REQUIREMENTS TO SET UP AN AURAL REHABILITATION PROGRAM FOR CHILDREN

REG. N0.M9418

AN INDEPENDENT PROJECT SUBMITTED AS PART FULFILMENT FOR THE FIRST YEAR M.Sc. (SPEECH AND HEARING) TO THE UNIVERSITY OF MYSORE, MYSORE

ALL INDIA INSTITUTE OF SPEECH AND HEARING: MYSORE 570 006

MAY 1995

DEDICATED TO

MY PARENTS

'WHO HAVE BORNE ALL THE PAINS,

TO GIVE ME THE BEST OF COMFORTS,

AND WHO ARE RESPONSIBLE,

FOR WHAT I AM TODAY'.

CERTIFICATE

This is to certify that the Independent Project entitled: **REQUIREMENTS TO SET UP AN AURAL REHABILITATION PROGRAM FOR CHILDREN** is a bonafide work in part fulfilment for the Degree of Master in Science (Speech and Hearing) of the student with Reg.No.M9418.

Mysore
May 1995

Dr.(Miss) S.Nikam
Director
All India Institute of
Speech and Hearing
Mysore - 6

C E R T I F I C A T E

This is to certify that the Independent Project entitled: **REQUIREMENTS TO SET UP AN AURAL REHABILITATION PROGRAM FOR CHILDREN** is prepared under my supervision and guidance.

GUIDE

Mysore

May 1995

Dr.(Miss) S.Nikam
Professor and H.O.D.
Audiology Department
All India Institute of
Speech and Hearing
Mysore 6

DECLARATION

I hereby declare that this Independent Project entitled: **REQUIREMENTS TO SET UP AN AURAL REHABILITATION PROGRAM FOR CHILDREN** is the result of my own study under the guidance of Dr. (Miss) S.Nikam, Prof. and Head of the Department of Audiology and Director, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier at any University for any other Diploma or Degree.

Mysore
May 1995

Reg.No.M9418

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INTRODUCTION

In the recent years, the diverse needs of the hearing-impaired individual have been recognized. Hearing-impairment, especially when severe or profound, drastically reduces the possibilities for children to develop intelligible speech, linguistic skills and educational standards that commensurate with the intellectual abilities. The nucleus of the hearing-impaired's problem is the interference in the process of communication. However planning a program of remediation for the hearing-impaired must be prepared to confront many aspects of the person's life, including educational objectives, personal and social development and employment status (Johnson, 1978).

Viewed historically, a transition has occurred in aural rehabilitation. During the first years of this century, there was extensive emphasis on the visual modality as well as on manual communication. In the 1940's and 1950's marked a transition to more amplification although, not as sophisticated as that provided by the high technology of today. In the 1960's and 1970's audiologists began to view aural rehabilitation for adults in terms of speechreading and auditory training. The issue for children continued on 'methodology', auditory-visual or auditory only. Parents of

the deaf children were confused and for that matter still are regarding the auditory visual versus the auditory-approaches to communication.

Several factors have contributed to the remedial philosophies presently in use. The development of the profession of audiology, rapidly expanding knowledge about the nature of language and its acquisition by children, the recent emphasis on the psychological impact of physical impairments on individuals and families, and technological advances in hearing aid design have all contributed to changes in the procedures employed. Advances in theory, federal and state legislations and developments in the empirical foundation upon which clinical practice rests, have each alone and together altered the shape and course of audiological rehabilitation.

The last few years have witnessed an enormous upsurge of interest in rehabilitation of the hard-of-hearing. Where then does rehabilitation begin? The management process begins as soon as hearing loss is confirmed. The main purpose of rehabilitation is to overcome the handicap. The aim must be initially to help him come to terms with the handicap and to develop skills which will alleviate the

adverse results of the deafness, so that he can continue to function within his social and occupational competency.

Audiologists are beginning to recognize the multifaceted needs of the hearing-impaired individuals. This awareness is resulting in the development of more appropriate and comprehensive programs for audiological rehabilitation. The Committee on Rehabilitative Audiology of the American Speech and Hearing Association (ASHA, 1974) has adopted guidelines for the audiologist in the rehabilitation of the auditorily handicapped. With limited modifications of the ASHA Committee guidelines (1974), the plan for comprehensive audiologic rehabilitation may include any or all of the following components:

1} Selection of an amplification system to make available as much undistorted sensory information as possible.
2) Development, remediation, or conservation of receptive and expressive language abilities.
3) Continuing re-evaluation of auditory function.
4) Assessment of the effectiveness of rehabilitative procedures.

However, the relative emphasis of audiological rehabilitation varies from individual to individual. Client therapy must be personalized and aimed at reconstructing that clients* approach to his/her communicative and relative needs. An interdisciplinary team effort is often crucial to the success of a rehabilitation program. Communication and coordination among professionals who are responsible for any aspect of the client's treatment is critical to the success of the program. Remediation programs must be individualized, efficient, flexible and appealing to the client.

The impetus for this project arose from a need for a thorough and comprehensive text covering the process of audiological rehabilitation. Theory based upon research forms the foundation of all rehabilitative efforts. Assessment considerations, goals and methods of remediation are discussed here with reference to theoretical foundation. It is also designed to provide a broad overview of audiological rehabilitation.

The project provides information to the audiologists, practising physicians, educators etc. It will hopefully be valuable in University training centres for resident

programs and curricula in deaf education to both graduate and post graduate levels.

The audience for this project will also include speech language pathologists, psychologists, special educators, counsellors and other professionals preparing to work with the hearing-impaired, may find this information relevant.

The chief goal is to demonstrate how we can help the various professionals help the clients with hearing loss, gain their fundamental right to attain their best potential communication skills as possible.

'If a deaf person has talent and cannot use it, we have failed. If a deaf person has talent and uses only half of it, we have partly failed. If a deaf person has talent and learns somehow to use, the whole of it, he and we have gloriously succeeded and won satisfaction and triumph few people even know' (Thomas Wolfe, cited by Frisina, 1976).

CHOICE OF SITE. LOCATION AMD SPACE

Steps in opening the doors of an aural rehabilitation centre include proper locale, either within the established group practice, a group that is forming or an individual private practice. It should be easily accessible to the patients, reasonable proximity from the residence of those served, and adequate parking with little or no traffic hazards particularly if invalids are involved. If a solo practice, it should be close to built-in or strong referral sources.

SPACE

Nowhere else, is self respect and the philosophy of patient care better reflected than in the choice and treatment of the space utilized by a clinical program. Space considerations must include the following:

1. the amount of space necessary to house all the elements of the program including the waiting areas, storage capacities, professional offices, and client treatment areas.

2. the geography of the rehabilitation program to specific medical departments or to specific medical availabilities, as well as other referral sources.
3. perceived status of the location (which includes area of the community, the floor level in the building, proximity of parking).
4. organisation of space. The administrator should be able to create space that represents the organisational philosophy.

Space should be so designed, built and treated in such a manner so as to convey feelings that would elicit positive approaches to evaluation and therapy, while reducing the natural anxieties of the patients, families, parents and children. Employees should be able to move about in orderly comfort, sufficient waiting area should be available for various ages and types of cases to find their own niche. The waiting area should convey a message of the program.

The next focus is on the cost of supporting the desired space. Local costs will cause some variations in the proposed expenditures and availability of fiscal resources may restrict the amount and quality of space desired. Even if the proposed space is not obtained immediately, it may remain as a target for future achievement. Square foot

costs are usually available for specific neighbourhoods and specific cities and can be calculated prior to actual inspection of sites. In large institutions like hospitals and schools those responsible for allocation of space will consider costs in much the same way.

If we assume zero available finance before deciding a setting in which to establish a service program, where should we begin? Firstly, analyse the space needed. Consider how the practice would function. Think about the patient flow. The amount of space may be then listed in the following way:

Space list	Square feet
Director	175
Supervisors	130
	130
Clinicians	100
	100
Technician	120
Office	180
Waiting area	140
Lounge	140
Group therapy	200

Audiologic labs			425
Storage	100		
		Sub-Total	2040
Hallways, construction (Doors, walls)			322.5
	Space	Total	2362.5 sq.feet

(Cited by, H.L.Gerstman, 1986).

Since space is extremely expensive, assigned space must be well utilized and requests for additional space carefully justified.

Location

Location of one's practice is critical, as it must be close to several strong referral sources. Acquiring space in a large medical building housing a range of specialities, does place one near possible referral sources, however, rents for floor space in such a building will generally be higher than in a smaller professional building. The latter might serve if strong referral sources have been established prior to opening the service.

Building noise ie air conditioning, blowers, elevators and street noises should be carefully reviewed. Often attractive locations have ambient noise levels which are prohibitive to the audiologist. To modify these noises to an acceptable acoustical level, is very expensive. Since considerable weight is involved with sound treated rooms, this should be considered while negotiating for space.

Such set-ups should be located in a quiet area. Acoustic environment plays an important role, while evaluating the hard-of-hearing. Carpeting keeps the noise down especially if it is installed on both walls and floors. For the various test requirements, the set-up must be provided with a satisfactory sound treated room.

CHARACTERISTICS OF A SOUND TREATED ROOM:

If audiometric tests are conducted without considering the ambient noise conditions inside and outside the rooms, there is every possibility of getting audiograms that are not valid due to the masking effect of the ambient noise in the test environment.

There are specific maximum ambient noise levels that can be tolerated in a sound treated room, where the audiometric tests are being carried out. The following table gives us the acceptable noise levels (in dB SPL for octave bands) in audiometric test rooms when testing is expected to reach '0' dBHL (ANSI, 1991):

Frequency (Hz)	Under earphones (dBSPL)	Sound field or bone conduction (dBSPL)
125	34.0	28.0
250	22.5	18.5
500	19.5	14.5
1000	26.5	14.0
2000	28.5	8.5
4000	34.5	9.0
8000	43.5	20.5

The following table gives us a comparison of acceptable noise levels (in dB SPL for 1/3 octave bands) for ANSI and ISO standards in audiometric test rooms when testing is expected to reach '0' dB HL for uncovered ears:

Frequency	ANSI (S3.1-1991)	ISO (8253-Part 1, 1989 (Assumes testing starts at 125 Hz)
125	23.0	20.0
250	13.5	13.0
500	9.5	8.0
1000	9.0	7.0
2000	3.5	8.0
4000	4.0	2.0
8000	15.5	15.0

Besides the above requirements, the sound treated rooms should be sufficiently spacious with good ventilation and diffused lighting for the comfort of the patient. These measures will avoid physical fatigue of the patient and thus will ensure good cooperation from the patient, which is essential for valid hearing measurements.

DESIGNING A SOUND TREATED BOOM

To achieve the above qualities for a sound treated room in a speech and hearing clinic, the following points should be considered:

i) ORIENTATION: Generally a sound treated room will be constructed in an ordinary room of a building. This particular room should be selected in such a way that it is away from heavy traffic or any other noise source in the vicinity.

ii) SIZE: It is preferable to have a room of a size of 10'x8'x8' for conducting all the tests. A small dimension may be chosen for the puretone and speech audiometry. The dimension may be changed in terms of user's requirements. In addition to the sound treated rooms, a control room of proper dimension should be provided.

iii) WALLS: In a moderate ambient noise level a single brick wall with two sides cement mortar plaster is adequate. Total thickness of the wall maybe 9-10 inches. In case of excessive ambient noise levels, it is advisable to have double walls of single brick in lengthwise construction separated by an air gap of 3-4". The air gap between the two walls should go deep into the floor atleast by 12 inches, which provides considerable isolation of the inner floor from the outer one.

iv) **CEILING:** The ceiling of the sound treated room must be of higher density materials suchas reinforced cement concrete. For double wall construction the outer wall should carry the concrete slab and the inner wall should support the false ceiling. The space between the concrete roof and false ceiling may be filled by sound absorbing material. It is acoustically for this purpose, that one inch thick compressed fibre glass wool plus air is used.

v) **FLOORS:** Floors may be covered with coir matting and carpets.

vi) **DOORS:** It is preferable to have double doors fixed in such a way that it opens into the room and the other opens outwards. Each door may be made up of teakwood frame covered with teakwood planks bearing an air gap between the planks. The air gap may be filled with sound absorbing materials such as glasswool or fine river sand. A thick rubber lining along the edges of the doors will be an added advantage to avoid leakage of sound waves.

vii) **OBSERVATION WINDOW**: In case of single wall construction, an observation window of 24"xl8" may be sufficient. This should be provided with 1/4" glass

sheets separated by maximum available air gap. Two separate windows of the same size mentioned above should be provided in case of double wall construction. It is an advantage to line the edges of glass sheets with suitable sound absorbing material such as sponge or glass wool. From the acoustic point of view and also from that of visibility, one of the glass sheets should be tilted a little inward.

viii) **INTERNAL ACOUSTICAL TREATMENT:** It is important that the ceiling and all four walls of the room should be treated acoustically. For this, one inch thick compressed fibre glass wool plus an air gap of 1" with a facing of acoustic tiles should be fixed on all the walls of the ceiling.

ix) **VENTILATION:** Indirect lighting may be provided by suitable means to make it pleasant. Air conditioning should be made by a suitable ducting system. It is essential that the AC plant, should be installed away from the sound treated room and the ducting should be so designed, so as to keep the noise level to a minimum. An alternative is to have a suitable room air cooler in the control room. This may be operated as frequently as desirable.

x) ELECTRICAL CONNECTIONS: The connection between the instruments in the control and the test room are made through suitable jacks and adaptors. Pipes or holes should not be used for this purpose.

A sound treated room in a new set-up can be constructed with a minimum of expenditure by considering the above. It is thought that a single brick construction of 10" thickness with cement plaster is adequate and the internal acoustic treatment can be made with glasswool and acoustic tiles. This type of construction can give satisfactory results for ambient noise levels of 65 dB. The room may be provided with ceiling made up of tin sheets instead of with costly RCC slabs.

The entire area of the rehabilitation unit, can be marked into the following sections:

i) Reception

ii) Office: Officer-in-charge and secretary

iii) Audiology Section:

a) Audiologist

b) Teacher coordinators (hearing therapist)

c) Playroom

d) Earmold laboratory.

iv) Speech Section

a) Psychologist

b) Speech Pathologist

c) Speech Therapist

v) Electronic laboratory

vi) Medical Departments

vii) Administrative Departments.

THE VARIOUS DEPARTMENTS. THEIR FUNCTIONS AND THETR COLLABORATION WITH OTHER DISCIPLINES

The provision for a comprehensive and integrated rehabilitation program is both natural and necessary, so that the multifaceted needs of the hearing-impaired can be met. The audiologist should not seek to incorporate every component of audiological rehabilitation into every program he/she develops, however each of these services should be available to the hearing-impaired client, if he/she presents a need for such activities.

The following should be the main departments in an aural rehabilitation set-up:

i) Department of Audiology and Speech Pathology
ii) Department of Otorhinolaryngology
iii) Department of Psychology
iv) Administrative Department.

Supportive service can be provided by electronics, publicity and information unit, etc. In addition to the above departments, we can also have specialists like paediatricians, neurologists, plastic surgeons to attend to the patients.

DEPARTMENT OF AUDIOLOGY AND SPEECH PATHOLOGY :

The clinical services provided by this department should include:

i) HEARING EVALUATION:

Patients are evaluated here, for their hearing ability, both either initial as well as periodic hearing re-evaluation. Pre and post medical or surgical evaluation is done, also those patients with tinnitus, vertigo etc. for whom hearing evaluation is done as a routine.

ii) HEARING AID TRIAL:

Hearing aid evaluation and recommendation of suitable hearing aids is one of the main rehabilitative activities of the department. This can be augmented through case history sheets, picture cards, new test procedures. Hearing aid trial can either be carried out objectively or subjectively.

iii) EARMOLD MAKING:

Custom earmolds can be made for the cases who can acquire hearing aids. Different types of molds such as

full molds, skeleton molds, shell molds can be made whenever indicated.

iv) THERAPEUTICS:

Guidance can be given to parents/patients regarding auditory training as well as speech therapy.

v) COUNSELLING:

All patients who are prescribed hearing aids, should be counselled regarding their use, care and maintenance. They should also be counselled regarding the importance of auditory training and speechreading.

DEPARTMENT OF OTORHTNOLARYNGOLOGY:

The main objective of this department is to render good clinical services for the hearing handicapped. Clinical services should be provided to all cases coming to the centre ie. to examine and diagnose the otolaryngological problems and also putting them on medication for speedy recovery.

Procedures like suction clearance of the ears with discharge, medical and surgical treatment should be given. If financial status is good, then plastic surgery and cochlear implants can be carried out for the hearing-impaired .

Apart from this, in collaboration with the department of audiology, the otolaryngologist needs to give clearance of wax or any other discharge before carrying out impedance audiometry. While testing the hearing acuity of children, the behavioural observation audiometry must be supplemented with evoked respone audiometry for which the children need to be sedated.

Before prescribing a hearing aid, the audiologist needs to confirm from the ENT specialist that no surgical procedure will bring about an improvement in hearing of the patient, if so, then to give a prescription for a hearing aid.

DEPARTMENT OF CLINICAL PSYCHOLOGY:

The patients coming to this department must be evaluated for routine and special psychodiagnostics which

includes neuropsychological assessment, assessment of intelligence, aptitudes, etc.

The patients, as well as parents of the mentally retarded children, other cases with behavioural problems should be counselled here regarding the management of problem behaviours, improving self help skills, vocational guidance etc.

ADMINISTRATIVE DEPARTMENT:

The director/head of the rehabilitative set-up is responsible for the coordination and development of services. Some responsibilities include:

i) provide professional consultative services to the centre

ii) offering direct rehabilitative services for the patients of the centre.

iii) being a liason between the centre and medical/non-medical community.

iv) working in association to maintain responsibility for third party reimbursement and to maintain ongoing contact with state and other agencies.

OBJECTIVES:

The key personnel within any rehabilitation centre need to convene regularly to discuss the policies and procedures

of the centre. One of the most important tasks that this group must undertake each year is short-term and long-term planning i.e. establishing the objectives of the organization.

Once the objectives have been established, it becomes necessary to review, each objective in detail, establishing benefits, barriers, dates of implementation etc. Furthermore, a plan of action needs to be established for each given objective in detail.

HUMAN RESOURCE STRATEGIES:

After establishing the objectives of the centre a performance appraisal system that is consistent with the mission of the organisation should be developed. Each department within the centre can develop its own specific objective that are in concert with the centre. Furthermore, staff members should have the opportunity in collaboration with immediate superiors to develop their own objectives for the year.

The organisation as well as the employees gain from the performance appraisals. When every individual in an

organisation has a review of his/her responsibilities and actually has a knowledge of performance levels, including needs for improvement, the centre's organisation will become stronger. It is through this individual objective planning that an organisation can encourage imagination, develop individual sense of responsibility and most important, intensify efforts to meet the organisation goals (Kinall and Gatza, 1963).

EFFICIENT BUSINESS MANAGEMENT SYSTEM:

The general purpose of the business office is to afford the director and all of the program coordinators the appropriate tools to run the programs and the centre in general. The business office system must be well documented, and the documentation must include:

i) a narrative chart of accounts

ii) a job description detailing responsibility and authority for each position.

iii) a description of additional reports and additional information to put into these reports.

GRANTS MANAGEMENT:

An essential function of the administrative department is to develop appropriate skills to attract funds from the

foundations as well as from state and other agencies. The administrator must learn to identify the appropriate funding sources and then to construct competitive application using the style and format specified by the grant agency. Once a grant has been issued, there is need for continued personal contact with a project officer and the necessity of project reports.

DEVELPMENT OF AN ANNUAL GIVING:

Several components are essential for giving program. They include developmental phase, implementation phase and a follow up phase. In the developmental phase, there is a need to create identity i.e. it is essential that the annual giving program have visibility within the community. The next phase is the implementation phase, which focuses on two factors:

i) development of a calendar of activities

ii) the scheduling of appointments.

Finally, the follow-up phase involves ensuring that the donors continue to give on a regular basis. Some of the activities which can contribute to the follow-up phase are, hosting a recognition award evening, revisiting with a

renewal of pledge, sending out periodic correspondence to the donors, starting an expansion from the local community to the region and planning for a capital funds drive.

DEVELOPMENT AND MARKETING OF NEW PROGRAMS:

New programs developed should satisfy:

i) the unique capabilities and expertise of the entire staff

ii) the needs within the community

iii) a minimal amount of external competition.

PUBLIC AND CUSTOM RELATIONS:

The coordination for the public relations should assist the director in reaching the community with activities of the centre.

To develop the customer relation norms which will be the norm in dealing with customers. These should include how to answer the phone, how clients are greeted and client waiting facilities.

Therefore, the administrator's position requires decisiveness, flexibility, some imagination, considerable skill in personal relation and patience.

RECRUITMENT OF PERSONNEL FOR THE SET-UP

The recruitment of personnel for an aural rehabilitation centre should be done carefully. The main aim of recruitment should be to procure best candidates for performing the various jobs at the centre. The goals of personnel management in any social service or educational system are to recruit, employ and motivate personnel for the purposes of -

- accomplishing the centre's objectives
- guiding the personnel in the achievement of position and unit standards of performance.
- offering career development opportunities.
- matching organizational and individual objectives.

(Casetter, 1981).

The personnel and program management roles in audiology and speech pathology have been delineated by Anderson (1981) and Fisher (1982). They include -

i) Staff selection, orientation, development and evaluation

ii) developing curricula, organizing clinical intervention, scheduling case loads.

iii) Securing appropriate materials, equipment and facilities.

iv) Coordinating referrals and support services.

v) Serving as a public relation agent.

vi) Evaluating program effectiveness.

The term 'recruitment' in personnel work refers to the process of advertising for and finding potential applicants to fill employment openings. The selection of personnel is the process of choosing the best qualified person, for each specific job and selection implies that a labour pool of sufficient size and type is available. Thus, effective recruitment is the first step in providing for effective selection (Plumbley, 1976).

The use of team management has become an accepted model for the provision of diagnostic and rehabilitative services. Interdisciplinary teams are assembled to integrate the expertise of various specialists and to promote a wholistic understanding of clinical cases and their families (Bennett, 1982; Brill, 1976). Professionally prepared personnel, generally come to position with considerable knowledge and a set of skills, that will assist them in adjusting to their assignment. Paraprofessionals and professionals must be utilized appropriately.

Salaries and jobs need to be competitive and express the attitude of administration relative to fair employee treatment. They should attract well trained people and assist in creating the institutional loyalty necessary for achieving team practice. Besides salaries and allowances, the employees are provided certain other benefits which include:

- Gratuity/bonus on retirement.
- Equal/more contribution to the provident fund.
- Sickness leave with full pay or a portion of it, reimbursement of medical treatment expenses/provisions of free medical care to the employee and his dependent family members.
- Free conveyance and other amenities such as loans and advances on easy terms.
- Overtime allowances i.e. payments at higher rates for the extra time an employee is required to put in.
- Sabbatical leave, earned leave, casual leave.
- Life Insurance, long-term disability insurance and accident insurance are also significant benefits.
- Discounts at the cafeteria, pharmacy and free parking are appealing to the staff.

The professional staff required, along with their respective duties, have been listed in a tabular form, below. The professional staff have been classified as :

i) administrative staff

ii) non-administrative staff.

PROFESSIONAL STAFF AND THEIR ROLES

Designation		Duties
ADMINISTRATIVE STAFF		
DIRECTOR (PRINCIPAL INVESTIGATOR)	:	Consultant on part time basis, coordination and administration
CO-INVESTIGATOR AND OFFICER-IN-CHARGE	:	Procurement of equipment, day to day work, coordination of team, guidance, administration.
NON-ADMINISTRATIVE STAFF		
AUDIOLOGIST	:	To organize the audiologic lab, diagnosis of cases, planning of therapy, prescription of hearing aids.
	:	To peform all types of audio-logical tests, instructions, maintenance of audiometers, audiometry room.
	:	To help the electronic engineer in the routine repairs of the audiometer.
ELECTRONIC ENGINEER	:	Installation, inspection, commissioning of audio and electronic equipments, their calibration, maintenance, and repair of hearing aids, measurement of noise levels and care of audiometry rooms.

OTORHINOLARYNGOLOGIST	:	It becomes a necessary practise that every case be examined by an otorhinolaryngologist, to exclude any organic cause as well as medical and surgical treatment could be given prior to therapy.
EARMOLD LABORATORY TECHNICIAN	:	To prepare custom made earmolds, other prosthesis, to maintain the equipment of the earmold laboratory.
PSYCHOLOGIST	:	To conduct various psychological tests of performance, intelligence, memory etc. to offer psychological support to patients requiring the same.
PUBLIC HEALTH NURSE	:	To work up the social case history of the cases attending the rehabilitation centre, take a look into their social problems and their implications to help the follow up program.
TEACHER COORDINATORS (HEARING THERAPIST)	:	Staffing, evaluation and therapy of cases with hearing disorders, preparation of test materials etc.

Besides, the above staff, the unit may also need collaboration with other professionals:

i) paediatrician

ii) neurologist

iii) physicians

iv) plastic surgeon

v) psychiatrist.

Hence, if a rehabilitation program is to be successfully developed, the trained personnel are as essential as the audiometers and hearing aids. The team approach on part of all members in the unit should be accepted as an important basis; collaboration with allied clinical and basic disciplines needs to be emphasised, for achieving clinical program by scientific methods.

INSTRUMENTATION

(i) EQUIPMENT REQUIRED:

Instruments can be used either for screening, clinical or research purposes. They can also be classified as instruments required for diagnosis or those required for rehabilitative purposes.

DIAGNOSTIC INSTRUMENTS:

(i) AUDIOMETER

It is an instrument for the measurement of hearing acuity (IS-1979).

MANUAL AUDIOMETER

It is a puretone audiometer, in which the signal presentation, frequency and hearing level selection, and recording of signals is done manually (IS-1979). It is most often used for screening, diagnostic and clinical purposes.

AUTOMATIC RECORDING AUDIOMETER:

It is a puretone audiometer where signal presentations, hearing level variations, frequency selection or variation

and recording of subject responses are implemented manually (IS-1979).

In order to know the type and degree of hearing loss, one needs to have the diagnostic audiometer with speech audiometry and some special test facilities.

ii) IMMITTANCE AUDIOMETER:

It is useful in supplementing and completing the information obtained from puretone testing. Immittance audiometers can be used for screening, clinical and research purpose, on the middle ear function. Screening instruments help in early identification of middle ear conditions. Clinical instruments emphasize on full manupilation of test configuration and more through testing. Generally the test capabilities of clinical impedance instruments include - diagnostic tympanometry, reflex threshold, reflex decay, eustachian tube function etc. The market for research instruments is small. They are basically constructed to support some particular investigation and are not commercially marketed.

iii) BRAIN STEM EVOKED RESPONSE AUDIOMETRY (BSERA):

In order to measure and evaluate the hearing of patients with neurological symptoms as well as to differentially diagnose the case based on the site of lesion, one may need to have BSERA, which measures the changes in the ongoing electrical, physiological activities.

POINTS FOR CONSIDERATION:

1) If a battery operated audiometer is purchased sufficient funds must be available to meet the recurring expenditure.
2) A two room situation is required to carry out speech audiometry using monitored live voice and for freefield testing.
3) A computer may be programmed to control all aspects of administering pure tone air and bone conduction stimuli, speech stimuli, masking, analyze the subject's responses in terms of threshold determinant criteria. The instrument is microprocessor controlled which allows it to be remotely operated by a computer.
4) An IBM compatible personal computer and an audiometer combined in one equipment is available, where all the controls are on the keyboard. It is a clinical model

with facilities for all tests, user-friendly software for storage of patient history, data and audiograms.

COST OF INDIGENOUS AUDIOMETERS

The approximate cost of the audiometers along with accessories are given, here:

Audiometers	Approximate price (in Rs.)
PORTABLE SCREENING AUDIOMETER	3,900-24,300
CLINICAL/DIAGNOSTIC AUDIOMETER	30,000-50,000
PC BASED AUDIOMETER	90,000
ACCESSORIES	
EXAMPLE:	
Internal accessories	
a) Narrow band masking	4,500
b) Insert masking	1,400
External accessories	
a) Freefield loud speaker in cabinet	6,550
b) Patient talk back system (Amplifier, microphone, speaker)	7,050

NoTe: Installation charges are to be paid separately. All local taxes like octroi duty etc. will have to be borne by the party.

CALIBRATION OF AUDIOMETER:

Use of calibrated equipment is a pre-requisite for an accurate audiological evaluation. For that, electronic instruments are necessary which can be used by qualified and experienced electronic engineer, who can use them properly. Some of the equipment needed for calibration are artificial ear, artificial mastoid/bone calibrator transducer, microphone, sound level meter, distortion analyzer, oscilloscope, audio frequency output meter, audio oscillator etc.

REHABILITATIVE EQUIPMENT

HEARING AID

Hearing aid is a personal amplification device worn on the individual and it helps to amplify the on coming sound signals.

After the evaluation of hearing thresholds, it becomes the job of the audiologist to provide the client with an appropriate hearing aid for the hearing loss, if it cannot be treated medically/surgically. The audiologist will have to evaluate the patients properly and determine which type

of aids are needed and then investigate about their availability. Ordering of hearing aids can be done in different ways, such as mentioned below:

i) the different types of aids can be purchased in bulk and stocked.

ii) another method could be to stock only those that are used for hearing aid evaluation. Once a hearing aid is recommended it can be ordered.

There are various types of hearing aid such as body level aid, behind the ear, in the ear, in the canal, eyeglass and CROS. Hearing aids can be classified based on the acoustic output like mild, moderate and strong gain hearing aids. While purchasing the hearing aids, one should look at the physical and electroacoustic properties.

The approximate cost of hearing aid and spares such as batteries, cords etc. are mentioned herein:

Hearing aids and its spares	Approximate cost(in Rs.)
Body level hearing aid	1200 - 2600
Behind the ear	4000 - 7500
In the ear/canal	6800 - 18000
Eye glass	9500
CROS	12000 - 16000

Spares:	
Batteries	11.75 per pair
Cord: Single cord	15 - 20
V/Y cord	30 - 40
V cord (3 pin)	32

SERVICE AND REPAIR

Requirements for the repair of hearing aids are as follows - multimeter, signal injector (battery operated), soldering iron, cutter, watch screw-driver set, forceps of different sizes, battery holder, brush, cotton, spirit, etc.

ASSISTIVE LISTENING DEVICES:

Assistive listening devices are those which aid an individual with hearing-impairment to listen better. An FM (Frequency modulated) system is one such personal device, that canbe used with children. Various other devices are also available presently, that aid the hearing-impaired child, in everyday situatins.

INSTRUMENTS FOR MEASUREMENT OF ELECTROACOUSTIC CHARACTERISTICS/INSERTION GAIN OPTIMIZATION OF HEARING AIDS

Electroacoustic measures are measurements of input-output functions ie. they measure how the output varies from the input signal.

Electroacoustic characteristics can be measured in the laboratory, in anaechoic chamber, or hearing aid text box. Instruments used to measure the electroacoustic characteristics should confirm to one or more standards (ANSI, IS, HAIC, IEC, etc.). While purchasing the hearing aid analyser, one should look at the technical specifications and accessories. The equipment for measuring IGO/ electroacoustic characteristics would approximately cost Rs.4 lakhs.

EARMOLD LABORATORY:

An earmold laboratory requires consumables and non-consumables which have to be procured. Apart from a physical set-up of an earmold laboratory, items such as work benches, wash-basins etc, the following would be the minimum requirements for setting up an earmold lab. The firm dealing with the dental materials would be able to supply the majority of the items.

Dental lathe (Rs.4000) and hanging motor (Rs.1000) are the only major investment items. Dental flask can be used as an earmold flask.

The following materials/instruments are used in the earmold lab, also their approximate cost is mentioned:

Materials	Cost/Approximate (in Rs.)
1) Plaster of paris	140 for 20 Kg.
2) Impression material (alginate)	400 for 750 gms.
3) Acrylic (hot cure)	1200 to 3 Kg. 900 for 4 lit.
4) Acrylic (cold cure)	800 for the set
5) Pumice for polishing	20 per Kg
6) Vasiline	38 for 400 gms

The following instruments are used in the earmold laboratory:

- Dental flask with clamp
- Dental lathe
- Hanging motor with straight handpiece.
- Rubber bowls
- Plaster spatulae

- Plugger
- Wax carver
- Plaster Knife
- Earmold rings
- Electronic stove for curing
- Proses
- Excavator
- Spirit lamp
- Acrylic trimmer
- Fishure burs and round burs
- Brushes for polishing

Most of the above mentioned items, will be available in any of the local dental depot.

ii) PROCUREMENT

The task of buying an equipment, often evokes apprehension, and sometimes anxiety in prospective purchases. A good purchase is a result of planning and multidimensional business decision. The person should have an up-to-date knowledge in the field. One should have the following information about the instrument:

i) one should have information regarding the technical specifications of that instrument.
ii) details about the accessories required with the instrument.
iii) one should know the cost of the instrument and accessories.
iv) whether the instrument is indigenous or imported.

The instrument chosen should meet the requirements of the user. Reputed and well established companies may be chosen when more than one instrument is required. Priority may be given to those from whom some other equipment is already purchased and is working to one's satisfaction. An Indian dealer should be available if the instrument is imported. If there is the possibility of expanding the facility's services, then equipment to be purchased should

have broad enough capabilities to meet further needs and to be able to interface effectively with any future purchases. Preferably obtain information about particular piece of equipment, which you wish to buy, from other professionals, who have worked on it. It is advisable to see the various pieces of equipment and also handle the equipment during exhibits in conferences, seminars etc. After making a checklist, the next step would be to contact the manufacturer or the instrument dealer.

BUYING A USED EQUIPMENT

When considering the purchase of used equipment, the following questions should be asked:

1. Is it in good working condition?
2. Is it still in production?
3. Can one get spare parts for it?
4. Was it manufactured by a reputable supplier?
5. Does the local manufacturer service the product?
6. How old is the equipment?

One advantage of purchasing used equipment is the cost factor.

HOW TO BUY AN INSTRUMENT:

Before buying any instrument one must have detailed information about that instrument. Such information is collected before making the budget. The equipment is then listed on priority of use. Once the list is prepared, the following information regarding the instrument is listed:

1) Name of the instrument as given by the company.
2) Accessories that might be required by the instrument.
3) Estimated cost of the equipment.
4) Justification for the use/need of that equipment in the department.
5) Proforma invoice, product literature and proprietary item certificate should be collected before requisition is made to higher authorities.
6) The equipment list is referred to the committee concerned, along with justification, which either approves it or rejects it depending on the sanctioned budget.
7) If the equipment is approved, then quotations are called from the firms, which manufacture that instrument.
8) As the equipment is delivered from the manufacturing unit, payment is done either through bank, or directly from the organisation to the company.

Along with the equipment the accessories are also purchased. Purchase can also be made by credit bill payment.

Instruments can be purchased within the country or outside the country. For the import of equipment, some additional steps have to be taken care of. Before purchase of equipment from foreign manufacturers, one has to get a "no objection certificate" (NOC), from the Director General of Technical Development (DGTD) and 'Not Manufactured in India' (NMI) certificate has to be taken from the Department of Commerce. Another approval is the 'Customs Clearance Permit" (CCP), which needs to be obtained from the Chief Controller of Import and Export. This is done to make way for the instrument without any problem at the custom.

While purchasing the instrument, check whether it has accessories or not. If so, whether it is optional or a standard one. If the accessories are indigenously available then it is better to purchase indigenously, than import it, as it is cost efficient. Owing to the hikes in the price, one may purchase the accessories in bulk. However, the shelf life of such purchases must be considered.

THE FINANCIAL MANAGEMENT

THE BUDGET PROCESS:

Audiologists, as well as practising professionals need both insight and instruction regarding their budgeting responsibilities or there should be specialists in budgetary processes to work with the department.

THE CAPITAL BUDGET:

The capital budget concerns the purchase of new equipment. There may be two kinds of capital budget projections requested, those for the current year and those for the long range planning.

The current year's budget will include all the department's capital needs regardless of the amount. The head of the organisation/director ranks them in the order of importance and identifies each, as an addition, a replacement or an improvement. The director is usually required to write a brief description of the item and discuss how it will support the goals of the department and the centre.

THE ANNUAL OPERATING BUDGET

Regardless of the type of budget process used, the process begins with a budget calendar. The controller directs the overall budget process and assists the development of reasonable projections of the departmental activities. Further, the director's professional expertise and judgement should prevail in budgetary decisions.

Budget projections are based on data from the department, statistics and data provided by the financial organisations.

DEPARTMENT ACTIVITY

This can be expressed in several ways such as, number of treatment hours or number of procedures. In making projections it is helpful to:

* Observe changes in activity, study their causes and determine the trends that will continue.
* Anticipate changes in patient flow.
* Consider the impact of new services and/or equipment.
* Consider changes in standards of care, staff or maintenance philosophy.

PRODUCTIVITY AND STAFFING:

Productivity can be stated in terms of calculating the time taken per procedure and convert it into treatment hours. A productivity goal is a necessity in determining all staffing needs. Factors to consider in determining this goal are:

a) Observed . changes from year to year, their causes, and possible trends.
b) Achievement of the previous year's productivity goal.
c) Anticipated changes that would affect the staffing patterns.
d) Impact of the new services and equipment.
e) Changes in standards of management philosophy that will affect staff.
f) Decisions regarding modification of the pay scale.

EXPENSE PARAMETERS:

Estimates of department expenses must consider every item of expenditure including wages and salaries, fringe-benefits, minor equipment purchases, educational activities, travel and supplies. A unit of measure is selected for each expense to show, how it is distributed over the burgest

year eg. monthly or semi-annually. These factors should be considered:

if a unit of measure adopted is appropriate for the type of expense incurred.

if trends and their causes other than inflation are identified.

- if any unanticipated new costs arise, such as maintenance, contracts for equipment on which the "free-service warranty" has expired.

WAGE AND SALARY SCALE:

Since a significant portion of the department expense is wages and salaries it is important to understand how these are determined and applied to audiologists etc.

Rowland (1984) states that after a job analysis is done and a job description developed, pertinent information about the specific nature of the job, is collected. Following the data collection, information is obtained regarding the salaries of comparable jobs in the community and the surrounding areas. The current job market and the cost of living are also aspects to be considered.

BENIFITS:

Benefits include paid vacation, sick and holiday time and some form of health insurance coverage. The health insurance plan may include outpatient services. Life insurance, long-term disability insurance and accident insurance are also significant benefits. It is important that the director of the service and supervisors make an attempt to provide appropriate training to their staff members. The success of the service depends on the willingness and ability of the individual staff members to market the service to patients, to other professionals and to the community.

CHARGES FOR HEARING SERVICES:

Chargesare based on amount of time spent with the patient, regardless of the type of patient or the type of disorder. Some services have a set charge for evaluations while others base the charge on the amount of time spent.

Several variables must be taken into account before establishing the charges in audiology, such as staff-time per procedure, test interpretation, equipment, maintenance

of equipment, space and supplies- The counselling time involved, the hearing aid fitting and service should also be included. Therefore a per procedure charge must be developed that takes these factors into account.

PAEDIATRIC AUDIOLOGICAL ASSESSMENT

(i) HEARING EVALUATION

The basic purpose of an audiological evaluation is to obtain information to identify an auditory disorder, to assess the degree of handicap and provide a plan for the management of the auditory disorders. Hearing evaluation does not consist of a single test but a battery of tests. The main purpose would be to determine how much of hearing loss the child has, whether it is unilateral or bilateral, and which are the parts of the ear that are causing the hearing loss. The ability to hear and understand speech are also tested.

All the hearing health care professionals do not use the same tests or use the same test material. However, the following table presents the more common types of tests. These tests are minimum to expect, as a part of paediatric hearing evaluation. Correct interpretations of these tests are as important as administration. The hearing evaluation usually includes the following:

i) Case history

ii) Behavioural observation audiometry

iii) Pure tone air/bone conduction tests

iv) Speech audiometry

(i) Speech Reception Tests

(ii) Speech Discrimination Test

v) Acoustic immittance test

vi) Most comfortable listening level/uncomfortable listening level

Other evaluations such as electro-cochleography and brain stem evoked response audiometry can also be carried out. But this depends upon the availability of equipment, trained professionals, time, funds etc.

CASE HISTORY

The audiologist will either ask the parents, relatives or other informants about any significant history, or the parents themselves volunteer to give the information. Few of the questions that need to be asked are:

1) How long have you noticed the problem?
2) Is the hearing poorer in one ear than in the other ear?
3) Was it sudden or gradual or have you noticed any changes in hearing?
4) Is there any significant prenatal, postnatal history?

5) Whether any one in the family has had a hearing problem?
6) Does the child experience pain, drainage or gets wax build up frequently?
7) Does he have any ringing noises in the ear?
8) Is there any history of ear surgery or ear injury?
9) What are the different type of auditory stimuli that the child responds to?

BEHAVIOURAL OBSERVATION AUDIOMETRY

It is a localisation procedure, which may or may not require response consequation (Fulton, 1978). It refers to the audiologists' attempts to elicit observable responses to sounds. The response can either be reflexive or voluntary (operant) which are temporally related to the auditory stimuli. It is applicable to infants above 3-4 months of age. Various stimuli (eg. warble tones, speech, noise) are presented through loudspeakers, which are placed at an angle to the child, and behavioural response or the orientation response is observed.

PURE TONE AUDIOMETRY

Pure tone tests for hearing are the most basic tests used by audiologists (Allen and Fernandez, 1960, cited by

Price, 1978). These tests are termed as 'Routine - Audiometry' as practically every audiologist uses these tests in the evaluation of children who are normal in all respects and are older than around 7-8 years, the standard procedure can be used. But in younger age groups and those with multiple handicap, mental retardation, the standard procedure cannot be adopted. Therefore, in order to evaluate such cases, modifications of the standard procedure must be used. Therefore, tests based on the operant paradigm are used. These tests can be classified based on the consequences used. The main categories are:

i) techniques using picture consequation

ii) techniques using mechanical toy consequation

iii) techniques using tangible consequences.

SPEECH AUDIOMETRY:

Speech audiometry can be defined as a set of procedures which allows for systematic presentation of carefully selected speech stimuli through a calibrated communication system and controlled environment (Fulton and Llyod, 1975). Speech audiometry mainly deals with the dimensions of speech perception process.

i) **Speech Detection Threshold:** Which may be defined as the level at which a listener may just detect the presence of an on-going speech signal and identify it as speech (Martin, 1978).

ii) gpeech Reception Threshold: defined as the lowest hearing threshold level at which at least 50% of a list of spondiac words can be correctly identified (Martin, 1975).

iii) **Speech Discrimination**: it is a measure of the ear's ability to understand speech at a suprathreshold level.

Thus the speech audiometric measures aid the clinician to make an accurate assessment of the handicapping effects of the hearing loss.

IMPEDANCE AUDIOMETRY:

Any pathology affecting the middle ear structures will impede the conduction of sound to the inner ear and thus might adversely affect the development of the child. Impedance audiometry aids in the determination of existing middle ear pressure, tympanic membrane mobility, eustachian tube function, continuity and mobility of middle ear

ossicles, and the condition of sensorineural system (Northern and Downs, 1974).

TYMPANOMETRY: It refers to the measurement of the compliance or the mobility of the tympanic membrane as the pressure is varied in the external ear canal (Northern and Downs, 1974).

ACOUSTIC REFLEX THRESHOLD: It can be defined as the signal threshold level at which the stapedius muscle contracts (Northern and Downs, 1974).

Thus impedance audiometry provides information regarding the threshold of sensitivity, the type of loss, and the type of pathology and to some extent the site of lesion.

COMFORTABLE AND UNCOMFORTABLE LOUDNESS LEVEL

These additional measures are incorporated into the test battery, if the clinician determines that hearing aid will be useful to the child. These levels can be established using puretones or speech or both. As the test name implies, these are the loudness levels at which the child will find the puretones or speech to be most

comfortable to listen to and the point at which they become uncomfortably loud. It is important to determine how much hearing aid should amplify so that it is comfortable to the child/infant.

(ii) AMPLIFICATION STRATEGY FOR HEARING IMPROVEMENT:

An integral part of any comprehensive habilitation program for a child with hearing-impairment, is appropriate amplification. There are various methods of amplification, some principles of amplification and their variables are high lighted below.

Infants can be fitted with a hearing aid as soon as their hearing loss is confirmed, even prior to the age of 3 months. Even children with profound hearing losses benefit from hearing aids. However, even with the use of the most efficacious amplification, individual speech sounds are mostly perceived as noises by the profoundly impaired child. Nevertheless, the task of speech and language development is benefitted by adequate amplification, especially when this is accompanied by an appropriate educational program started at an early age.

Another important aspect of amplification, is that the residual hearing must be fully exploited effectively. If this is not achieved, then faulty amplification must be suspected.

Guidelines for the amplification in children differ from those in adults. Any approach to hearing aid assessment in young children must consider the speech, language and vocal factors in a systematic manner. Progression of the hearing loss may also be expected in cases of viral infections, and delayed inherited hearing losses.

SPEECH SPECTRUM:

The principle of 'speech spectrum' must be considered in the auditory process of normal human hearing and aided hearing. The sensitivity curves of the normal human hearing permit an audiogram of a hearing-impaired person to be compared directly to the levels shown.

In addition to its primary function of speech detection, other spectral information may be obtained by amplification into the speech spectrum. Also to have a

control of the suprasegmental aspects of speech, amplification must reach the speech spectrum.

HEARING AID ASSESSMENT:

How well a hearing aid is serving an individual may be evaluated in several ways. In the adult, a hearing aid is well fitted when it allows the person to monitor the speaking voice so that soft voice quality and good speech timing may be achieved. However, such characteristics cannot be evaluated in the hearing-impaired child, who has little or no speech. The following assessments of the hearing aid should be made:

i) SOUND FIELD AIDED AUDIOGRAM:

This test examines the subject, the hearing aid and the mold, and hence it is critical. In the hearing-impaired child, aided test scores confirm the hearing aid functions needed to hear the speech sounds, since amplification puts the sounds in the speech spectrum.

ii) HEARING AID ANALYSIS:

The hearing aid analyser consists of a microphone, a coupler that represents a model of the ear, and a generator that transmits a wide range of sounds. Hearing aid output performance is measured with the analyser, which also detects distortion in the aid that cannot be discerned by the examiner's ear. Other information provided by the hearing aid analyser is frequency response level of gain at each frequency and in some cases information on the status of the mold.

iii) OBSERVATION:

Observation by the educator and parents is indispensible in monitoring the hearing acuity of a hearing-impaired child, and the function of his or her hearing aid. If a difference in hearing and listening ability is noticed at that point it is necessary to examine the hearing (aided and unaided), analyse the hearing aid and recommend for middle ear examination.

It is also best to evaluate each individual while wearing several ear level and body type of amplification for each child. However, most educators believe that for

children with profound hearing loses, and low frequency 'corner audiograms', use of residual hearing is best served by body level hearing aids. As the child becomes older, the switch can be made to ear level hearing aids for greater gains in the higher frequency.

HABILITATION AND EDUCATION OF DEAF AND HARD-OF-HEARING CHILDREN

Hearing-impairment leads to a broad array of symptoms that affect all aspcts of speech and language to a large extent. In general, the more severe the hearing loss, the greater the impact, but even mild hearing problems can have serious consequences for the development of language in children (Roeser and Downs, 1981; Nothern and Downs, 1978; Davis, Shepard, Stelmachowicz and Gorga, 1981).

Parents initial concern about their child's hearing-impairment is its effect on the development of speech. Their emphasis is on oral production without realization of the depth of impairment and its impact on language itself (Moores, 1987). Usually the first people with whom they have extended conversations about hearing loss and its implications are the audiologist who make the initial diagnosis. Because hearing-impairment may directly or indirectly affect functioning in several developmental areas as well as possibly coexisting with other handicapping conditions, the audiologist must recognize that recommendations for training and education must be made by an interdisciplinary team. The audiologist cannot and should not function autonomously.

Audiologist must have a broader understanding of the issues that are specific to hearing-impaired children. They must approach each child and family on an individual basis and must wait for the results of the comprehensive interdisciplinary assessments before making any predictions or promises.

CENTRAL ISSUES IN UNDERSTANDING AND PLANNING HABILITATTON

The audiologist dealing with hearing-impaired children should:

1) Understand the impact of hearing loss on speech and language development. This includes an awareness of the impact of chronic otitis media, unilateral hearing loss, and mild to moderate degrees of hearing loss on learning. It is of particular importance that the audiologist convey the difference between speech and language to families.

2) Be trained and experienced in the diagnosis of hearing loss in paediatric population. This will ensure that assessment is conducted reliably and efficiently. This, in turn will minimize the time between diagnosis

of hearing loss, fitting of amplification and the initiation of intervention.

3) Be familiar with various amplification devices, so that the child is provided with an optimal auditory signal under a variety of listening conditions. Amplification system might include personal hearing aids, FM auditory trainers and vibrotactile devices.

4) Be familiar with the array of educational options available to families and children, including, among others, the acoupedic approach, aural - oral approach, total communication, expectations for child with cochlear implants, etc.

5) Be familiar with resources available to families within the geographic region.

6) Keep abreast of research regarding the effectiveness of various intervention strategies on the performance of hearing-impaired children.

7) Have knowledge and experience in how to communicate with families in supportive and clear manner (Luterman, 1979).

INTERDISCIPLINARY TEAM ASSESSMENT:

Effective planning for the hearing-impaired child can be accomplished best through the efforts of an interdisciplinary team. The team members bring expertise in their individual experience and knowledge in the special needs of hearing-impaired children. The parents too need to be included in the assessment and management process so that their strengths, needs and priorities for their child can be assessed.

An assessment team for a hearing-impaired child should include: (a) Audiologist (b) Speech Language Pathologist (c) Psychologist (d) Social Worker (e) Teacher for Hearing-Impaired (f) Family Members (g) Any medical specialist who would enhance the understanding of a child's specific needs Eg. Otologist, Paediatrician.

AUDIOLOGIST'S ROLE ON THE TEAM

Ideally the audiologist is responsible for providing information about:

i) type and extent of hearing loss (eg. conductive vs.sensorineural, permanent vs. intermittent, static vs. progressive).

ii) the child's amplified hearing (how much of the speech signal is within a child's range of audibility).

iii) how amplification should be set and used under a variety of listening conditions.

iv) how often hearing should be re-evaluated both aided and unaided, to assure that the child is receiving an optimal signal. In addition the audiologist should explain these findings to other professionals and the child's family.

Finally, the audiologist can perform a very useful ongoing diagnostic function by working with a child's teacher, therapists and family. Frequently observations outside the diagnostic setting can establish the need for adjustments of amplification equipment or to Taring to light a change in hearing status.

REQUIRED AUDIOLOGICAL INFORMATION

The following information and test results are required by any school, to program effectively for the child.

1. Annual otological evaluation.
2. Annual audiological evaluation:
   a) Immittance testing for each ear
   b) Puretone air and bone conduction testing for each ear
   c) Spondee detection threshold testing (SRT) for each ear
   d) Speech detection threshold testing for each ear if SRT cannot be obtained

e) Word discrimination scores for each ear

f) Most comfortable and uncomfortable loudness levels for each ear.

3. Semi-annual amplification/implant assessment:

a) Electroacoustic analysis of each hearing aid or FM worn by child.

b) Speech processor map/tune up as necessary.

c) Warble tone sound field threshold testing (from 250-4000 Hz) binaurally.

d) Spondee detection threshold for each ear and binaurally

e) Word discrimination scores for each ear and binaurally

f) Description of earmolds.

g) Hearing aid data sheet.

SPEECH/LANGUAGE PATHOLOGIST

Of all the team members, this group has the widest general background in the areas of speech and language acquisition and development the areas most affected by hearing loss. In general this professional should provide a comprehensive profile of the child's communicative functioning including the ability to understand and use

language (irrespective of whether signed and/or spoken) phonologically, syntactically and pragmatically. In addition, the assessment should address any factors that would impede the child's ability to develop communicative competence (eg. physical factors, such as impaired oral motor coordination, or social problems). This team member should develop a plan for intervention based on the results of the assessment, that includes goals for the child in three areas (1) development of use of residual hearing (in conjunction with audiologist) (2) development of speech (3) development of receptive and expressive language.

ASSESSMENT COMPONENTS:

Audiological evaluation:

Maddell (1989) summarizes the fundamental components of an audiological assessment as -

1) Unaided (puretone audiometry, speech recognition testing, and immittance testing)
2) Sound field testing (aided and unaided)
3) Real ear measurements.
4) Electroacoustic analysis of amplification equipment.
5) Comprehensive written report.

Maddell (1989) discusses the importance of early and appropriate selection of an amplification system as being

the single most habilitative tool for the hearing-impaired child.

Speech and Language evaluation:

The speech and language evaluation must be comprehensive as these are the areas primarily affected by hearing-impairment. When assessing the child's production skills and the ability to improve speech production, four areas should be investigated (1) auditory speech perception (2) phonetic production (3) phonologic production (4) speech intelligibility (Dunn and Newton, 1986; Osberger, 1983).

TEAM PLANNING

When assessment is completed, ideally all team members meet together to review the results of their testing and to develop a plan of action that meets the strengths and needs of the child and the family. When such a plan is developed by the school, it is known as an individualised education plan (IEP). For very young children this plan must be reviewed and updated at least every six months, for older children, the review is annual or sooner, if needed. Key issues such as (a) educational approach that

will be used (b) the educational setting that will be most appropriate are addressed. The resources within the region are also explored. The plan will include:

1) Long and short-term goals.
2) A description of who will provide services
3) How the services will be delivered (eg.frequency, duration, individual versus group) to meet the goals.
4) An evaluation component to review whether programming has been effective.
5) Any special support services that the child may require (eg. FM system, tutor-notetakers, interpreters etc.).

Major Distinctions In Educational Approaches:

After a comprehensive assessment, the team selects intervention strategies for enhancing the child's ability to understand and use language. It is generally agreed that auditory training and speech training are key elements of the education of the hearing-impaired child. The great distinctions between educational approaches for the hearing-impaired is whether the approach also uses a manual form of language. Those that do not include a manual form are known as oral options and may or may not include the visual support of speechreading.

ORAL OPTIONS:

Within the oral options, there are subtle distinctions regarding the relative emphasis placed on the use of residual hearing and vision. In general, children who learn language through oral method, receive input through a combination of speechreading and amplification of sound while expressing themselves through speaking. There is no use of formal sign language or finger spelling. The approach most nearly mirrors the normal path to speech and language acquisition.

Ling (1984) and Gatty (1987) report that there is much individual variability in children's ability to acquire speech by using the oral approach - some are very successful, some are not. Factors that seem to influence degree of success include the amount of residual hearing, the absence of additional handicaps, and degree of parental involvement.

UNISENSORY APPROACH

This is a subcategory of the oral approach. It posits that oral communication skills are acquired most naturally

through audition. Young children are not directly encouraged to adopt visual speechreading strategies and visual cues are withheld as much as possible. Communication training is conducted with the speakers mouth covered so that the child relies exclusively on auditory information.

The kind and type of auditory training that a hard-of-hearing child needs depends on the type and degree of hearing-impairment.

Generally, this type of child is one who has a profound loss and without amplification does not hear the ordinary sounds of life sufficiently well to pay attention to them. Such a child needs to be taught, first of all, that sound vibrations can be meaningful. At start, it will be necessary to make the child aware of the different sounds that exist in the environment and the differences among these sounds. Carhart has described this process as the gross sound discrimination. Thus the child should be taught that the bell and a horn make different sounds, and these objects can be differentiated on the basis of their sounds.

After the child has learned to distinguish gross sounds, the next step is to recognize the elements of

speech. Preferably, this training should be based on whole words. If the child is able to associate the word ball with the object for which it stands, there is no need to spend time on the recognition of the separate sounds that make up the word. If however, the child confuses the word 'ball', with the word 'bell', it may be necessary to teach the acoustic differences between the vowels ah and eh. If work on sounds is necessary, auditory training should start with the vowels, which are acoustically more easily distinguished than are the consonants. A reasonably good mastery of fine speech discrimination is a prerequisite to the understanding of speech. Working with paired words that differ only in the consonants present (minimal pairs) is a good technique for the child with a loss for the higher speech frequencies. At the start, the therapist may have to say each word while pointing to the printed word or to the picture that the word represents and while the child watches for speechreading cues. After extensive practice, however the child can learn to make many distinctions on the basis of hearing alone.

CUED SPEECH:

Lying midway between oral options and options that use a manual form of language is cued speech (developed by

Cornett, 1967). It uses a system of eight handshapes and four hand positions, shown near the face. Research concerning the use of cued speech as a tool for first language acquisition and as an educational method is gradually being generated and has shown promise for the reception of language by young children (Nichous, 1979). Cued speech can be used to teach phonics, to provide a visual referent for words for which there are no formal signs, for nonsense words that occur in children's rhymes and songs (Otero, 1986).

TOTAL COMMUNICATION:

Gutason et al (1972) points out that total communication (TC) is neither a method nor a prescribed system of instruction, but rather a philosophy. Moores (1987), states "A total communication philosophy endorses the right of every hearing-impaired child to communicate by whatever means are found beneficial. Communication might be by speech, by signs, gestures, by writing or by some other means depending on the circumstances". The term therefore, embraces all forms of communication and the selection of one form or another depends upon the needs of the individual and the particular situation.

Ling (1984) summarizes the major tenets of a total communication philosophy as follows:

1) All visual - manual and/or auditory roles in the communication process are complimentary.
2) Early identification and full acceptance of the child as a hearing-impaired individual by both the parents and the school are necessary to ego development and self concept.
3) Total communication should begin when the disability of deafness is first diagnosed to provide for immediate communication learning and language development.
4) Increased learning potential is achieved with the added dimension of a multisensory approach.

A variety of sign systems are currently in use in total communication programs. These include the sign systems that have been invented to manually code the various languages eg. American Sign Language.

COCHLEAR IMPLANTS

Although not specifically an educational option, the use of cochlear implants in paediatric population presents

an alternative when traditional amplification equipment has been unsuccessful. Children with implants are found in both oral and total communication programs, and it is incumbent on personnelto be knowledgeable about the devices and the development of auditory and speech skills for children using them (Moog and Geers, 1991; Tye-Murray, 1992). Contact with an educational specialist from a cochlear implant team can be extremely helpful (Nevins, et al. 1991).

It is extremely difficult to compare research regarding the efficacy of one educational mode/philosophy with another because over the course of time those children who begin in oral only options and are not successful find their way into total communication programs. The authors through a comprehensive review of the literature and practical experience with hearing-impaired children, have come to agree with Moores (1987) with respect to selection of educational options for hearing-impaired children. Moores (1987) stated 'If there is any chance that sole reliance on auditory-vocal communication will present a child with difficulty, oral manual communication should be initiated immediately. Withholding the manual communication until a child "fails" orally is disservice to the child'.

We must however emphasize that all components of an auditory oral program must be in place. That includes fastidious care of amplification equipment, emphasis on the development of residual hearing, training for the development of oral speech and family participation and cooperation. There is no reason to wait before incorporating the use of visually supported communication.

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