended that clients should, where possible, make a token contribution to the cost of the hearing aid and maintenance. This would be a way to increase the value to the owner of the hearing aid and encourage them to look after it.

### **WORKSHOP 3.2 PRODUCTION AND DELIVERY OF HEARING AIDS**

- 26 **External Conditions.** It is recommended that hearing aids should be adapted to all applicable environmental and climatic conditions
- 27 **Quality.** It is recommended that there should be one international quality standard applied to all production of hearing aids.
- 28 **Appropriateness.** It is recommended that research in production and delivery of western models of hearing aids should be conducted concerning their appropriateness for developing countries.
- 29 **Tenders.** It is recommended that tenders for hearing aids supply should cover as a minimum:- quality standards for components (internal and external), casing and climatic requirements; training of engineers; provision of spare parts; documentation; fitting service requirements (mould supplies, tubing etc); long-term support; assistance in setting up services; extended warranties (one to two years after fitting) and quality control.
- 30 **Local Assembly.** It is recommended that local, in-country assembly of hearing aids should be encouraged if determined to be cost effective.
- 31 **Medical Instruments.** It is recommended that for purposes of customs duty and professional ethics, hearing aids and spare parts and accessories and other equipment for identification and rehabilitation of hearing handicap should be regarded as medical instruments, and not as electronic consumables. They should be importable without duty. Manufacturers, vendors, consumers, governments, inter-governmental agencies including WHO and WTO, should be made aware of this recommendation.
- 32 **Used hearing aids.** It is recommended that used, second-hand hearing aids must be factory refurbished and supported with spare parts, maintenance and a 3 year warranty before being re-used.
- 33 **Supply.** It is recommended that marketing, bulk purchase and distribution of hearing aids should be discussed in a special meeting with associations of manufacturers.
- 34 **Accreditation.** It is recommended that governments in developing countries should be responsible for the accreditation of personnel for the distribution of hearing aids.
- 35 **Delivery.** It is recommended that an infrastructure for hearing aid delivery should be in place before hearing aids are promoted and made available.

### **WORKSHOP 3.3 EAR MOULDS**

#### Technology

- 36 **Improving technology.** It is recommended that WHO should encourage hearing aid manufacturers to improve existing ear mould technology for application in developing countries.

- 37 **Multi-system approach.** It is recommended that the multi-system approach be used in order to obtain the best fit. The strategy should include raising consumer awareness for ear mould alternatives
- 38 **Community-based fitting.** It is recommended that instant ear mould technology, as well as newer technology such as expandable foam plugs, should be considered for community-based ear mould fitting at the primary level.

#### Laboratory services

- 39 **Ear mould laboratories.**  
(1) It is recommended that every country should have at least one functional ear mould making laboratory with mobile outreach services at least for other regions of the country.  
(2) It is recommended that ear mould laboratories should be set up adjacent to hearing aid maintenance facilities, or alternatively linked to dental laboratories.

#### Procedures and Supplies

- 40 **Protocol and standard list.** It is recommended that WHO should publish an ear impression protocol that includes a standard list of ear mould impression materials and supplies.
- 41 **Manufacturers and suppliers.** It is recommended that WHO should assist and encourage governments, in collaboration with appropriate NGOs, to identify material manufacturers and suppliers (preferably local), and arrange for bulk purchase for ease of distribution.

#### Training

- 42 **Regional training.** It is recommended that WHO in collaboration with appropriate agencies should facilitate regional training for ear mould making services in order to assist in the development of national capacity.
- 43 **Production and impression training.** It is recommended that appropriate aspects of ear mould production technology should be included in the training of audiologists and audiological technicians, and earmould impression making in the training of audiometrists and anyone who tests hearing (e.g. teachers, CBR workers, health care workers).

### **WORKSHOP 3.4 MAINTENANCE**

- 44 **Repair facilities.**  
It is recommended that hearing aid manufacturers should set up repair facilities in developing country markets. These facilities should be clean and dust free, and comply with manufacturer's standards. These facilities should be located within or linked with audiological and hearing aid clinics.
- 45 **Guidelines to reduce repairs.** It is recommended that guidelines should be developed for reduction or prevention of repairs (such as through consumer education, robust hearing aid design, utilization of microphone and hearing aid covers and humidity sealers, providing a troubleshooting checklist and maintenance kits to people in the community).
- 46 **Calibration.** It is recommended that calibration of equipment should be conducted on a systematic basis with biological checks being performed daily and full calibration annually; expensive calibration equipment should be shared on a national and regional basis.
- 47 **Training.**  
(1) It is recommended that, prior to distribution, hearing aid manufacturers should provide assistance for training for maintenance and repair in developing country markets both at their

factory and in-country.

(2) It is recommended that hearing aid repair specialists should be trained and should be responsible for repairs, analysing, calibration, advice to consumers, ordering and stock-keeping. In addition, trained specialists could become trainers.

### **WORKSHOP 3.5 OTHER AMPLIFICATION DEVICES**

- 48 **Promotion and availability.** There is a wide range of assistive amplification and signaling devices designed to improve the quality of life of people with hearing loss. It is recommended that these devices, such as loop and FM systems, teletype telephone and alert warning systems, should be promoted and available in all countries.
- 49 **Frequency assignment.** It is recommended that an FM frequency should be assigned for assistive FM hearing amplification systems.
- 50 **Accessibility for persons with impaired hearing.**  
It is recommended that WHO should encourage the creation of acoustically friendly environments and that building codes should take into account the needs for people with hearing loss. Architectural schools should be aware of and promote hearing accessibility.

### **WORKSHOP 4.1 PRIMARY LEVEL TRAINING**

- 51 **Training for all.** It is recommended that the training of all health care personnel should include appropriate topics and content on audiology and hearing health care and should be conducted at local, national and regional levels.
- 52 **Primary ear and Primary eye care.** It is recommended that primary health workers' training should include primary ear care and primary eye care with simple otoscopy and ophthalmoscopy, raising awareness in the community, screening and detection, and information on available services including the availability of hearing aids.
- 53 **Guidelines for referral.** It is recommended that guidelines for the referral of ear problems to ENT specialists should be developed and distributed to PHC workers, audiologists and all personnel involved in hearing health services.

### **WORKSHOP 4.2 SECONDARY & TERTIARY LEVEL TRAINING**

- 54 **Personnel.** It is recommended that adequate training should be implemented for hearing aid repair technicians, ear mould technicians and audiology technicians, and degree level for training clinical audiologists (who work in cooperation with ENT doctors).
- 55 **Additional training for primary level workers.** It is recommended that selected PDH and CBR workers should be given additional training to become competent to assess hearing problems, fit and follow-up prescribed hearing aids and make ear mould impressions or one stage ear moulds.
- 56 **Career Development.** It is recommended that career tracks and professional accreditation for audiologists and ENT specialists should be developed according to needs and existing situations prevailing in different countries.

- 57 **Follow-up training.** It is recommended that follow-up training for all relevant health personnel should be considered as important as initial training.
- 58 **Location of training.** It is recommended that technical training should generally be conducted in-country or regionally rather than internationally. Regional training programmes should be developed from existing training programmes modified to the needs of their member countries.

#### **WORKSHOP 4.3 RESEARCH, DEVELOPMENT and TECHNICAL COOPERATION**

- 59 **Data collection and research coordination.** It is recommended that WHO should promote and assist the gathering of epidemiological data and set up, maintain and distribute data-bases and be the coordinating agency for the standardization of research programmes, normative values and bench marks for best practice in programme development
- 60 **Burden of disease and its socio-economic consequences.** It is recommended that research should be conducted on the burden of disease (such as the approach using the disability adjusted life year (DALY)) and on the socio-economic consequences of deafness and hearing impairment.
- 61 **Hearing Aids usability.** WHO should coordinate research findings and other information gathered on hearing aid usability.
- 62 **Development of requirements.** It is recommended that WHO should convene a small working group of independent experts to develop detailed requirements for appropriate and affordable hearing aids, ear moulds and services for developing countries according to the recommendations of this workshop. These requirements should then be shared with hearing aid manufacturers with a view to development and production of hearing aids that are appropriate and affordable in developing countries.

#### **WORKSHOP 4.4 RESOURCE MOBILISATION**

- 63 **Data Need.** In order to mobilise resources effectively, there is an urgent need for accurate epidemiological data on the prevalence, causes and needs for deafness and hearing impairment in developing countries. It is recommended that WHO continue and increase its efforts to encourage and assist countries to collect such data.
- 64 **Partnerships.** WHO should encourage and coordinate partnerships between concerned organisations working for the hearing impaired.
- 65 **Co-operation.** It is recognised that it will take time to establish the recommended programmes for rehabilitation of those disabled through hearing impairment and deafness. It is recommended that, in the interim, governments should cooperate with non-governmental organizations to implement mass provision of affordable hearing aids through their primary health care services.

## **ANNEX 1: PLAN OF WORK**

**Opening of the meeting:** *Mr C Garms, Executive Director, CBM; Dr B Thylefors, Director, Disability/Injury Prevention and Rehabilitation, WHO*

### **SESSION 1: WHAT IS THE CURRENT SITUATION?**

#### **1.1 WHAT IS THE SIZE OF THE PROBLEM?**

- (a) Introduction to the Meeting and Epidemiology of hearing impairment - *Dr A. Smith*
- (b) Estimates of people needing hearing aid services - *Presentation by Prof P. Alberti*

**1.2 HOW DO WE ASSESS NEEDS?** - *Presentation by Prof G. Brobby*

**1.3 WHERE ARE WE NOW?** - *Presentation by Prof V. Newton*

#### **1.4 REPORTS FROM REGIONS**

AFRICAN REGION	<i>Presentation by Dr C. Prescott</i>
AMERICAS REGION	<i>Presentation by Ms B. Rayman</i>
EASTERN MEDITERRANEAN REGION	<i>Presentation by Ms C. Mason</i>
EUROPEAN REGION	<i>Presentation by Prof A. Parving</i>
SOUTH-EAST ASIAN REGION	<i>Presentation by Prof H. Hendarmin</i>
	<i>Presentation by Prof R. Shrivastav</i>
WESTERN PACIFIC REGION	<i>Presentation by Prof X. Bu</i>

### **SESSION 2: WHAT SERVICES DO WE NEED?**

**Introduction:** *Ms C. Mason*

WORKSHOP 2.1: RAISING AWARENESS

WORKSHOP 2.2 SERVICES FOR INDIVIDUALS.

WORKSHOP 2.3 DEVELOPMENT OF PROGRAMMES

### **SESSION 3: WHAT TECHNOLOGY DO WE NEED?**

**Introduction:** Prof N. Amin

WORKSHOP 3.1 HEARING AIDS

WORKSHOP 3.2 PRODUCTION and DELIVERY

WORKSHOP 3.3 EARMOULDS

WORKSHOP 3.4 MAINTENANCE

WORKSHOP 3.5 OTHER AMPLIFICATION DEVICES

### **SESSION 4: TRAINING and DEVELOPMENT**

**Introduction:** Dr P. Victor

WORKSHOP 4.1 PRIMARY LEVEL TRAINING

WORKSHOP 4.2 SECONDARY & TERTIARY LEVEL TRAINING

WORKSHOP 4.3 RESEARCH, DEVELOPMENT and TECHNICAL COOPERATION

WORKSHOP 4.4 RESOURCE MOBILISATION

### **SESSION 5: PLAN OF ACTION and RECOMMENDATIONS**

## ANNEX 2: PROPOSED DISCUSSION TOPICS FOR INDIVIDUAL WORKSHOPS

### SESSION 2: WHAT SERVICES DO WE NEED?

<b>Workshop 2.1: RAISING AWARENESS</b>	<b>Workshop 2.2: SERVICES FOR INDIVIDUALS.</b>	<b>Workshop 2.3: DEVELOPMENT OF PROGRAMMES</b>
<ul style="list-style-type: none"> <li>● individuals, communities, health professionals, governments</li> <li>● promotion of realistic expectations</li> <li>● taking account of cultural attitudes</li> </ul>	<ul style="list-style-type: none"> <li>● target groups (hard of hearing, deaf; children, adults; particular causes)</li> <li>● prescription, fitting, user training, follow-up</li> </ul>	<ul style="list-style-type: none"> <li>● sustainable service models</li> <li>● infrastructure development</li> <li>● centres, outreach</li> <li>● programme evaluation, cost-effectiveness</li> <li>● integration with habilitation/rehabilitation and education services</li> </ul>

### SESSION 3: WHAT TECHNOLOGY DO WE NEED?

<b>Workshop 3.1 HEARING AIDS</b>	<b>Workshop 3.2 PRODUCTION and DELIVERY</b>	<b>Workshop 3.3 EAR-MOULDS</b>	<b>Workshop 3.4 MAINTENANCE</b>	<b>Workshop 3.5 OTHER AMPLIFICATI ON DEVICES</b>
<ul style="list-style-type: none"> <li>● specifications required (portfolio)</li> <li>● appropriate, affordable, reliable, durable, acceptable</li> <li>● variations by region and by level of available technology</li> <li>● power sources (technology needs, batteries (disposable, rechargeable, solar power, availability, cost))</li> </ul>	<ul style="list-style-type: none"> <li>● manufacture and/or assembly in developed and/or developing world?</li> <li>● regional production?</li> <li>● use of reconditioned, second-hand hearing aids</li> <li>● marketing, penetration, bulk purchase, import restriction, tax</li> <li>● distribution</li> </ul>	<ul style="list-style-type: none"> <li>● technology</li> <li>● production, delivery, fitting</li> <li>● setting up an earmould laboratory (static, mobile)</li> </ul>	<ul style="list-style-type: none"> <li>● repair, replacement</li> <li>● availability of spare parts</li> <li>● testing and calibration of hearing aids and equipment</li> <li>● setting up a hearing aid repair laboratory</li> </ul>	<ul style="list-style-type: none"> <li>● especially in relation to children in an educational setting</li> </ul>

### SESSION 4 WORKSHOPS: TRAINING and DEVELOPMENT

<b>Workshop 4.1 PRIMARY LEVEL TRAINING</b>	<b>Workshop 4.2 SECONDARY &amp; TERTIARY LEVEL TRAINING</b>	<b>Workshop 4.3 RESEARCH, DEVELOPMENT and TECHNICAL COOPERATION</b>	<b>Workshop 4.4 RESOURCE MOBILISATION</b>
<ul style="list-style-type: none"> <li>● teachers, parents, users, PHC and CBR workers</li> </ul>	<ul style="list-style-type: none"> <li>● clinical audiologist, audiological technician, earmould technician, hearing aid repair technician)</li> <li>● course types and content (including management issues)</li> <li>● regional training centres</li> </ul>	<ul style="list-style-type: none"> <li>● basic and operational R &amp; D</li> <li>● partnerships between developed and developing countries and regions</li> </ul>	<ul style="list-style-type: none"> <li>● for individuals</li> <li>● for programmes</li> </ul>

<b>Workshop 4.1 PRIMARY LEVEL TRAINING</b>	<b>Workshop 4.2 SECONDARY &amp; TERTIARY LEVEL TRAINING</b>	<b>Workshop 4.3 RESEARCH, DEVELOPMENT and TECHNICAL COOPERATION</b>	<b>Workshop 4.4 RESOURCE MOBILISATION</b>

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#### ANNEX 4: GRADES OF HEARING IMPAIRMENT

Grade of impairment	Corresponding audiometric ISO value (Average of 500, 1000, 2000, 4000 Hz)	Performance	Recommendations
<b>0</b> No impairment	<b>25 dB or better</b> (better ear)	No or very slight hearing problems. Able to hear whispers.	
<b>1</b> Slight impairment	<b>26 - 40 dB</b> (better ear)	Able to hear and repeat words spoken in normal voice at 1 metre.	Counselling. Hearing aids may be needed.
<b>2</b> Moderate impairment	<b>41 - 60 dB</b> (better ear)	Able to hear and repeat words using raised voice at 1 metre.	Hearing aids usually recommended.
<b>3</b> Severe impairment	<b>61 - 80 dB</b> (better ear)	Able to hear some words when shouted into better ear.	Hearing aids needed. If no hearing aids available, lip-reading and signing should be taught.
<b>4</b> Profound impairment including deafness	<b>81 dB or greater</b> (better ear)	Unable to hear and understand even a shouted voice.	Hearing aids may help understanding words. Additional rehabilitation needed. Lip-reading and sometimes signing essential.

#### DEFINITIONS:

Disabling hearing impairment in adults should be defined as a permanent unaided hearing threshold level for the better ear of 41 dB or greater; for this purpose the "hearing threshold level" is to be taken as the better ear average hearing threshold level for the four frequencies 0.5, 1, 2, and 4 kHz."

Disabling hearing impairment in children under the age of 15 years should be defined as a permanent unaided hearing threshold level for the better ear of 31 dB or greater; for this purpose the "hearing threshold level" is to be taken as the better ear average hearing threshold level for the four frequencies 0.5, 1, 2, and 4 kHz."

**FROM:** *Report of the Informal Working Group on Prevention of Deafness and Hearing Impairment Programme Planning WHO, Geneva, 1991. With adaptations from Report of the First Informal Consultation on Future Programme Developments for the Prevention of Deafness and Hearing Impairment, World Health Organization, Geneva, 23-24 January 1997, WHO/PDH/97.3.*

**ANNEX 5: COUNTRY QUESTIONNAIRE ON RESOURCES FOR DEAFNESS AND HEARING IMPAIRMENT, INCLUDING PROVISIONS OF HEARING AIDS**

**Country Data**

Name of country:

Name and address of Centre:

Please would you make an estimate of the following:-

Population of the country:

Proportion of the population:

- 1) Pre-school age (state age range)
- 2) Elderly (state youngest age in this category)

Proportion    Age Range

No. of ENT/Audiology Department in the country:

No. of ENT Specialists in the country:

No. of Audiologists/Audiological technicians in the country:

No. of private hearing aid Centres (if any):

Is there training available in your country for:

	Length of training	
	<u>Country</u>	<u>Centre</u> <u>(wks/mths/yrs)</u>
testing the hearing of children	Yes/No	Yes/No
testing the hearing of adults	Yes/No	Yes/No
making earmoulds	Yes/No	Yes/No
selection and fitting of hearing aids	Yes/No	Yes/No

If training NOT available are people sent abroad? Yes/No

- If "yes"
- a)      To which countries
  - b)      Source of funding (self/government/charity)

## **Centre Data**

No. of ENT Specialists:

No. of Audiologists/Audiology Technicians/Hearing Aid Technicians

No. of Clinic Officers:

No. of ENT Nurses:

	<u>In the Centre</u>	<u>In a mobile unit</u>
Do you have pure tone audiometry?	Yes/No	Yes/No
Do you have tympanometry?	Yes/No	Yes/No
Do you have a hearing aid test box?	Yes/No	Yes/No
Can you make insertion gain measurements?	Yes/No	Yes/No
Do you have equipment to test children <3 years old?	Yes/No	Yes/No
Do you have a sound treated room for testing?	Yes/No	
Do you have an otoscope?	Yes/No	Yes/No

## **Population Data**

### 1. **Adults**

- 1.1 How many adults do you estimate have a bilateral hearing loss >40 dBHL:
  - a) Over the whole country?
  - b) Seen in total by your Centre?
- 1.2 How many of the adults do you estimate to have a permanent bilateral hearing loss:
  - a) Over the whole country?
  - b) Seen in total by your Centre?
- 1.3 How many with a permanent bilateral hearing loss would you estimate to have a hearing loss >80 dB HL?

### 2. **Children** (state age range for "children" in your country)

- 2.1 How many children do you estimate to have a bilateral hearing loss >30 dB HL:
  - a) Over the whole country?
  - b) Seen annually by your Centre?
- 2.2 What proportion do you estimate to have a permanent bilateral hearing loss:
  - a) Over the whole country?
  - b) Seen annually by your Centre?
- 2.3 How many do you estimate to have a permanent bilateral hearing loss >80 dB HL:
  - a) Over the whole country?
  - b) Seen annually by your Centre?

### 3. **Patient Data**

- 3.1 What proportion(%) of your patients fall into the following age groups:-
  - ≤ 5 years
  - 6-16 years
  - 17-60 years
  - over 60 years

- 3.2 What proportion(%) of the following types of hearing aids are used by patients in your Centre?
- |   | <u>Proportion(%)<br/>with 1 hearing aid</u> | <u>Proportion(%)<br/>with 2 hearing aids</u> |
|---|---|--|
| Body worn                               |   |  |
| Behind-the-ear                          |   |  |
| In-the-ear/in-the-canal                 |   |  |
| Bone conduction aids                    |   |  |
| Other (spectacle,<br>programmable etc.) |   |  |
- 3.3 Are the hearing aids fitted:
- a) In your own Centre? Yes/No  
 If "yes" - by whom?
- b) Outside by a hearing aid specialist? Yes/No
- 3.4 What proportion(%) of the patients with a hearing loss  $\geq 40$  dB HL have an audiogram which can approximately be described as:-
- a) flat?  
 b) steep high frequency hearing loss?  
 c) low frequency hearing loss only?  
 d) Other?
- 3.5 What proportion of your patients could be fitted with:
- Proportion(%)
- 1 BTE fitting a hearing loss averaging 40-80 dB HL (500- 4kHz)
- Of the **remainder** what proportion could be fitted with 1 BTE fitting a hearing loss averaging  $>80$  dB HL (500-4 kHz)
- Of the **remainder** what proportion could be fitted with 1 BW hearing aid fitting a loss  $>80$  dB HL (500-4 kHz)
- Of the **remainder** what proportion could be fitted with 1 bone conduction hearing aid
- (BTE = behind-the-ear: BW = body worn)
- 3.6 What do you think is the maximum the average patient would be willing to pay for one hearing aid? US\$
- 3.7 How long a warranty would you want if a warranty cost an extra US\$10 per hearing aid per year?
- 3.8 Does the Government pay towards the cost of hearing aids for children? Yes/No
- If "yes" - what proportion(%)?
- Does the Government pay towards the cost of hearing aids for adults? Yes/No
- If "yes" - what proportion(%)?

4. **Earmoulds**

- 4.1 Do you have an earmould laboratory:
- |    |   |  |        |
|----|---|--|--------|
| a) | In the country?                         |  | Yes/No |
|    | If "yes", how many?                     |  |        |
| b) | In your Centre?                         |  | Yes/No |
| c) | Accessible the same day?                |  | Yes/No |
|    | Do you have to send out of the Country? |  | Yes/No |
- 4.2 What type of earmoulds are available to you and in what proportion:
- |    |                             |        |                   |
|----|-----------------------------|--------|-------------------|
|    |                             |        | <u>Proportion</u> |
| a) | hard acrylic                | Yes/No | (%)               |
| b) | soft acrylic                | Yes/No | (%)               |
| c) | universal (non-custom made) | Yes/No | (%)               |
| d) | Other (silicone based)      | Yes/No | (%)               |
- 4.3 How long on average does it take to obtain an earmould after the impression has been taken? (days/weeks/months)
- 4.4 What do you consider is an affordable cost for an earmould for the average patient?  
US\$
- 4.5 Does the Government contribute towards the cost of earmoulds for children?  
Yes/No
- If "yes", in what proportion(%)?
- Does the Government contribute towards the cost of earmoulds for children?  
Yes/No
- If "yes", in what proportion(%)?

5. **Maintenance and Calibration**

- 5.1 Do you have access to a maintenance service for your equipment? Yes/No
- If "yes"
- |    |                     |        |
|----|---------------------|--------|
| a) | In your Centre?     | Yes/No |
| b) | In your local area? | Yes/No |
- If "no", do you send abroad for repairs? Yes/No
- 5.2 Do you have access to a calibration service for your equipment? Yes/No
- If "yes":
- |    |                     |        |
|----|---------------------|--------|
| a) | In your Centre?     | Yes/No |
| b) | In your local area? | Yes/No |
- If "no", do you send abroad? Yes/No
- How often is your equipment calibrated (mths/years)?

6. **Batteries**

- Does the Government supply batteries free? Yes/No
- Do you issue batteries? Yes/No
- Do charities provide batteries:
- |    |                         |        |
|----|-------------------------|--------|
| a) | free?                   | Yes/No |
| b) | at an affordable price? | Yes/No |

Types of batteries available and average price:

		<u>Type</u>	<u>Average Price (US\$)</u>
BTE	mercury	Yes/No	
	zinc air	Yes/No	
BW	alkaline batteries	Yes/No	
	Rechargeable	Yes/No	

ANY ADDITIONAL COMMENTS OR INFORMATION:

**ANNEX 6: COUNTRY AND CENTRE DATA REGARDING THE SITUATION AND RESOURCES FOR DEAFNESS AND HEARING IMPAIRMENT AND PROVISION OF HEARING AIDS**

Contributors:	Bangladesh (Dhakia)	Professor M N Amin
	Costa Rica	Dr J Madriz
	Ghana (Kumasi)	Professor G Brobby
	India (Lucknow)	Professor S C Mishra
	Indonesia (Jakarta)	Professor H Hendarmin
	S. Korea (Seoul)	Professor Noh
	Nepal (Kathmandu)	Professor R P Shrivastav
	Philippines (Manila)	Dr N Martinez
	Thailand (Bangkok)	Professor S Prasansuk
	Venezuela (Caracas)	Dr A Diaz De Palacios

**Table 1: STAFF SPECIALISTS ETC (1st page of Questionnaire); NUMBER OF STAFF AVAILABLE**

	Pop. (millions)	ENT/Aud Dept	ENT/Aud PH	Population per ENT	Audiol /A.Tech	Population per Audiol /A.Tech	Priv-ate
Bangladesh	125	14/1	222	563,000	2 / 20	6,250,000	
China	1,200	~2,000	~18,000	67,000	~1200	1,000,000	~50
Costa Rica	3.3	16	52/3	63,000	32	103,000	10
Ghana	18	3	10	1,800,000	- 10 -	1,800,000	2
India	700	401	14,700	48,000	- 1,200 -	583,000	600
Indonesia	210	13	450	466,000	- 0 -	-	5
S. Korea	42	100/30	1800	23,000	30 / 200	210,000	300
Nepal	18.5	12/9	30	617,000	- 7 -	2,642,000	1
Philippines	72	20	250(c)	288,000	- 50 -	1,440,000	25
Thailand	60	100	500	120,000	60 / 100	600,000	10
Venezuela	20	20	300	67,000	20	1,000,000	6

**TRAINING TO TEST HEARING (1st page of Questionnaire) P = part of this time**

	Children			Adults			Training Abroad
	Country	Centre	Duration	Country	Centre	Duration	
Bangladesh	-	+	3 mths	-	+	3 mths	+
China	+	+	2 weeks	+	+	2 weeks	
Costa Rica	+		2-3 yrs (P)	+		2-3 yrs (P)	
Ghana	-			-			+
India	+	+	15w-5yrs(P)	+	+	12w-5yrs(P)	
Indonesia	+			+			
S. Korea	+	+	4 mths	+	+	4 mths	
Nepal	-	+	2-4 wks	-	+	2-4 wks	
Philippines	-	+	1 mth	-	+	1 mth	
Thailand	+	+	3 mths	+	+	2 mths	
Venezuela	+	+		+	+		

**TRAINING FOR HEARING AID FITTING AND FOR MAKING EAR MOULDS (1st page of Questionnaire) (P = Part of this time)**

	Children			Adults			Training Abroad
	Country	Centre	Duration	Country	Centre	Duration	
Bangladesh	-	+	3 mths	-	+	3 mths	+
China	+	+	½ weeks	+	+	½ weeks	
Costa Rica	+		2-3 yrs (P)	+		2-3 yrs(P)	
Ghana	-			-	-		+
India	+	+	12w-5yrs(P)	+	+	12w-5yrs(P)	
Indonesia		-			+		
S. Korea	+	+	1 mth	+	+	7 mths	
Nepal	-	+	1-3 mths	-	+	1-2 mths	+
Philippines	+	-	1 wk	+	-	1 wk	
Thailand	+	+	1 mth	+	+	1 mth	
Venezuela	+	-		+	-		

**FACILITIES FOR THE CENTRE (MOBILE UNIT) (Page 2)**

	PTA	TYM	HATB	IG	BEHAV	STR	OTOS
Bangladesh	+(+)	+(+)	+(-)	+(-)	+(+)	+	+(+)
China	+(+)	+(+)	+(+)	+(+)	+(+)	+	+(+)
Costa Rica	+	+	-	-	-	+	+
Ghana	+	+	+	-	+	+	+
India	+(+)	+(-)	+(-)	-(-)	+(+)	+	+(+)
Indonesia	+	+	-	-	+	+	+
S. Korea	+(+)	+(+)	+(+)	+(+)	+(+)	+	+(+)
Nepal	+(-)	+(-)	+(-)	+(-)	+(-)	+	+(+)
Philippines	+(+)	+(+)	+(+)	+(+)	+(+)	+	+(+)
Thailand	+(+)	+(+)	+(-)	+(-)	+(+)	+	+(+)
Venezuela	+(+)	+(+)	-(-)	-(-)	+(+)	+	+(+)

HATB - Hearing Aid Test Box; IG- Insertion Gain; STR- Sound Treated Room

**NUMBER OF ADULTS WITH EACH DEGREE OF HEARING LOSS (COUNTRY/CENTRE - SEEN ANNUALLY) (Q's 1.1 - 1.3)**

	> 40 dBHL	PERMANENT	>80 dBHL
Bangladesh	- / 15455	- / 3035	2752 (Centre)
China	23.3 m / ?	21.3 m / ?	8.5 m (> 71 dB)
Costa Rica			2 - 2.5000 (Country)
Ghana	6000/1620	- / 1620	154800 (Country)
India		14% / -	
Indonesia	2.16 / -		0.35% / -
S. Korea	250000/2000	150000/1000	50000 (Country)
Nepal	1689850/445	1377552/144	38553/72
Philippines	- / 271	- / 112	- / 24
Thailand	13.6% / 30000+	10% / 30000+	0.5% (Country)

Venezuela			
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**NUMBER OF CHILDREN WITH EACH DEGREE OF HEARING LOSS (COUNTRY/CENTRE - SEEN ANNUALLY) (Q 2.1 - 2.3)**

	AGE RANGE	> 30dBHL	PERMANENT	> 80dBHL
Bangladesh	0 - 15	- / 1250	- / 54%	
China	0 - 14	1.7m (>40 dBHL)	11.7m	0.7m
Costa Rica	0 - 15			
Ghana	< 18	234000/340	- /236	39600/196
India			- /3.5%	- /5.8%
Indonesia	0-14			
S. Korea	0 - 9	200000/2000	50000/1000	20000/1500
Nepal	0 - 16	460416/280		
Philippines	0 - 16	- /24		- / 91
Thailand	0 - 15	4.9%/300	5%/200	0.5%/200
Venezuela				

**CENTRE AGE-GROUPS % (Q 3.1)**

	> 5	6 - 16	17 - 60	60+ YRS
Bangladesh	16	29	48	7
China		7.48% (0-14 y)	37.69% (16-59 y)	54.83%
Costa Rica	15	40	45	
Ghana	30	15	45	10
India	60	30	10	2
Indonesia	73	27		
S. Korea	20	20	30	30
Nepal	2.3	19.3	73.3	5
Philippines	10	10	70	10
Thailand	10	10	50	30
Venezuela				

**HEARING AIDS AT EACH CENTRE (%) (Q 3.2)**

	BW		BTE		Other	
	One	Two	One	Two	One	Two
Bangladesh	47	7	45	1		
China	5	0	85	20	10	1.5
Costa Rica	2	0	40	10	30	8
Ghana	51.5	0.5	47.5	0.5		
India	65	9	25		1	
Indonesia	41.46		47.72		10.82	
S. Korea	0.5	0.5	12.5	12.5	37	37

Nepal	65.4		34.6			
Philippines	4	4	30	30	16	16
Thailand	30		60		10	
Venezuela						

**SHAPE OF HEARING LOSS (%) (Q 3.4)**

	Flat	SI HF	LF	Other
Bangladesh	42	41	10	7
China	50	44	5	1
Ghana	20	60	15	5
India	15	40	40	5
S. Korea	20	70	5	5
Philippines	70	20	10	-
Thailand	20	50	20	10

**PROPORTION FITTED (Q 3.5)**

	1 BTE 40-80	% of remainder 1 BTE >80	% of remainder 1 BW ->80	% of remainder 1 BC
China	20	20	5	0.5
Ghana	50%	20	29.5	0.5
India	25%	95	60	0.5
Indonesia	28.6%	19	52.4	-
S. Korea	20%	50	10	1
Nepal	35%	5	60	-
Philippines	70%	25	3	2
Thailand	60%	20	10	10

**EARMOULDS (Q 4.1)**

Country	Labs	Access Same Day
Bangladesh	3	+
China	50	-
Costa Rica	2	+
Ghana	1	+
India	50	+
Indonesia	+	-
S. Korea	10	-
Nepal	+	+
Philippines	6-8	+
Thailand	10	+
Venezuela	2	



**TYPES AVAILABLE (%) TO CENTRES (Q 4.2)**

Country	HA	SA	UN	OTHER	TIME
Bangladesh	99.9	0.1	-	-	2-3 days
China	80	10	0	10	10 days
Costa Rica	70	25	<1	4	7 days
Ghana	100	-	-	-	1 day
India	20	20	50	10	7 days
Indonesia	+	-	-	+	2-3 days
S. Korea	50	30	-	20	
Nepal	+	-	-	+	
Philippines	2	7	1	90	1 day
Thailand	40	40	20	20	2 weeks
Venezuela					

HA = Hard Acrylic; SA = Soft Acrylic; UN = Universal; Other = silicone based

**AFFORDABLE PRICES (USD) Questions: 4.4 3.6 3.7**

	Earmould	Hearing Aids	Warranty
Bangladesh	10	30-40	3 years
China	4	50	5 years
Ghana	5	75	2 years
India	2	25	1 year
Indonesia	4	70	1 year
S. Korea	20	1000	6 months
Nepal	2	25	2 years
Philippines	10	200	10 years
Thailand	10	10	
Venezuela			

**BATTERIES (Q 6)**

Country	Supplier				Cost (USD)
	Government	Centre	Charity		
			Free	Aff	
Bangladesh	-	+	+	+	0.5
China	-	+	-	-	0.7 - 1.8
Costa Rica	+ (4-6)	-	-	-	0.75-5
Ghana	-	+	+	-	0
India	-	-	-	+	0.25-4
Indonesia	-	-	-	-	0.7
S. Korea	-	+	+	+	1-5
Nepal	-	+	-	+	0.45
Philippines	-	-	-	-	0.6-7
Thailand	-	+	-	+	0.5-1
Venezuela	-	-	-	+	

**TYPE OF BATTERY (Q 6)**

	Hg	Zn	ALK	RECH
Bangladesh	+	+	+	-
China		+	+	+
Costa Rica	-	+	+	+
Ghana		+	+	
India	+	+	+	+
Indonesia	-	+	-	-
S. Korea	-	+	+	+
Nepal	-	+	-	-
Philippines	+	+	+	+
Thailand	+	+	+	-
Venezuela				

Hg = Mercury; Zn = Zinc oxide; ALK = Alkaline; RECH = Rechargeable

**COST OF BATTERIES (USD) (Q 6)**

	Hg	Zn	ALK	RECH	Average
Bangladesh					0.5
China		0.7	0.2	1.8	
Costa Rica		1	0.75	4-5	
Ghana	FREE				
India	0.25	2	0.5	4	
Indonesia		0.7			
S. Korea		1	1	5	
Nepal		0.45			
Philippines	1	1.2	0.6	7	
Thailand	1	1	0.5		
Venezuela					

Hg = Mercury; Zn = Zinc oxide; ALK = Alkaline; RECH = Rechargeable

**EQUIPMENT MAINTENANCE (Q 5.1)**

	Access	Centre	Locally	Send Abroad
Bangladesh	-			
China	+		+	
Costa Rica	+	-	+	
Ghana	+	-	-	
India	-			
Indonesia	+	-	+	
S. Korea	+	-	+	
Nepal	+			
Philippines	+	-	+	+
Thailand	+	+	+	
Venezuela	+	-	+	

**CALIBRATION (Q 5.2)**

	Access	Centre	Local	Abroad	Frequency
Bangladesh	+(P)	+		+	3 mths/1 yr
China					
Costa Rica	+(P)	+	-		3 mths
Ghana	+	-	-	-	1 mth/5 yrs
India	+	+	+	-	
Indonesia	+	-	+		1-2 /yr
S. Korea	+	+	+		1 yr
Nepal	-		-	-	yrs
Philippines	+	-	+	+	1 yr
Thailand	+	+	+		1 yr

Venezuela	+	-	+		yrs
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P = PARTIAL