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EFFECTS OF A CONCENTRATED PROGRAM
OF EDUCATION ON THE ATTITUDES
OF HEARING IMPAIRED ADULTS

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GAIL MOIRA WHITELAW

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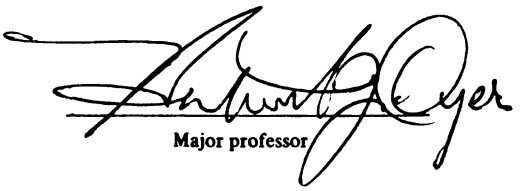

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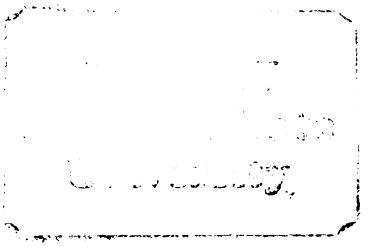

EFFECTS OF A CONCENTRATED PROGRAM OF EDUCATION ON THE ATTITUDES OF HEARING IMPAIRED ADULTS

BY

GAIL MOIRA WHITELAW

A THESIS

Submitted to
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ABSTRACT

EFFECTS OF A CONCENTRATED PROGRAM
OF EDUCATION ON THE ATTITUDES
OF HEARING IMPAIRED ADULTS

BY

GAIL MOIRA WHITELAW

It has been suggested that the information which a hearing impaired person has pertaining to hearing and hearing loss may affect his/her attitudes towards his/her hearing loss. Yet, the literature reflects a lack of research in both informational and affective counseling aspects of audiological rehabilitation for adults.

The problem under investigation was to determine whether a relationship exists between the information level and attitudes towards a hearing loss in hearing impaired adults. If a relationship was found to exist, the question was to determine whether attitudes could be changed by changing informational levels.

Six hearing impaired adults participated in a group short-term concentrated education program. A multiple-choice test and the Denver Scale of Communication Function were administered individually both pre- and post-program.

Results of this study revealed significant changes in information level occurred after participation in the concentrated education program. Significant changes in attitudinal levels were demonstrated for thirteen out of the twenty-five items of the Denver Scale of Communication Function after participation in the education program.

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Thanks to Mary, Rod, Kim, Judi, Fred, Claire, and Cyndie - I am very proud to call them both friends and colleagues. Special thanks go to Kim for sharing the same dream in a different way - I will never forget her encouragement and understanding.

With much love, I thank my Mom and Dad for always encouraging me to do it all - and for the sacrifices they made so that I could.

Finally, I thank Ray for believing in me even when I did not believe in myself. For his love, I will always be grateful.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

In 1974, the American Speech and Hearing Association (ASHA) Committee on Rehabilitative Audiology--in recognizing the relationship between self-concept, adjustment, and success in a rehabilitation program--recommended that counseling be included in the audiological rehabilitation services available to the hearing impaired population (ASHA, 1974, p. 68). This statement supports the need for counseling with the hearing impaired as a step in the audiological rehabilitation process. Currently, very little research has been done in this area (Oyer and Frankman, 1975). This lack of literature is in keeping with Sanders' (1982) belief that management of the needs of the adult hearing impaired are characteristically ignored, since "it is commonly felt that the adjustment the adult must make to their hearing impairment is not great" (p. 401). The lack of research in this area, accompanied by the lack of training that audiologists receive in the management of non-audiological needs of the hearing impaired adult, is an unfortunate situation (Sanders, 1982; Pollack, in Alpiner, 1978).

Cooper (1982) emphasizes that:

> Clinicians are less confident in their counseling skills than they are in their behavior modification skills. We appear to know how to change behavior but are less certain as to how to change feelings and attitudes (p. 9).

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Sataloff (1966) states that one cannot restrict a hearing loss to the ear itself, since it is impossible "to divorce the ears from what lies between them" (p. 340). Too frequently audiologists lose sight of this fact and focus their rehabilitative attention on the defective ear, instead of viewing the client as a gestalt, with attitudes, assumptions, personality characteristics, and a self-concept that may affect his/her performance in a rehabilitative program or communication abilities in general. Thus, the audiologist should assess the attitudes that the client has towards his/her hearing impairment and evaluate the knowledge the client has pertaining to hearing and hearing loss in general. This information may help to determine whether this knowledge, and these attitudes and assumptions may be affecting his/her performance in a rehabilitation program. Giolas (1982) supports this position in his description of two of the major responsibilities of the audiologist: assessing the handicapping effects the hearing impairment has upon the client, particularly upon their communication abilities, and gauging the success of any procedure utilized in the rehabilitation of the client in terms of alleviating or minimizing these handicapping effects. If the goal of audiological rehabilitation is to assist each client in achieving his/her optimal level of communication functioning accompanied by an understanding of, and in turn, a successful adjustment to, the hearing loss, then this assessment and evaluation along with informational and affective

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counseling are necessary in tailoring a management program to each client's needs.

There is an underlying presumption that hearing loss affects a client's self-concept and emotional adjustment, both of which may affect his/her communication, behavior and performance in a rehabilitation program. This presumption is supported by a variety of sources. Of course, several variables may interact to affect a client's reaction to a hearing loss--including age of onset of the hearing loss, configuration of the hearing loss, manner of onset of the hearing loss, and individual differences (i.e., home life, health, intelligence, and presence of other disabilities). Rosenthal (1975, p. 201) states that hearing loss "inevitably affects behavior," since the hearing impaired person must focus extra concentration on the words of others, is deprived of sound, may fear being labeled as "stupid" and may have the desire to isolate himself/herself; these factors inevitably induce some personal adaptations. Galbraith, as cited by Ballantyne (1977), indicated that "An acquired hearing loss brings an inevitable deterioration in the individual's security and self-esteem" (p. 213). Ramsdell (1960) emphasizes that the loss of hearing is not usually the most significant loss experienced by the hearing impaired adult; it is the fact that the loss of hearing often results in a reduction or loss or relationship with the world that is primarily maintained via auditory contact. Thus, the sense of being alive is lost (p. 501).

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Compounding his/her attitudes toward the hearing loss, the hearing impaired adult must also deal with the reactions of others toward his/her hearing impairment. It is rare for the loss of hearing not to affect the hearing impaired person's family relationships; often both family members and friends may be resentful at the need to repeat or become impatient that the listener cannot pick up on innuendos (Rosenthal, 1975, p. 200). In a study examining the family integration of hearing impaired homemakers, Oyer and Paolucci (1970) found a positive correlation between the amount of marital conflict/tension experienced by husbands and the severity of their wife's hearing losses. Hearing impairment has been classified as the invisible impairment since it does not manifest itself in outward signs, as do blindness and other physical disabilities; thus strangers, unaware of the hearing impairment, may be apt to classify the hearing impaired person as stupid or snobbish.

All too frequently ignored is the fact that the loss of hearing is just that, a LOSS. Tanner (1980) describes grief as the "human reaction to loss" and indicates "loss is a fundamental aspect in any disability which requires rehabilitation since the client has lost a function which requires rehabilitation since the client has lost a function which he/she has previously possessed" (p. 916). In the case of hearing loss, a variety of reactions to this grief may occur. Rousey (1971) defines the major reactions to hearing loss as the defense behaviors of projection and

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denial. Schneider, as cited in Tanner (1980), has compiled information on reactions to loss and grief and has found three categories that the majority of reactions fall into -- attempts to overcome the loss, including denial, rage and bargaining; awareness of the loss; and acceptance of the loss. The order and progress of these stages may vary, but it is suggested that they are common to all who experience a loss. The audiologist must keep in mind that this process of grieving applies to all clients who are experiencing loss in any dimension.

Acknowledging the underlying attitudes, reactions, and assumptions that a hearing impaired adult is experiencing toward his/her hearing loss is very desirable in the development of a rehabilitation program. Chermak (1981) states:

> Forstering psychological adjustment is of paramount importance to the audiologist in remediation. Only a well-adjusted individual can be expected to function at his/her full potential. Psychosocial adjustment must be an essential goal and concern of the client, his/her family, and the audiologist coordinating the remediation process. Individual reactions to disability is diverse and must be considered on an individual basis (p. 350).

If the client is denied the opportunities to explore and express his/her attitudes, reactions, and assumptions, the probability that the client may accept his/her hearing loss and the implications of that hearing loss may be reduced. Tanner (1980) stresses the importance of acknowledging the feelings of the client, as he discusses the client's feelings toward his/her hearing loss:

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> Interruption of the normal grieving process can reduce the patient's motivation for therapy and interfere with the client-clinician relationship; alter, postpone, and interfere with the short-term and long-term goals of rehabilitation; and contribute to the maintenance of counterproductive behaviors (p. 916).

Mykelbust (1960) suggests that if the audiologist fails to consider psychological factors and concerns of the client, a poor rehabilitative outcome may result, even in the presence of a successful speech reading and auditory training program coupled with adequate amplification. This is supported by Giolas (1982), who insists that the audiologist must have information about how the client feels about his/her hearing impairment if "the total rehabilitation program is to be optimally effective" (p. 51). If the audiologist is going to assist the client in becoming well-adjusted toward his/her hearing impairment, then the audiologist should be prepared to undertake a counseling program with the client for purposes of providing information and probing client feelings and attitudes.

The term "counseling," as it applies in the audiological rehabilitation process, refers to both informational and affective aspects. Audiologists generally have received most of their counseling training in the area of informational counseling, yet they are rarely trained to deal with the feelings of their clients. Chermak (1981, p. 361) contends that informational and affective counseling are interdependent entities and should be undertaken simultaneously as a step in rehabilitation. Luterman (1976) emphasizes this stand:

> ...in order for us as professionals to convey information, we must first allow the emotional issues to be worked through. We are not dealing with emotionally disturbed people, per se, but communication problems invariably have emotional components (p. 62).

Pollack (in Alpiner, 1978, p. 140) believes that for an audiologist to implement an effective rehabilitation program, he/she must be willing to deal with both affective and informational components of counseling.

Statement of the Problem and Purpose of the Study

The problem under investigation in this study is to examine the effects, if any, that a short-term concentrated counseling program, which focuses on informational issues, has upon the attitudes and knowledge of hearing impairment on hearing impaired adults.

The following questions were proposed:

1. Is there a relationship between the informational level which the hearing impaired adult possesses about his/her hearing disability and his/her attitudes towards the hearing impairment?

2. If a relationship does exist, is it possible to change the attitudes of a hearing impaired adult to his/her hearing loss by changing his/her informational level?

Importance of the Study

The amount of research currently available in the area of counseling and its effects on the audiological rehabilitation process is limited. Yet, the literature that is available is in agreement that if a rehabilitation program is to be motivating and meaningful for the client, both informational and affective counseling are vital. If it is found that the short-term, concentrated counseling program described in this study does have positive effects on the attitudes and knowledge of hearing impaired adults, additional support will be given to the importance of counseling in a rehabilitation program. Thus, this type of counseling program may have potential implications for use in the audiological rehabilitation process.

Definition of Terms

Subjects -- Adults, aged 18-65 years of age, who sustained a sensorineural hearing loss after having developed normal auditory discrimination of spoken English. These persons may possess any degree of bilateral sensorineural hearing loss, including mild to moderate, in which communication problems associated with speech reception or discrimination are sustained.

Educational Program -- Program developed by the researcher which presents information on various aspects of hearing and hearing loss to the hearing impaired adult. This program will be presented in four informational sessions.

Denver Scale of Communication Function (Alpiner, Chevrette, Glascoe, Metz, and Olsen, 1974) -- A communication scale which subjectively assesses the communication attitudes of adults with acquired hearing losses. This scale examines four areas of functioning: family, social-vocational, self, and communication.

Audiological (Aural) Rehabilitation -- A process to assist the hearing impaired individual in achieving his/her optimal communication potential. This term refers to a restoration of skills previously possessed by the hearing impaired person, thus this individual has acquired a hearing loss after developing speech and language skills. The rehabilitation process may consist of a variety of components including fitting with appropriate amplification, counseling of client and family, and developing, remediating, or conserving receptive and expressive language skills.

Counseling -- An interactive process between clinician and client in which the client gains a better understanding of himself/herself and his/her surroundings. A variety of methods, based on counseling theories, are available to the clinician. ASHA (1974) offers the following objectives of the counseling program:

1. Assistance in the resolution of pertinent problems [related to the disability]
2. Stimulation and motivation to achieve [optimum communicative potential]
3. Improvement of self concept and social relationships.

Counseling will be broken down into two components:

informational counseling and affective counseling.

> Informational counseling -- Advice and information given to the client pertaining to his/her hearing loss. This may include interpretation of diagnostic results, assistance in the understanding of the function of hearing, and suggestions to minimize the communication difficulty the hearing impaired person may experience.
>
> Affective counseling -- Counseling which focuses on the attitudes, feelings, and behaviors that the client exhibits to his/her hearing loss. This emotional component is closely intertwined with informational counseling since the client may experience difficulty in processing and assimilating information if his/her affect level is high.

Organization of the Study

Chapter I has included an introduction to the problem, the purpose of the study, the importance of the study, the definition of the terms, and the organization of the thesis.

Chapter II consists of a survey of the literature pertinent to the study of counseling of hearing impaired adults, including informational and affective considerations.

Chapter III describes the subjects, equipment, and testing procedures employed in the study.

Chapter IV discusses the analysis and results of the study.

Chapter V contains the summary of the study and conclusions.

CHAPTER II

REVIEW OF THE LITERATURE

Historically, the adjustment problems associated with the hearing impaired have focused primarily upon the needs of the deaf population, thus fostering the assumption that the person with a hearing loss, even though it may affect day-to-day communication, needs no special assistance or rehabilitation services, since his/her hearing problem is not significant. Alpiner (1969) states this point in viewing vocational services available to the hearing impaired. He indicates that the population of adults who have acquired a hearing loss, that may be in need of vocational readjustment counseling, fail to receive services since available services focus on the needs of the deaf or persons with severe to profound hearing losses. Traditionally, counseling services to both the deaf and hearing impaired populations have consisted primarily of vocational rehabilitation (although this appears to be changing with recent trends in rehabilitation counseling); if the vocational needs of the hearing impaired populations are being neglected, then various other psychological/adjustment needs of this population may be neglected. In reviewing the literature, this premise is supported--the literature available in the areas of the adjustment and counseling needs of the hearing impaired population is sparse in comparison to literature available in all other areas of audiology. The available literature

often focuses on the needs of the deaf, or generalizations about the behaviors and characteristics of the hearing impaired adults are made, which are not substantiated by research. Carmen (1977) supports this in his statement:

> Extensive research has been carried out in the area of hearing loss and its effects on the many aspects of human development. This research, unfortunately, has been primarily a study of those people afflicted with very severe or profound hearing loss (deafness) and therefore any generalizations made about this group or about deafness must be made with great caution as applied to hard of hearing people ... I am primarily concerned with a partial loss of hearing because there are so plainly a lack of materials available to inform professionals and hearing impaired people about what the affliction can do to change attitudes, ideas, direction in life, relationships, etc. The deaf as a population have been far easier to study and evaluate than hard of hearing groups ... We are only recently coming to realize that even a partial loss of hearing can have serious effects on one's life, the most significant being a feeling of separation (p. 5).

As early as 1923, Menninger (1924) examined "the mental effects of deafness" in a paper presented to the American Federation of Organizations for the Hard of Hearing. In this paper, he focuses on the "brain defect" (i.e., "diminution or loss of auditory perceptual tracts") in contrast to the "mind defects" of deafness. Menninger (1924) utilizes Freudian concepts and presents the following definition of deafness as a "mind defect:"

> Loss of hearing reacts upon the individual in the sense that any deprivation does, but it is augmented in its intensity by reason of the peculiar personalness of loss. It is as if something vital to ones existence has been torn from him. Psycholanalytic study has shown that

> the deprivation complex has many roots in the unconscious ... as a result of this deprivation (or rather, of these deprivations culminating in a deafness) there develops in the psyche, consciously or unconsciously, and as a matter of fact usually both, a sense of Inferiority (p. 146).

Types of compensation, divided into categories of satisfactory adjustment and unsatisfactory adjustment, are discussed by Menninger. Terms utilized in labeling neurotic and psychotic behavior are employed to examine methods of "decomposition," or unsatisfactory compensations towards deafness. Although he attempts to focus on the psychological effects of deafness, little differentiation between behaviors occurs based on hearing loss. Menninger tends to make some generalizations about behaviors of the deaf, yet these claims are not substantiated by clinical evidence.

Berry (1933) addresses the emotional aspects of deafness in a paper at the Eighty-Fourth Annual session of the American Medical Association. He discusses the adjustments made by the "progressively deaf" individual, which he focuses on lip-reading and hearing aid use ("the two crutches that the hard of hearing must rely on"), vocational measures, and social adjustment. An interesting postulation by Berry is that impaired hearing may be an asset rather than a liability for some individuals, since deafness:

> a) decreases the distractions and increases concentration, b) fosters constructive thought, though unfortunately the person may not have the creative genius to respond, c) and can and in some cases it does increase interpretative capacity of the other senses (p. 1601).

Berry offers more of a 'pep talk' for the deaf person than

constructive information on how the adjustment needs of the hearing impaired person may be met.

Knapp (1948) reports a study conducted at Deshon General Hospital, a World War II Army Hospital Center, which investigated the 'emotional aspects of hearing loss.' This study warned against making sweeping generalizations about patients with hearing loss, and concluded "the population of this study showed no one 'psychology of deafness,' but the psychology of many individuals defending themselves against a sensory handicap which lead primarily to difficulty in communication" (Knapp, 1948, p. 221). The study at Deshon Hospital attempts to dispell the assumption that the hearing impaired population manifest a greater amount of psychiatric disability than the population in general.

Ramsdell (in Davis and Silverman, 1960) offers one of the earliest attempts to examine the psychology of the hard-of-hearing adult, by exploring the personality/attitudinal changes that accompany a hearing loss, why these changes occur, and why they occur with a greater severity in those with acquired hearing loss than in those whose hearing loss is congenital. He states:

> ... [the loss of hearing] produces a psychological impairment more basic than the difficulty in communication. The characteristic depression [which accompanies a hearing loss] is caused by this subtle impairment. Recognition and understanding of the cause are necessary if the depression is to be overcome and not attributed, as is so often the case, to a character weakness in the deafened (p. 499).

Ramsdell offered three psychological levels of hearing

experienced by normal hearing individuals, as a means for further understanding the loss experienced by the person with the acquired hearing loss. These levels consist of:

-- the symbolic level, or level utilized in speech and language comprehension

-- the warning level, or level that serves to rouse an awareness of signals of events (i.e., a siren)

-- the primative level, or level which provides an auditory background and adds depth to the environment (i.e., birds chirping) (p. 501).

Although a hearing loss which affects any of these levels may be devastating, Ramsdell points out a hearing loss at the primative level can often be most disturbing. A loss at this level, which may accompany a relatively mild hearing loss, is generally accompanied by depression, since the person has the realization that something is missing although they may not be able to pinpoint what has changed. Davis and Silverman (1960) state Ramsdell's recognition of the "three states in utilization of hearing and particularly the importance of the 'feeling of oneness with an active environment' was a major advancement in the understanding of the deprivation and isolation of the deafened adult" (p. 506). Rousey (1971) notes Ramsdell's work as "the major initial contribution to the psychology of hearing and hearing loss" (p. 382).

Myklebust (1960) and Levine (1960) each offer a "psychology of deafness," although their primary focus is on the deaf individual. Individual psychological reactions to hearing loss are analyzed by Rousey (1971), who indicates

that common reactions to hearing loss include "mourning, shame, and lowering of self-esteem" (p. 328). Rousey's work is based on psychoanalytic theory, although in response to this work Rosenthal (1975) warns, "One should dismiss theories launched for esoteric or unverified psychoanalytic hypothesis" (p. 203-204). Rosenthal (1975) in his psychology of hearing impairment, emphasizes that people with hearing losses must be considered as individuals first. He suggests that hearing impairment can be classified by degree, but people cannot be classified primarily as hearing-impaired.

Much research has focused on the concept of a 'psychology of deafness.' In response to this, Sandlin (1974) emphasizes:

> Educators, audiologists, hearing aid dispensers, or other disciplines concerned with hearing impairment run the risk of accepting a definition of "psychology of deafness," or "hearing impairment" and then fitting the impaired person into the definition and reacting to him accordingly. This is an affront to the hearing impaired and is extremely unjust. To assume there is a well defined 'psychology of hearing impairment' is no different than saying there is a well defined 'psychology of audiologist.' ... Some of the publications about deafness and impaired hearing relative to psychological types have treated a circumscribed population and not individuals within that population (p. 22-23).

Presently, the psychological reactions, if any, which will be associated with an adult-onset hearing loss are unknown. It is impossible to describe a 'typical' psychological profile of hearing impaired adults, since the psychological characteristics of this population are as varied as those characteristics in a group of normal hearing adults (Wylde, in Alpiner, 1982, p. 144; Jackson, in Hull,

1982, p. 30).

It may be inferred that the degree of hearing handicap can be directly related to the degree of hearing loss, yet this has been found NOT to be the case. Oyer (1966) suggests that hearing loss and hearing handicap are "two distinctly different things" (p. 14). He points out that very few generalizations about the amount of hearing handicap a hearing impaired person possesses are based on scientific evidence, and that there is no one-to-one relationship between hearing loss and hearing handicap, "but rather hearing handicap varies as a function of the demands that are placed on the person with the loss" (p. 14).

Therefore, although audiometric results may be meaningful, individual differences in the areas of social, psychological, and communicative differences must be considered (Katz and White, in Hull, 1982, p. 22).

It is suggested that the psychological ramifications the hearing loss has upon the individual may be greater than the hearing impairment itself. Menzel (1963) indicates that it is apparently more psychologically difficult to lose one's hearing after experiencing a number of years of normal hearing than to be born hearing impaired. Griffing (1971, p. 7) supports this point in suggesting that the handicapping effects of hearing loss are just as real for the hearing impaired as they are for the deaf.

The severity of the handicapping effects of the loss of hearing may be related to the extent to which the person has been dependent upon his/her hearing, as indicated by

Noble (1978). He states that the partial loss of hearing in adulthood may be devastating, since the individual has not prepared himself/herself for transition from a hearing social network to the type of isolation and bereavement that may accompany a hearing loss (Noble, 1978, p. 18). Giolas (1982) supports this view, in his examination of the effects of hearing loss on communication ability:

> A hearing impairment that is acquired either gradually or precipitously and is extensive enough to interfere with the normal communication process creates a myriad of problems so complex that coping with the hearing world becomes quite difficult for hearing impaired persons. The resulting adjustment problems can be numerous and severe (p. 19).

It becomes obvious that evaluating the handicapping effects of a hearing impairment merely by examining audiometric test results is not feasible, if not impossible. Oyer and Frankman (1975) stress that the handicap resulting from hearing loss will vary among individuals due to individual differences and demands. They state, "There are well developed methods for measuring hearing loss, but not for the measurement of a handicap (p. 93).

Describing the handicaps accompanying hearing loss, particularly in relation to "age, sex, attitudes, and vocational adjustment" needs further investigation, as indicated by Oyer and Hardick (in Oyer, 1976, p. 62). Defining the handicapping effects of a hearing impairment can be considered no simple matter. ASHA ("On the Definition of Hearing Handicap," 1981) has compiled this comprehensive statement:

> The degree to which a hearing impairment is a handicapping condition will depend on the interaction of a number of factors, and ideally any definition of hearing handicap should be based on a comprehensive consideration of the interrelationships of such factors as: the present age of the individual, the age of the individual when the impairment developed, the nature and extent of the hearing impairment, the person's communication needs and the nature of the settings in which communication occurs, the relationship of the hearing impairments, the amount and success of rehabilitative treatment already received, the individual's reaction and the reaction of others to his or her impaired hearing, and the effect of the hearing impairment on the individual's expressive communication ability (p. 293).

In defining the handicapping effects of a hearing impairment appears to be a difficult task, assessing their effects on an individual is even more complex. Due to the nature of this procedure, many audiologists have either shyed away from assessing the effects of hearing handicap upon the individual or have underestimated the importance of this assessment, particularly in terms of determining further steps in the rehabilitation process. Giolas (1982) stresses this as he addresses the components of the audiological evaluation of impaired hearing. Once hearing impairment is detected, he identifies three major concerns pertaining to the nature of the impairment -- extent of the hearing loss, type of hearing disorder, and the handicapping effects of the hearing impairment. Giolas states, "Answers to these concerns contribute basic information for the planning of a significant portion of the rehabilitation process" (p. 32). High, Fairbanks, and Glorig (1964) suggest:

> Systematic investigation of hearing handicap has lagged far behind development of techniques for the measurement of hearing impairment ... So long as our knowledge of hearing handicap derives primarily from anecdotal material, both the need for, and the result of therapy directed at the correction of hearing impairment can be assessed only with uncertainty ... Until such a time as objective and quantifiable means are available for evaluating handicap, the efficacy of therapeutic treatment in borderline cases [moderate losses] can be evaluated only on the basis of clinical judgement or the basis of reduction of impairment (p. 215).

This view is supported by Noble and Atherly (1970) as they suggest the need for further research in the area of disability caused by hearing disorders. They emphasize the importance of evaluation of a hearing handicap since "measureable loss of hearing may or may not reflect the ability of the individual to hear everyday life" (p. 193).

With advances in recent technology in the field of audiology, strides have been made in assessing the extent and type of hearing impairment, yet little research has been devoted to obtaining data to assist in further understanding of hearing handicaps (Oyer, in Bradford and Hardy, 1979; Giolas, 1982). The attention that has been devoted to this area consists of attempts to develop instruments useful in the measurement of hearing handicaps. These devices fall into two categories: Early measurement devices which utilize clinical audiometric measurements as a means of determining hearing handicap, and more recent scaling or profile methods.

The Social Adequacy Index (SAI) (Davis, 1948) attempted to predict degree of hearing handicap based on reception

threshold and speech discrimination abilities. Kryter (1963) and Harris (1965), in separate studies investigating the relationship between pure-tone thresholds and the ability to understand speech, concluded that threshold measurements at 1, 2, and 3 kHz provided the most accurate estimate for the ability to understand everyday speech. This lead to a quantitative system to determine percentage of hearing handicap, as originally proposed by the American Academy of Opthalmology and Otolaryngology in 1969 (revised, 1975) which consisted of a formula being applied to the average of pure-tone thresholds of .5, 1, and 2 kHz. Davis (in Davis and Silverman, 1978) presents classifications of hearing handicap originally based on the 1960-1962 National Health Survey. These classes attempt to group individuals by a three frequency (.5, 1, and 2 kHz) pure-tone threshold for the better ear and classify their ability to understand speech based on this information. Such systems of evaluating hearing handicap have applications in determining Workman's Compensation or Veteran's Administration ratings, yet their clinical relevance is questionable, since they fail to consider individual differences. Ewertson and Birk-Nielsen (1973) stress, "It is a well known fact that patients with identical audiometric characteristics get along quite differently in daily life" (p. 180).

In 1964, the self-report method of evaluating the handicapping effects of the hearing loss was initiated with the development of the Hearing Handicap Scale (HHS) (High

et al., 1964). The first of many self-evaluation devices, the HHS premiumized on information that audiolgoists have often realized--that audiometric evaluation is not enough; observation and discussion over a period of time are much more effective in identifying areasof difficulty, thus more closely assessing the client's needs. Among the self-report type evaluation devices that are available are the Hearing Measurement Scale (Noble and Atherly, 1970), the Social Hearing Handicap Index (Ewertson and Birk-Nielsen, 1973), the Profiles Questionnaires for Rating Communication Performance (Sanders, 1980), and the Denver Scale of Communication Function (Alpiner et al., 1971). Although all of these devices are geared toward evaluating the handicapping effects of hearing loss based on its effects on communication, each utilizes a different client response criteria and focuses on different issues.

Since the Denver Scale of Communication Function (Alpiner et al., 1971) is utilized in this study, it will be discussed briefly. The Denver Scale focuses on assessing the attitudes and problem areas of the hearing impaired individual with an acquired hearing loss. Four categories are examined: Self, Family, Social-Vocational, and Communication. The client responds to twenty-five statements about his/her communicative function in situations within these categories. Response mode is a Likert scale. It is recommended that the scale be administered prior to initiating therapy, thus attempting to avoid response bias. Alpiner (1978)

states, "Pre- and post-service testing compares the client with himself, not his therapy counterparts or any other norm" (p. 32). Sanders (in Pollack, p. 402) points out that the Denver Scale of Communication Function is based heavily on how the client feels about the effect of his/her hearing loss. He suggests that it may generate valuable information concerning attitudes that may be utilized by the audiologist in client counseling. This view is also supported by Giolas (1982):

> Used creatively, the Denver Scale can be a valuable clinical tool. It is reliable (McNeil and Alpiner, 1975) and touches on extremely relevant issues in a hearing impaired person's life. Furthermore, the Denver Scale appeared when nothing of its kind was available and, like the Hearing Handicap Scale, it expanded the concept of assessing handicapping effects of hearing impairment (p. 57-58).

In general, the literature supports the use of self-evaluation instruments as a means for gaining insight into the handicapping effects of hearing loss, in addition to evaluating attitudinal information, assisting in establishing an effective rehabilitation program. Giolas (1982) suggests use of these types of devices "to assess aural rehabilitation programs, hearing aid candidacy, and successful hearing aid use and to generate a profile of attitudes toward communicative performance is certainly a step in the right direction" (p. 57-58). Hearing handicap evaluation devices obviously have a place in the diagnostic test battery, allowing the audiologist to assess both the attitudinal and specific listening difficulties which confront the

hearing impaired adult. Although communication handicap scales as a whole have received criticism for their limited scope and focus, their use has been encouraged to assist in developing a therapeutic plan for each client. Martin (1981) states, "Before an aural rehabilitation program can begin, it is essential that the hearing handicap be assessed" (p. 423). Sanders (in Pollack, 1975) stresses:

> It is necessary to establish the nature of the special needs of a person in order to develop a realistic plan of management. Underestimating the impact of a person's hearing deficit will result in inadequate counseling and may deprive the person of the help he needs (p. 402).

The emphasis on individual attitudes and needs becomes vital when the trends and future direction of audiological rehabilitation for adults are examined. In order to motivate clients in a rehabilitation program, their individual needs must be met. Unfortunately, the current focus in adult rehabilitation emphasize fitting with appropriate amplification as the major means of remediation. The existence of a 'progressive' approach to therapy for adults, as described by Fleming (1972) is not supported by the literature. Sanders (1982, p. 401) states that it is generally assumed that the adjustment the hearing impaired person must make is not great, which is supported by evidence that once some hearing impaired persons are fit with appropriate amplification, they are able to compensate for their hearing handicap. This makes a blanket generalization that all hearing impaired persons will compensate for their hearing

losses once they are fit with amplification, which ignores the needs of each client and may deprive hearing impaired clients of the special services they need.

Oyer and Hardick (in Oyer, 1976, p. 49) found that with the exception of the Veteran's Administration, no delivery system, either community or national, of comprehensive audiological rehabilitation services for adventitiously hearing impaired adults is currently available in the United States.

The importance of audiological rehabilitation programs for hearing impaired adults has been well documented, although little emphasis has been placed on further development in this area. A variety of studies have indicated that although most audiologists agree that some form of effective audiological rehabilitation should be available, both clinicians and clients alike are reluctant to commit themselves to an audiological rehabilitation program (Brooks and Johnson, 1981; Northern,Ciliax, Roth and Johnson, 1969; Rassi and Hartford, 1968). Oyer et al., (1976) in an attempt to determine why hearing impaired adults did not follow through on recommendations for audiological rehabilitation, found that 66% of the 45 adults interviewed listed lack of motivation as their reason for not enrolling in therapy. The second two most frequently occurring responses in this study were lack of awareness of the service and its value and scheduling problems. The implications drawn from these findings included, "Audiolgoists are not as effective

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as they might be in interpreting the need for aural rehabilitation to clients," and "audiologists are unable to demonstrate to a client the worth of aural rehabilitation and the changes that it can bring about" (p. 29). Thus, the lack of interest in audiological rehabilitation may lie as much with the audiologist as it does with the hearing impaired person for which these services are recommended. Rosen (1967) stresses this point:

> It is true that the audiologist may have mentioned lipreading, auditory training, or training in the use of a hearing aid [to an adult hearing impaired client] but probably did not offer to provide these services himself. Furthermore, the advice was likely to be offered half-heartedly, as if the audiologist was not really aware or convinced of its value ... The drift from aural rehabilitation has been so extensive that it represents a change in the basic orientation of the field (p. 171).

The orientation of the state of the art of adult audiological rehabilitation needs to be considered. Oyer and Hodgson (in Hodgson and Skinner, 1977, p. 207) point out that the rehabilitation of hearing impaired persons is the primary concern of audiology, yet too often this rehabilitation program is thought of as being limited to auditory training and speechreading. Giolas (1982) emphasizes:

> There is probably no single rehabilitative process in the area of communication disorders that has been more misunderstood than aural rehabilitation. It has been viewed as a series of lipreading classes or, in more recent years, it has been expanded to include the use of visual cues in general (p. 80).

He suggests that when audiological rehabilitation is viewed as encompassing a narrow range of components, "it does

a partial job at best and fails miserably at worst" (p. 80). The terms "comprehensive," "tailor-made," and "individual management plan" appear again and again in the literature as describing audiological rehabilitation. The concept that audiological rehabilitation encompasses only speechreading, auditory training, and hearing aid evaluation and fitting should be one of the past. Currently, the literature documents changes in scope and focus in rehabilitation therapy with hearing impaired adults. The Committee on Rehabilitation Audiology of the American Speech and Hearing Association (1974) made the following statement pertaining to the audiologist's role in audiological rehabilitation:

> The development of a comprehensive plan of audiological habilitation is a crucial step in the habilitation process. The plan should be designed to develop and maintain functional language skills. It may include any or all of these 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) counseling of client and family;
>
> 4) continuing re-evaluation of auditory function;
>
> 5) assessment of the habilitative procedures in terms of their effectivensss (p. 69).

Generally, audiological rehabilitation is thought to include any procedure to assist the hearing impaired person reach and utilize his/her maximum communication potential (Hull, in Lass, McReynolds, Northern, and Yoder, 1982; Chermak,

1981).

It is universally accepted that counseling is an integral component of any audiological rehabilitation program. Oyer and Hardick (1975, p. 25) stress that counseling is a very important part of the audiologist's role in rehabilitation of the hearing impaired. Wylde (in Alpiner, 1982) states that the audiologist is well qualified to counsel within his/her realm of expertise, providing that the hearing impairment is the primary causative agent in the difficulties experienced by the client. She includes the following recommendations within the realm of counseling: additional hearing evaluation, medical intervention, amplification, or rehabilitative services. Hartbauer (1975, p. 59) suggests that the first goal of audiological rehabilitation should be to assist the individual in understanding his/her handicap, thus counseling is crucial in the rehabilitation process. Chermak (1981) states:

> The relationship between hearing impairment and adjustment has been documented ... therefore, it behooves the audiologist to confront concomitant psychological aspects of hearing loss as well make provisions for the exchange of information between client, his/her family, and clinician (p. 363).

Support of counseling as a step in audiological rehabilitation is also given by Hardick and Gans (1982): "Careful probing of feelings and attitudes is essential to the success of the rehabilitative effort" (p. 178). Counseling in rehabilitation therapy may focus on dealing with attitudes and feelings that the hearing impaired person may be experiencing

in light of his/her hearing loss and educating the individual in a variety of aspects of hearing and hearing impairment in order to gain a better understanding of his/her hearing loss.

Hull (1982, p. 1086-1087) analyzes counseling within the rehabilitation process and suggests the following areas as focus in this type of therapy: provision of information so that the client may better understand the reason for their communication difficulties and frustrations; facilitation of airing of feelings, and in turn, instruction in methods of coping with those feelings toward the loss of hearing and the disability it may entail; and assistance in adjustment to the frustration of debilitation of a hearing impairment. He stresses the counseling may be utilized to facilitate adjustment of the hearing loss, motivate the client to become involved in an audiological rehabilitation program, provide assertiveness training to make sure the client does not withdraw from social situations, and to assist the client in developing coping behaviors, which enhances the humans natural ability to adapt.

Two major areas of counseling can be identified -- informational and affective. Pollack (in Alpiner, 1978, p. 132) states that traditionally the audiologist has focused on imparting information to clients, while failing to recognize the attitudes, feelings, and behaviors that may be attached to a hearing impairment. This may promote the assumption that although audiologists may not be counseling

sufficiently in affective areas, they are effectively providing informational counseling as a routine part of the audiological rehabilitation program. This premise is not supported by the literature, since little research is found in informational counseling aspects of audiology and few programs focusing on educational counseling are available.

Wylde (in Alpiner, 1982) suggests that the audiologist, as a function of his/her rehabilitative responsibilities, frequently provides counseling for his/her clients:

> The hard-of-hearing adult frequently requires additional information; confirmation of a thought, belief, or attitude; and the opportunity to discuss something bothering him. Any of these activities we engage in with him can be referred to as counseling (p. 145).

The American Speech and Hearing Association (1974) stresses the responsibility of the audiologist to provide informational counseling, not only to the hearing impaired individual but also to his/her family. The following areas are suggested for inclusion in an informational program:

1) hearing
2) the hearing mechanism
3) the client's hearing loss
4) the use of amplification
5) economic considerations
6) referral procedures for appropriate public assistance or community programs, and
7) appropriate placement in educational settings and participation in vocational rehabilitation programs (p. 70).

Martin (1981) emphasizes:

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> The patient should be educated as fully as possible about hearing loss in general and the particular handicap ... How the ear works and what has gone wrong, the effects on speech communication, implications for progression of the loss, and interactions with family and friends must all be discussed openly and honestly with the patient (p. 423-424).

In describing a public information program, Giolas (1982, p. 80-81) states that the nature of hearing impairment and its handicapping effects is one of the most important functions of a comprehensive rehabilitation program. He explains an educational program in the following terms:

> When first confronted with a hearing loss, people are eager, however, for information which will help them to understand what they are experiencing. Such information can be provided by conducting a series of lectures and discussion groups ... which center around hearing in general and present the material at the elementary and practical level (p. 81).

An early program of this type, Hearing Reeducation, as proposed by Browd (1951), combines traditional audiological rehabilitation skills with a process of education focusing on hearing and listening. Browd (1951) believes the hearing impaired can benefit from this type of education program:

> ... It [Hearing Reeducation] makes no attempt to regain or replace hearing power lost through damage. Instead it concerns itself only with that section of the hearing system in which the hard of hearing possess as much power and keenness as anyone else: the brain (p. 4).

Northern et al., (1969) describes the audiological rehabilitation program implemented by the Army Audiology and Speech Center. This program requires each new hearing aid wearer be enrolled by regulation in this two to three

week course. Informational issues are thoroughly covered in this program, which is considered part of patient care. Northern et al. concludes:

> It is our impression, however, based on this survey that attitudes toward hearing loss and the use of amplification can be altered through an organized program of hearing therapy. And, if aural rehabilitation procedures do nothing more than alter patient attitudes to assure acceptance of amplification, the service has achieved a worthwhile goal. Our appraisal of military patients attitudes towards hearing therapy indicates that aural rehabilitation is indeed beneficial and important (p. 394-395).

Success or failure as a hearing aid wearer may be affected by the attitudes that the client possess towards hearing loss in general and amplification. Madell (1973) supports this in her description of the Hearing Aid Orientation program implemented by the New York League for the Hard of Hearing. The program consists of group meetings once a week for five to six weeks. Topics covered during this program include the benefits and limitations of amplification, anatomy and physiology of the auditory mechanism, types of hearing impairment, and the functions of hearing. Madell reports, "The people who have participated in the program seemed excited about it ... The audiologists feel there are many more successful hearing aid users than in the past" (p. 5).

Brooks and Johnson (1981) also discuss improving attitudes toward hearing loss, thus increasing success as a hearing aid wearer, as rational for providing informational counseling to clients:

> Attitude often stems from motivation but may also be influenced by heresay, by gulliable acceptance of misleading advertising, or by personal acquaintanceship with someone who has either succeeded or failed with a hearing aid (p. 16).

They describe the program which was implemented with new hearing aid wearers. It consisted of four two-hour sessions spread over the period of four weeks. During these sessions, information is presented covering a variety of topics including medical aspects of hearing loss, audiometric configuration and its effect on the understanding of speech, the psychological effects of hearing impairment on the individual and his/her family and friends, the benefits and limitations of amplification, and environmental factors pertinent to the hearing impaired individual.

Danish and Swedish systems of delivery of audiological rehabilitation services are reported by Markides (1977). These systems include the following view on informational counseling:

> All new patients with a hearing aid require a basic course which should include fundamental information:
>
> (i) on deafness (pathology, type, severity, treatment, etc.)
>
> (ii) on hearing aid use (advantages, limitations, basic maintenance, manipulation, etc.)
>
> (iii) on environmental aids (demonstration, use, telephone use instructions, etc.)
>
> (iv) on communication tactics (using both auditory and visual clues, positioning, monitoring speech loudness, tackling different communication situations, etc.)

(v) assessment of special needs.

> Information courses need to be taken on an individual basis and conducted at a deliberately slow pace so that the pateint can have his/her questions answered. It is worthwhile to encourage other members of the family to participate in these courses too (p. 79-80).

This type of program is implemented nationwide in both Denmark and Sweden, and is under consideration in centers providing audiological services in Great Britain.

Various authors support programs which provide information for both the hearing impaired person and his/her family and acquaintances. Chermak (1981) describes a program of bibliotherapy, in which the client and his/her family are provided with reading material which covers a variety of areas including the structure and function of the auditory system; the vocational, social, and personal ramifications of hearing loss; and explanation of audiological rehabilitation options available to the hearing impaired individual. The goal of bibliotherapy is to permit in-depth coverage of information which time may not allow during scheduled therapy sessions. Bibliotherapy is offered as a supplement, not a substitute, for counseling in audiological rehabilitation. This counseling step is vital, as suggested by Hartbauer (1975) since the hearing impaired individual may need to be responsible for informing both family members and acquaintances of his/her disability and needs.

The literature documents the importance of counseling in audiological rehabilitation, not as an isolated step, but as an ongoing process. Yet, even though the importance of

counseling has been well supported, little attention has been devoted to this area. Frisina (1966) points out:

> The extent to which audiologists, in general, have immersed themselves directly in the counseling aspects of aural rehabilitation appears to be somewhat limited. The principle investment in time, on the part of the audiologist, has been in the measurement of hearing and recommendation of hearing aids. Counseling activities have been in large part the short term variety related specifically to the data collected from audiometric measurement (p. 124).

This is unfortunate since it perpetuates the belief that the main component of audiological rehabilitation are speechreading and auditory training. These are important aspects of audiological rehabilitation, yet they consist of only part of the entire process. In order to meet the individual needs of each client, a blanket recommendation of audiological rehabilitation limited to speechreading and auditory training is inappropriate. A focus on individual case management, along with the emphasis on counseling may be representative of the direction of audiological rehabilitation for adults. Hopefully, this will lead to both renewed interest in provision of rehabilitative services for adults and research in audiological rehabilitation on the part of the audiologist. Martin (1981) suggests, "Many audiologists are more comfortable in the role of diagnostician than therapist ... Modern audiology demands that the clinician be facile in both areas" (p. 424). Tobias (in Alpiner, 1982) states:

> To practice rehabilitative audiology, one simply

> helps hearing-impaired people to learn to understand what they hear and, sometimes, to learn to talk so that others can understand what they say. In order to create an atmosphere in which clients or patients will be receptive to help, one must also counsel them about potential difficulties and help them to accept the handicapping nature of hearing loss (p. 375).

Oyer and Hardick (1976) emphasize there is a great need for further research in the area of audiological rehabilitation, particularly in further description of the handicapping effects accompanying a hearing loss.

> ...research which would lead to scientific construction of materials for rehabilitation sessions is needed, as well as research on the effects of specified training/retraining procedures on eventual communication performance ... also, the broad area of counseling with the hearing handicapped individual ... needs rigorous scientific study (p. 62).

Many have suggested the lack of studies which verify the effectiveness of current therapeutic procedures utilized in audiological rehabilitation. McCarthy and Alpiner (in Alpiner, 1978) state:

> A variety of therapy procedures for the hearing impaired adult has been used since the beginning of the century. Even in this decade, however, audiologists have not been able to validate these procedures. The need for more extensive research in hearing rehabilitation has been advocated by various authors but it is obvious that research to date has been quite limited.

In response to the problem of the question of validity of current methods, Oyer and Hodgson (in Hodgson and Skinner, 1977) propose the possibility of a more predictive type of audiological rehabilitation program -- it "would be worthwhile to develop the training materials for a more predictive

approach to aural rehabilitation" (p. 220). This need for a more scientific approach to audiological rehabilitation is suggested by various authors. Oyer (1979) points out the implications of this type of rehabilitation research:

> ... with the proper measures related to the handicap at hand at the outset, with a set of norms for normal-hearing individuals, and with the application of tested materials and procedures, one could demonstrate to the handicapped individual, or relevant others, the progress that was being made through the rehabilitative sessions and in the process provide a much greater accountability of the rehabilitative work undertaken. In addition, with sufficient data, one could also predict the amount of time that it would take to shift the profile of the handicapped person specified distances toward normalcy. It appears to this writer that by using the approach described above aural rehabilitation would be further reinforced as an applied science (p. 317).

In reviewing the literature, it is evident that there is a continued interest in the area of audiological rehabilitation, particularly in the development of more comprehensive programs to meet the individual needs of each client. Currently, the impetus appears toward renewed research in the area of audiological rehabilitation, focusing on handicapping effects of hearing loss and determining the effectiveness of methods used in hearing rehabilitation therapy.

CHAPTER III

SUBJECTS, INSTRUMENTATION AND PROCEDURES

Introduction

The problem under investigation in this study was to determine what relationship, if any, existed between the information levels possessed by hearing impaired adults and the attitudes that they possess towards their hearing loss.

Subjects

Six hearing impaired adults participated as subjects in this study. Subjects were required to meet the following criteria:

1. May possess any degree of bilateral sensorineural hearing loss. This includes persons with mild to moderate hearing losses who sustain communication problems associated with speech discrimination or reception. (Audiograms, speech reception thresholds, and speech discrimination results appear in Appendix A).
2. May or may not utilize amplification.
3. Have been identified as possessing a loss of hearing through an audiometric evaluation conducted by an audiologist.
4. Are not currently involved in, or have not previously participated in, any formal or informal rehabilitation program, other than hearing aid evaluation and hearing aid orientation.
5. Will be between 18-65 years of age.

Subjects were identified from the files of the Michigan State University Speech and Hearing Clinic and from the

files of an audiologist and otolaryngologist in the Lansing, Michigan-area. The final subject group consisted of six males, ranging in age from 27 to 62, with a mean age of 49.

Test Materials

The following test materials were employed in this study.

The Denver Scale of Communication Function

The Denver Scale of Communication Function "is a tool designed to help ... make a subjective assessment of communication attitudes of adults with acquired hearing loss" (Alpiner, 1982, p. 20). This device was used to assess the attitudinal levels possessed by hearing impaired adults. McNeil and Alpiner (1975, as cited in Alpiner, 1982, p. 20) have demonstrated the reliability of the Denver Scale of Communication Function. (The Denver Scale of Communication Function appears in Appendix B.)

Multiple Choice Instrument

A 50-question multiple-choice test, designed by the researcher, was used to assess the informational level of subjects in this study pertaining to hearing loss and hearing impairment. This multiple choice test was based on the informational program presented in this study. The test was designed according to guidelines for construction of objective test items and general rules for construction of multiple-choice items established by Harrington (1974). Face validity was determined by a review of this instrument

by three experts in the area of audiology. Reliability was demonstrated by administration of this test to six subjects knowledgeable in the area of audiology (six Master's level students in audiology at Michigan State University); it was then re-administered in a scrambled form to the same six subjects to check test-retest reliability. (See Appendix C.)

Information Program

The educational program, designed by the researcher, consisted of the following topics:

1. Basic physics of sound;
2. the function of hearing, including its place in the communication process;
3. basics of audiology;
4. anatomy and physiology, including neuroanatomy and neurophysiology of the hearing mechanism;
5. overview of pathologies of the hearing mechanism;
6. effects of hearing on speech intelligibility and production;
7. amplification systems and devices;
8. hearing conservation;
9. effects of hearing/hearing impairment on self-concept and social adjustment; and
10. rehabilitation options available to the hearing impaired individual.

Use of topics included in this information program is supported by a variety of authors, including Wylde (in Alpiner, 1982, p. 150) in her discussion on counseling responsibilities of the audiologist.

Procedures

Pre-Program Assessment

Attitudinal and informational levels of each subject were assessed one week prior to beginning participation in the concentrated educational program. Attitudes were assessed via administration of the Denver Scale of Communication Function (Alpiner et al., 1971) according to the administration procedure recommended by Alpiner (1975, p. 32). Informational levels were assessed via administration of the multiple choice device designed by the researcher. The following instructions were given in both oral and written forms prior to administration of this instrument:

> This is a multiple-choice device designed to assess the knowledge you possess in the areas of hearing and hearing loss. This is not a test, but merely an instrument to assess your knowledge. You will be given 50 multiple-choice questions. Each question has 3 responses from which you may choose. Read each question carefully, then select the letter of the response which best answers the question, and CIRCLE IT.
>
> Here is an example:
>
> SAMPLE: The sense organ associated with hearing is:
>
> a. the ear
> b. the eye
> c. the nose
>
> You would choose response A, and circle the letter A.
>
> You are not expected to know all of the answers to these questions, and if you are not sure of an answer, feel free to guess. The only requirement is that you answer all of the questions. The responses to each question are randomized and there is no pattern which correct responses follow. You have as much time as you need to complete

this. I will be here to answer questions you may have, although I cannot answer about definitions, etc. (Oral instructions include: Do you have any questions before you begin?)

Both assessment tools were administered by the researcher to each subject individually; this administration occurred in a quiet room and no time limit was imposed for completion of each task. (Although Alpiner suggests a 15-minute time limit for completion of the Denver Scale of Communication Function, the time limit was waived during administration of that device.)

Informational Program

This program consisted of four, one and a half hour group sessions, presented twice a week for two weeks. The following schedule was established for this program:

Session I

Topics

1. Basic physics of sound;
2. the function of hearing, including its place in the communication process; and
3. basics of audiology.

Session II

Topics

1. Anatomy and physiology, including neuroanatomy and neurophysiology, of the hearing mechanism; and
2. overview of the pathologies of the hearing mechanism.

Session III

Topics

1. Effects of hearing on speech intelligibility and production; and
2. amplification systems and devices.

Session IV

Topics

1. Hearing conservation;
2. effects of hearing on self-concept and social adjustment; and
3. rehabilitation options available to the hearing impaired individual.

The following instructions were given orally prior to the beginning of the program:

> This is an educational program designed to present information to you on different topics involving hearing and hearing loss. Since each of you has a hearing impairment, you probably already have some knowledge of the hearing mechanism and different aspects of hearing loss. It is my hope that this program will present new information to you which may help you to gain further knowledge on your hearing/hearing impairment after participating in this program.
>
> I have already met with each of you on an individual basis, at which time you answered two questionnaires. We will now meet as a group for four one and a half hour sessions, in which various issues of hearing and hearing impairment will be examined. The format of this program is such that I will be presenting some information to you during each session. All you are required to do is listen, although I request that you do not take notes. If you have specific questions or need to have a point clarified, feel free to interrupt me.

These instructions were briefly reviewed before beginning each session.

The topics of the sessions followed the schedule developed for this program. (See Appendix

The entire educational program was presented in a classroom with appropriate ventilation and lighting.

Post-Program Assessment

Upon completion of the program, attitudinal and informational

levels of each subject were assessed utilizing the same procedures as stated in Pre-Program Assessment.

CHAPTER IV

ANALYSIS AND DISCUSSION

Results

Two basic questions to be answered were: 1) whether changes in the informational level were demonstrated as a result of participation in the concentrated education program; and 2) whether changes in attitudinal levels toward hearing loss occurred with changes in informational level.

It was necessary at the outset to determine the test-retest reliability of the multiple choice information test administered to six graduate students in audiology. The raw score data are shown in Table 1. A rank-order co-efficient of correlation was used to establish correlation which is appropriate for use with an n of 30 or fewer subjects. A rho co-efficient of .87 was established which denotes a high to very high relationship (Garrett, 1964, p. 179).

Next, the pre-and post-educational score differences were determined. Upon inspection of raw data in Table 2, it can be observed that there is a noticeable difference in information levels of subjects following participation in the concentrated information program. Although differences in information level were expected, it was of interest to determine whether these differences were statistically significant. Therefore, a t-test for related measures was employed. As shown by the results in Table 3, a significant

TABLE 1

RAW SCORES OF GRADUATE SUBJECTS
FORM A/FORM B TEST-RETEST RELIABILITY

Student	Raw Score Form A	% Form A	Raw Score Form B	% Form B
1	47	94	48	96
2	47	94	48	96
3	48	96	47	94
4	45	90	47	94
5	48	96	47	94
6	47	94	45	90

$r = .87$

$r^2 = 76\%$

Table 2

RAW SCORES OF EXPERIMENTAL SUBJECTS
PRE- AND POST- MULTIPLE CHOICE TEST RESULTS

Experimental Subjects	Pre (Form A) Raw Score	%	Post (Form B) Raw Score	%
1	23	46	37	74
2	17	34	37	74
3	28	56	30	60
4	29	58	47	94
5	17	34	29	58
6	31	62	42	84
MEAN	24	48	37	74

Table 3

RESULTS OF T-TEST FOR DIFFERENCES BETWEEN PRE- AND POST-ADMINISTRATION OF MULTIPLE CHOICE TEST

Pre-Post	Means	t	df	Level*
A and B	24 and 37	4.960	5	.005 percent

* A t of 4.032 is required at the .005 percent level.

difference of information levels after participation in the concentrated education program was established.

Changes in attitude based on changes in information levels were analyzed using non-parametric methods. Since the Denver Scale of Communication Function is based on an ordinal scale, the most powerful test which may be applied to these data is the Signed-Ranks Test established by Wilcoxon. Results of pre-and post-education program administration of the Denver Scale of Communication Function are shown in graphic form in Appendix A, Figure 2. Inspection of these data demonstrate changes in pre- and post-administration for all subjects. It was, of course, of interest to determine those changes that were statistically significant. In order to determine this, the numbers 1-7 were assigned to each degree of the Likert scale, assigning the number 1 to "disagree" through the number 7 to "agree." Raw data per question are shown in Appendix E. The Wilcoxon matched pairs Signed-Rank Test for each question of the Denver Scale of Communication Function are shown in Table 4. Examination of these data demonstrates that thirteen of the twenty-five questions were significant to a .05 level, and twelve questions demonstrated no statistical significance.

Table 4

RESULTS FOR THE WILCOXON SIGNED-RANKS TEST
PER QUESTION OF THE DENVER SCALE OF COMMUNICATION FUNCTION

Question	Sum of Ranks (T)	z	p	Level of Significance**
1	0	-1.60	.1051	.05
2	0	-1.82	.0647	.05
3	0	-1.60	.1051	.05
4	0	-1.60	.1051	.05
5	0	-1.34	.1766	.05
6	0	.44	.6423	not sig.
7	2	-1.82	.0647	.05
8	0	-1.34	.1766	.05
9	0	.44	.6423	not sig.
10	2	-1.00	.3186	.05
11*	0	---	---	not sig.
12*	0	---	---	not sig.
13	0	-1.00	.3186	.05
14*	0	---	---	not sig.
15	0	-1.82	.0647	.05
16	4.5	-.80	.4241	not sig.
17	0	-1.34	.1766	.05
18	1	-.44	.6423	not sig.
19	3	-.73	.4721	not sig.
20	0	-1.34	.1766	.05
21	3	.001	.3045	not sig.
22	2.5	-.26	.6876	not sig.

Table 4
Continued

Question	Sum of Ranks (T)	z	p	Level of Significance**
23	3	1.34	.1766	not sig.
24	2.5	-.26	.6876	not sig.
25	0	-1.82	.0647	.05

*Not significant because six sets of data demonstrated zero differences.

**According to Siegel, 1956 (Table G, p. 254). These data were analyzed as a two-tailed test since prior to examination of the data, it was predicted that the pre-and post-information would differ, although the direction of the difference was not predicted. A T (sum of ranks) value of 0 was required for data to be considered significant at the .05 level. This level was the only level which could be analyzed with n = 6.

Discussion

Although change in attitudinal level was found to occur following participation in a concentrated educational program, this change was found to be statistically significant for only some aspects of the Denver Scale of Communication Function.

Changes in attitude were found to be significant for questions 1-4, all of those which pertain to the area of Family. Of the questions pertaining to Self (5-9) questions 6 and 9 demonstrated no statistical significance. The area of Social-Vocational questions, consisting of most of the questions on the Denver Scale of Communication Function (10-20), demonstrated statistically significant changes in 5 of the 11 questions (numbers 10, 13, 15, 17 and 20). In the final area, Communication, only one of the five questions (number 25) demonstrated a change of significance.

Although statistical analysis demonstrates thirteen out of twenty-five questions as being significant, the content of the statements of the Denver Scale of Communication Function should be considered. Statements 21-25 are stated as negatives, and subjects generally disagreed with these statements in the pre-program assessment. Differences post-program were not anticipated, since it was not expected that the informational program would change attitudes toward the negative. Thus, although no statistically significant changes were demonstrated, the results conformed expected results.

The categorical breakdown of the Denver Scale of Communication Function demonstrates that the most significant attitudinal changes appeared to occur in the Social-Vocational areas with little change occurring in the area of Communication. Yet, in examination of the statements on the scale, all are directly addressing communication not just the statements labeled under the area heading of communication.

Since significant changes in level of information were demonstrated following participation in the concentrated program of education and since changes, although not as strongly statistically significant, were demonstrated in attitudes, factors which may have influenced the attitudinal results were examined.

First of all, the size of the sample size utilized in this study may have been too small to allow for the differences that might have been observable in a larger sample.

These results were based upon the testing of male subjects.

The evaluative strength of the attitudinal measure must also be considered. It has been suggested that the reliability of the Denver Scale of Communication Function should be re-assessed (Kaplan, Feley, Brown, 1978, p. 16; Cancro, Nicosia, Mazor, 1982, p. 52). Sanders (in Pollack, 1975) points out:

> ... The information it (The Denver Scale of

> Communication Function) generates is heavily weighted in terms of how the client feels about the effect of his hearing loss on his performance to communication and how he feels others react to him ... the Denver Scale does not provide specific information about specific types of situations peculiar to a particular person's environment (p. 358).

Perhaps the Denver Scale of Communication Function was not a powerful enough assessment device for the type of information to be gathered for this study. Thus, the use of the Denver Scale may be enhanced if used in conjunction with other devices designed to assess attitudes.

The results of this study indicate that there appears to be a relationship between information levels of hearing impaired adults and attitudes possessed concerning their hearing losses. Yet, this study has also raised other questions for future examination. A number of variables involving informational/attitudinal factors can and should be considered for future investigation in the area of counseling.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The amount of literature available on counseling as part of the audiological rehabilitation process is limited, yet the existing literature supports the importance of counseling as a step in the audiological rehabilitation process. Unfortunately, this lack of literature is also reflected in the training of audiologists, who are well trained in the informational aspects of hearing loss, yet rarely are instructed in dealing with the emotional aspects of hearing loss.

It has been suggested that the information which the hearing impaired person possess about his/her hearing and hearing loss may affect the attitudes that the person possesses concerning his/her hearing impairment. Thus, misinformation, myths, or a lack of understanding in informational areas of hearing and hearing loss may affect the person's feelings and attitudes toward his/her own hearing loss.

The problem under investigation was to determine if a relationship exists between the informational level possessed by the hearing impaired adult about his/her hearing loss and the attitudes he/she held concerning the hearing impairment. If a relationship exists, the question was as to the possibility of changing the attitudes of hearing impaired adults by changing their informational levels.

Subjects in this study consisted of six hearing impaired males who had not been involved previously in any type of audiological rehabilitation program, including educational counseling (other than hearing aid orientation). A concentrated educational program was administered to the subjects as a group, after each had completed a multiple-choice test pertaining to hearing and hearing loss and the Denver Scale of Communication Function. The same evaluation devices were administered upon completion of the concentrated informational program. Results demonstrated that significant changes in informational level occurred upon completion of the informational program. Changes in attitudinal level, as measured by changes in responses to questions on the Denver Scale of Communication Function, demonstrated statistically significant changes in attitudes for thirteen of the twenty-five questions appearing on the Denver Scale.

Conclusions

On the basis of the results derived from this study, the following conclusions appear to be warranted:

1. Informational levels of hearing impaired adults can be significantly changed after participation in a short-term concentrated education program.

2. Significant shifts in attitude were found to occur as a result of changes in information level. This was demonstrated by statistically significant changes for some attitudinal areas of the Denver Scale of Communication Function, most notably the areas of Family and Self.

Suggestions for Future Study

1. Investigation of sex differences in attitudinal changes based on informational changes.

2. Utilizing other attitudinal measures, (i.e., the Hearing Performance Inventory, the Three Profile Questionnaires) to assess attitudinal changes related to informational changes.

3. Comparison of results of a long-term versus short-term educational counseling program and the effects on attitude.

4. Comparison of changes in attitude after participation in a group educational program for hearing impaired adults versus a group educational program for hearing impaired adults and their families.

5. Study of the adjustment of hearing aid wearers as related to changes in information and attitudes.

APPENDICES

APPENDIX A

Subject 1
Age 27

Figure 1

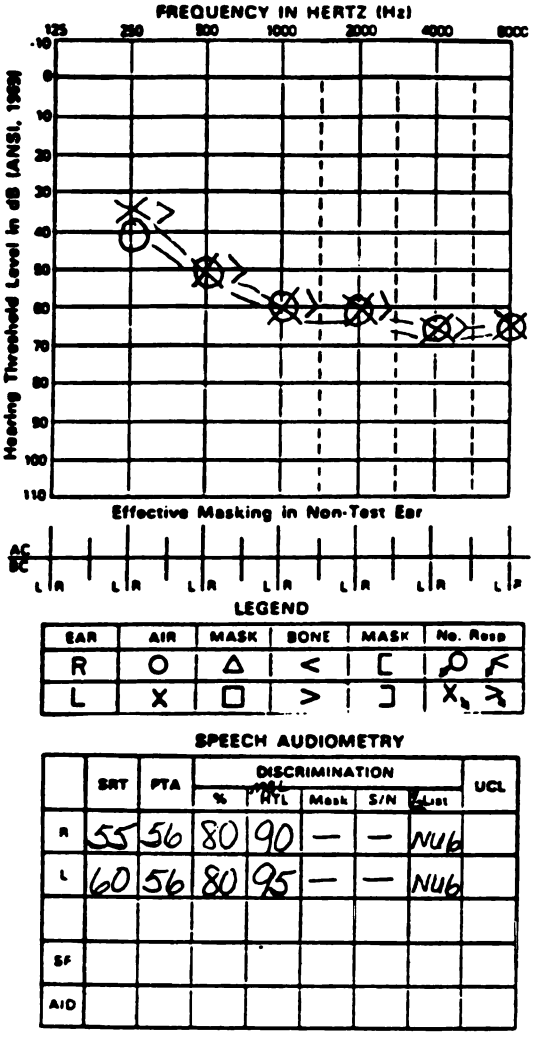
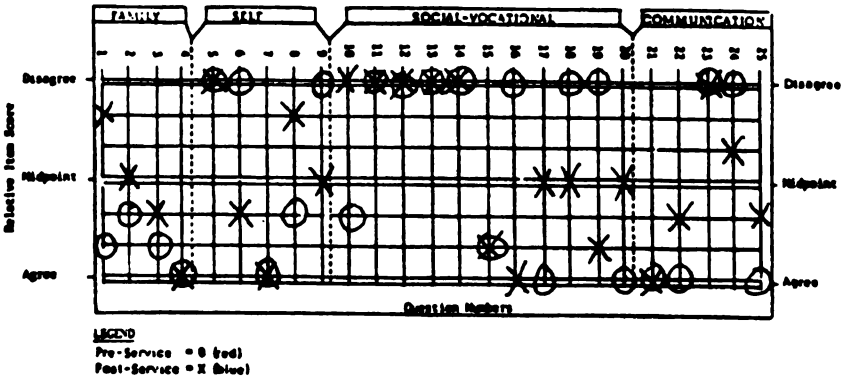


Figure 2



Subject 2
Age 51

Figure 1

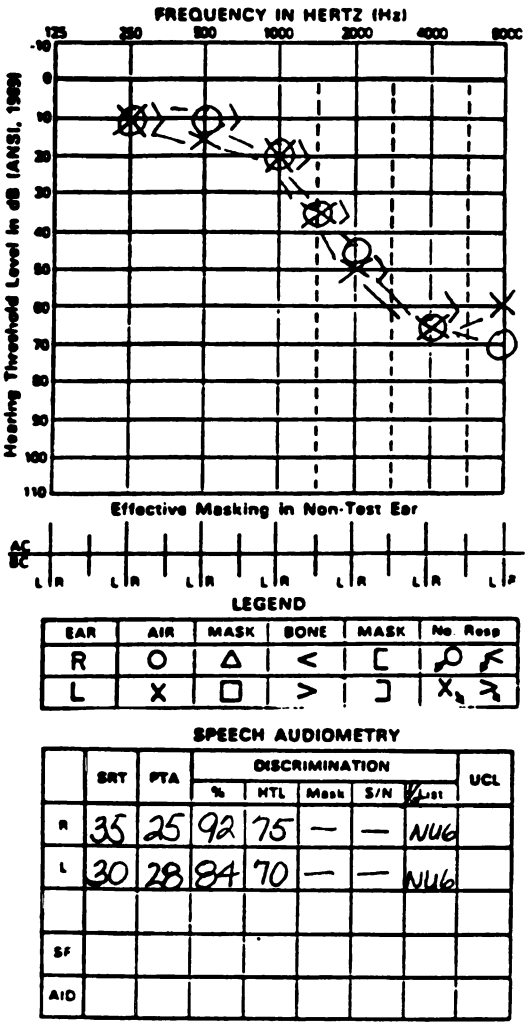
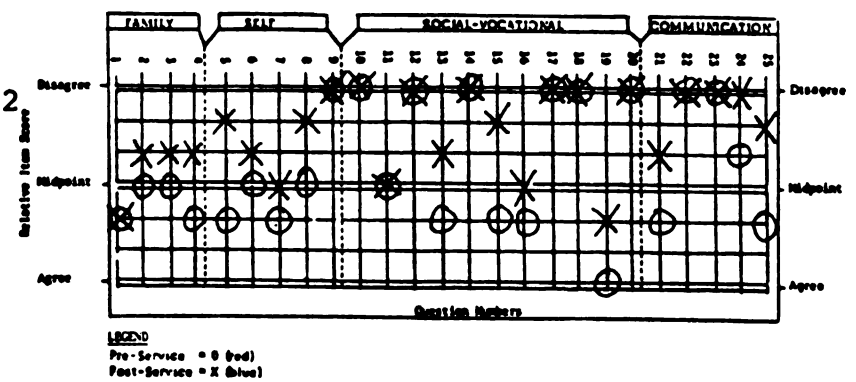
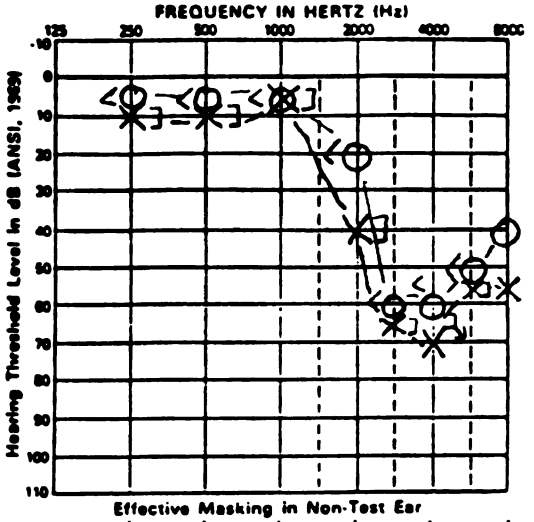


Figure 2



Subject 3
Age 45

Figure 1



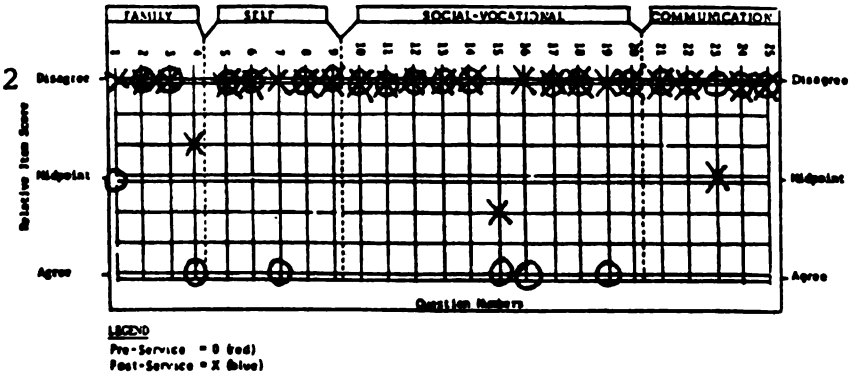
LEGEND

EAR	AIR	MASK	BONE	MASK	No. Resp
R	O	Δ	<	[	
L	X	□	>	]	

SPEECH AUDIOMETRY

	SRT	PTA	DISCRIMINATION					UCL
			%	HTL	Mask	S/N	%List	
R	10	10	96	50	—	—	NU6	
L	15	14	92	55	—	—	NU6	
SF								
AID								

Figure 2



Subject 4
Age 62

Figure 1

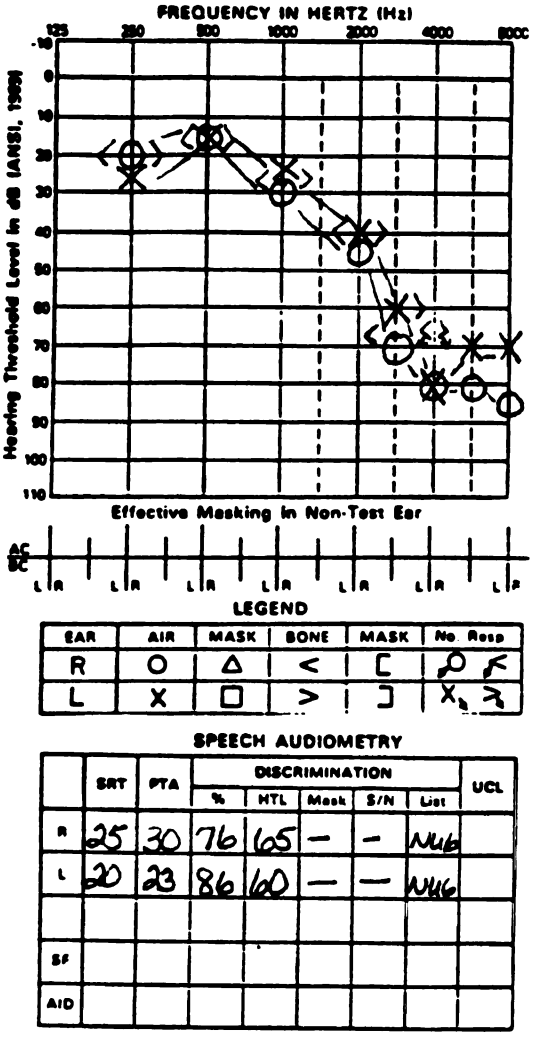
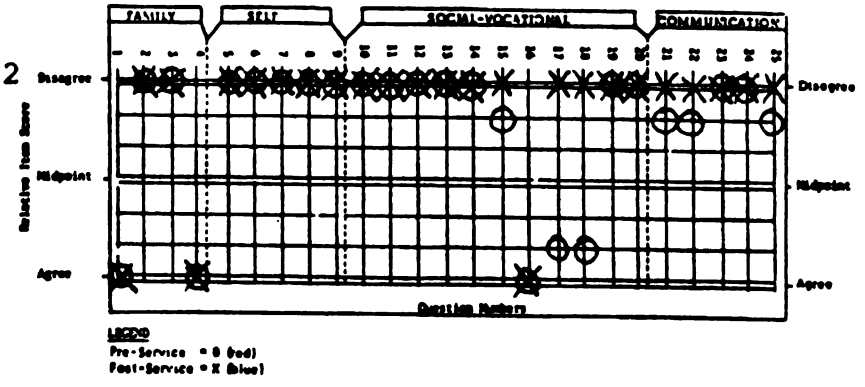
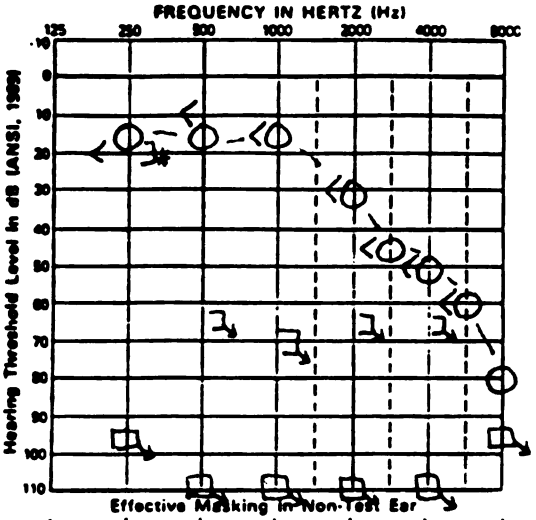


Figure 2



Subject 5
Age 47

Figure 1



LEGEND

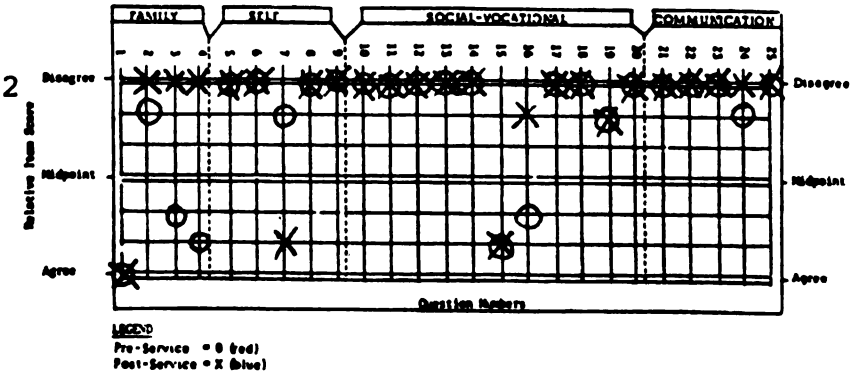
EAR	AIR	MASK	BONE	MASK	No. Resp
R	O	Δ	<	[	
L	X	□	>	]	

SPEECH AUDIOMETRY

	SRT	PTA	DISCRIMINATION					UCL
			%	HTL	Mask	S/N	List	
R	20	20	96	60	—	—	NU6	
L	←	CNT					→	
SF								
AID								

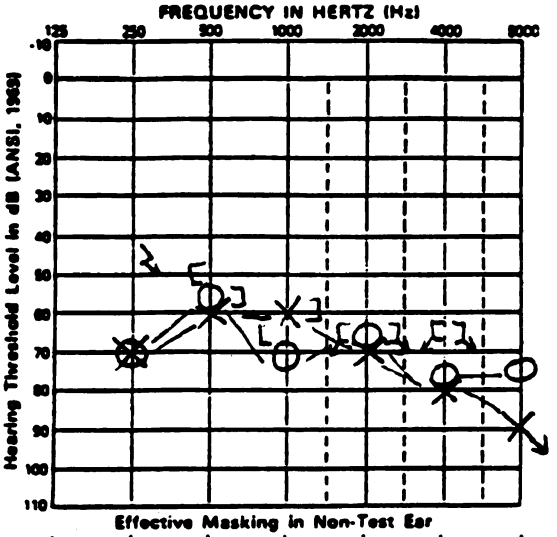
* PROBABLY VIBROTACTILE RESPONSE

Figure 2



Subject 6
Age 57

Figure 1



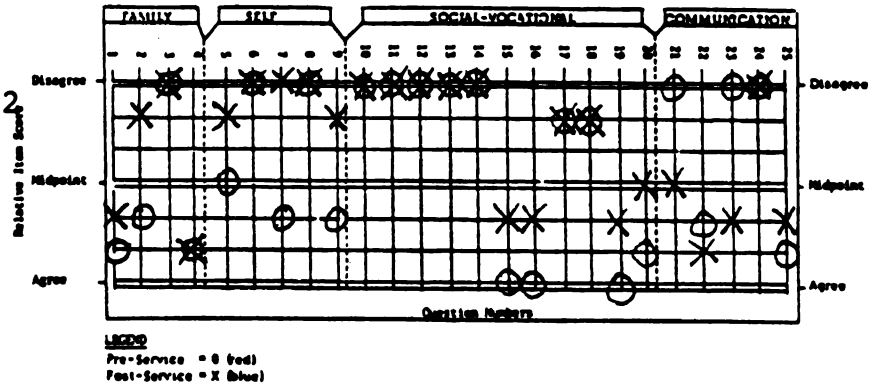
LEGEND

EAR	AIR	MASK	BONE	MASK	No. Resp
R	O	Δ	<	[	
L	X	□	>	]	

SPEECH AUDIOMETRY

	SRT	PTA	DISCRIMINATION %	DISCRIMINATION HTL	DISCRIMINATION Mask	DISCRIMINATION S/N	DISCRIMINATION ½ list	UCL
R	60	63	84	90	—	—	NU6	
L	60	62	84	90	—	—	NU6	
SF								
AID								

Figure 2



APPENDIX B

The Denver Scale of Communication Function

by

T. Alpiner, W. Chevrette, G. Glascoe
M. Metz and B. Olsen

Pre-Service_____ Post-Service_____
Date:_____ Case #_____

Name_____Age_____Sex_____
Address_____

_____
(City) (State) (Zip)

Lives alone_____In apartment_____Retired_____
(if no, specify)

Occupation_____

Audiogram (Examination Date_____Agency_____

Pure Tone:

	250	500	1000	2000	4000	8000 Hz
RE	___	___	____	____	____	____
LE	___	___	____	____	____	____

Speech:

SRT	DISCRIMINATION SCORE (%)	
	Quiet	Noise S/N =)
RE_____dB	RE_____	_____
LE_____dB	LE_____	_____

Hearing Aid Information

Aided_____For How Long_____Aid Type_____

Satisfaction_____

EXAMINER:_____

The following questionnaire was designed to evaluate your communication ability as you view it. You are asked to judge or scale each statement in the following manner.

If you judge the statement to be very closely related to either extreme, please place your check mark as follows:

Agree X ____ ____ ____ ____ ____ ____ Disagree

or

Agree ____ ____ ____ ____ ____ ____ X Disagree

If you judge the statement to be closely related to either end of the scale, please mark as follows:

Agree ____ X ____ ____ ____ ____ ____ Disagree

or

Agree ____ ____ ____ ____ ____ X ____ Disagree

If you judge the statement to be only slightly related to either end of the scale, please mark as follows:

Agree ____ ____ X ____ ____ ____ ____ Disagree

or

Agree ____ ____ ____ ____ X ____ ____ Disagree

If you consider the statement to be irrelevant or unassociated to your communication situation, please mark as follows:

Agree ____ ____ ____ X ____ ____ ____ Disagree

PLEASE NOTE: Check a scale for every statement.
Put only one checkmark on each scale.
Make a separate judgement for each statement.

ALSO: You may comment on each statement in the space provided.

1. The members of my family are annoyed with my loss of hearing.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

2. The members of my family sometimes leave me out of conversations or discussions.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

3. Sometimes my family makes decisions for me because I have a hard time following discussions.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

4. My family becomes annoyed when I ask them to repeat what was said because I did not hear them.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

5. I am not an "outgoing" person because I have a hearing loss.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

6. I now take less of an interest in many things as compared to when I did not have a hearing problem.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

7. Other people do not realize how frustrated I get when I cannot hear or understand.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

8. People sometimes avoid me because of my hearing loss.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

9. I am not a calm person because of my hearing loss.
   Agree ___ ___ ___ ___ ___ ___ ___ Disagree
   Comments:

10. I tend to be negative about life in general because of my hearing loss.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

11. I do not socialize as much as I did before I began to lose my hearing.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

12. Since I have trouble hearing, I do not like to go places with friends.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

13. Since I have trouble hearing, I hesitate to meet new people.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

14. I do not enjoy my job as much as I did before I began to lose my hearing.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

15. Other people do not understand what it is like to have a hearing loss.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

16. Because I have difficulty understanding what is said to me, I sometimes answer questions wrong.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

17. I do not feel relaxed in a communicative situation.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

18. I do not feel comfortable in most communication situations.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

19. Conversations in a noisy room prevent me from attempting to communicate with others.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

20. I am not comfortable having to speak in a group situation.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

21. In general, I do not find listening relaxing.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

22. I feel threatened by many communication situations due to difficulty hearing.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

23. I seldom watch others people's facial expressions when talking to them.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

24. I hesitate to ask people to repeat if I do not understand them the first time they speak.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

25. Because I have difficulty understanding what is said to me, I sometimes make comments that do not fit into the conversation.
Agree ___ ___ ___ ___ ___ ___ ___ Disagree
Comments:

APPENDIX C

A

MULTIPLE CHOICE INSTRUMENT

1. The portion of the soundwave in which air pressure increases slightly as air particles move more closely together is known as:

   a. compression
   b. oscillation
   c. rarefaction

2. The part of the hearing aid which transforms soundwaves into electrical energy is:

   a. the amplifier
   b. the microphone
   c. the receiver

3. A "stress reaction," in which circulation to the extremities of the body--including the ear--decreases and the hair cells of the inner ear are deprived of oxygen, most commonly occurs in:

   a. exposure to noise
   b. middle ear infection
   c. otosclerosis

4. If the hearing impaired listener does not understand what is being said, the most effective way for the speaker to make himself/herself understood is to:

   a. repeat the message louder
   b. rephrase the message
   c. write the message down

5. The condition commonly known as a middle ear infection is:

   a. external otitis
   b. otitis media
   c. otosclerosis

6. In a sudden hearing loss, speech usually:

   a. deteriorates gradually
   b. remains unchanged
   c. remains unchanged for a short period of time, then rapidly deteriorates

7. The type of hearing loss which results for a defect in the nerve cells of the inner ear and demonstrates a loss in both loudness and clarity of sound is a:

   a. central hearing loss
   b. conductive hearing loss
   c. sensorineural hearing loss

8. Words that look like other words when they are seen on the lips are called:

    a. homophenous
    b. phonemes
    c. consonant blends

9. A speech message begins:

    a. at the linguistic level, when a thought is formulated in the speaker's brain
    b. when a listener hears a speakers message
    c. when the vocal folds of the speaker begin to vibrate and sound is heard

10. The ossicles are:

    a. folds present in the tympanic membrane (eardrum)
    b. layers of the eardrum
    c. three tiny bones

11. The portion of the soundwave in which air pressure decreases slightly as air particles move farther apart is known as:

    a. compression
    b. oscillation
    c. rarefaction

12. Once damage has been done to the hair cells of the inner ear:

    a. a hearing aid can be utilized to restore the hearing to near normal
    b. a variety of surgical procedures can be used to restore the hair cells
    c. nothing can be done to restore the hair cells

13. The primitive level of hearing serves to:

    a. assist the listener in comprehending language
    b. provide a background of feeling of the environment
    c. signal the listener to the presence of danger

14. Hearing fine differences which assist in the understanding of speech sounds is:

    a. speech detection
    b. speech discrimination
    c. speech reception

A

15. Stapedectomy, or removal of the stapes bone and replacement with a prosthetic device, is used to treat:

    a. Meniere's disease
    b. otitis media
    c. otosclerosis

16. The type of hearing loss in which the sound transmitting devices of the hearing mechanism are defective and results in a reduction of sound loudness is:

    a. central hearing loss
    b. conductive hearing loss
    c. sensorineural hearing loss

17. A sensorineural hearing loss is present if the person:

    a. hears better by bone conduction than by air conduction
    b. hears equally well by air conduction and bone conduction
    c. hears only by air conduction

18. Articulation refers to:

    a. the manner in which speech sounds are produced
    b. the rate at which we speak
    c. the vibration we use in our voice

19. The cochlea is the:

    a. balance mechanism of the body
    b. end organ of hearing
    c. middle ear mechanism

20. The two basic characteristics of a soundwave are:

    a. amplitude and wavelength
    b. amplitude and compression
    c. compression and rarefaction

21. In a hearing aid, electrical energy is made louder in:

    a. the amplifier
    b. the microphone
    c. the receiver

22. Hearing loss is often referred to as "the invisible impairment" since:

    a. a great majority of hearing impaired persons withdraw from the mainstream of life
    b. amplification devices have become so small that they are not easily visible
    c. hearing impairment shows itself in no outward signs

A

23. Presbycusis is characteristically associated with:

    a. central hearing loss
    b. conductive hearing loss
    c. sensorineural hearing loss

24. Generally, the first change in speech which accompanies a loss of hearing is one of:

    a. articulation
    b. loudness of the voice
    c. quality of the voice

25. In a hearing test, the lowest level of loudness that a person is able to respond to 50% of the time is known as:

    a. frequency
    b. pure tone average
    c. threshold

26. Residual hearing is:

    a. the amount of hearing that has been lost
    b. the hearing levels obtained by use of a hearing aid
    c. the serviceable hearing that remains

27. "Self-hearing," the role which hearing has during speech, is important because:

    a. it allows the speaker to place his/her thoughts into spoken words
    b. it acts to monitor and control speech production
    c. it helps the speaker to determine when others are speaking

28. The waxy secretion in the ear canal is known as:

    a. the cerumen
    b. the tragus
    c. the tympanum

29. Amplitude is perceived by the ear as:

    a. frequency, or pitch, of sound
    b. intensity, or loudness of sound
    c. quality, or timbre, of sound

A

30. To be certain that a particular hearing aid does not become uncomfortably loud for the wearer, the audiologist measures the hearing aid wearer's:

    a. level of tolerance
    b. pure tone averages
    c. thresholds

31. Surveys have demonstrated that the highest level of community noise is generated from:

    a. household appliances--vacuum cleaners, blenders, garbage disposals
    b. recreational sources--snowmobiles, hunting
    c. transportation related sources--highways, subways

32. Vertigo is:

    a. a sensation of motion
    b. a feeling of fullness in the ear
    c. a ringing or buzzing in the ear

33. A conductive hearing loss is present if the person:

    a. hears better by air conduction than by bone conduction
    b. hears better by bone conduction than by air conduction
    c. hears equally well by air conduction and bone conduction

34. Teaching the hearing impaired person to make maximal use of his/her remaining hearing is:

    a. auditory training
    b. hearing aid evaluation
    c. vocational rehabilitation

35. The small, snail-shaped structure known as the organ of hearing is:

    a. the cochlea
    b. the incus
    c. the utricle

36. Wavelength of a soundwave is perceived by the ear as:

    a. frequency, or pitch, of sound
    b. intensity, or loudness, of sound
    c. quality, or timbre, of sound

A

37. The majority of hearing aids purchased today are:

    a. ear level hearing aids
    b. eyeglass hearing aids
    c. in-the-ear hearing aids

38. The human ear is:

    a. equally sensitive to noise across the entire frequency range or spectrum
    b. more sensitive to noise that falls above 4000 Hz than at any other frequencies in the spectrum
    c. more sensitive to noise that falls between 1000 Hz and 3000 Hz than at any other frequency in the spectrum

39. A disease associated with a malfunction of the Eustachian tube is:

    a. Meniere's disease
    b. otitis media
    c. otosclerosis

40. The frequency range between 500 Hz and 2000 Hz is often referred to as:

    a. the consonant range
    b. the high frequencies
    c. the speech frequencies

41. Tinnitus refers to:

    a. a buzzing or ringing in the ear(s)
    b. a loss of hearing in the high frequencies
    c. a sensation of movement

42. Components which are traditionally thought to make up aural rehabilitation are:

    a. counseling and vocational rehabilitation
    b. hearing aid evaluation and hearing aid orientation
    c. speechreading and auditory training

43. The inner ear is located deep within the:

    a. occipital bone of the skull
    b. parietal bone of the skull
    c. temporal bone of the skull

A

44. Increasing the loudness of a sound from zero decibels to 120 decibels increases the sound power:

    a. 120 times
    b. 1,200 times
    c. a trillion times

45. Measurements of how a hearing aid performs, or what it is able to do, are referred to as:

    a. electroacoustic characteristics
    b. levels of tolerance
    c. thresholds

46. Generally, continuous noise exposure damages:

    a. the hair cells of the cochlea
    b. the ossicles
    c. the tympanic membrane

47. Hearing loss traditionally associated with advancing age is:

    a. Meniere's disease
    b. otosclerosis
    c. presbycusis

48. The severity of hearing loss is generally measured in:

    a. loss of decibels of hearing
    b. a single percentage figure
    c. a pure tone average

49. The most efficient method of hearing is via:

    a. air conduction
    b. bone conduction
    c. tactile stimulation

50. In a hearing aid, amplified electrical energy is changed back into soundwaves and transmitted to the ear by:

    a. the amplifier
    b. the microphone
    c. the receiver

B

MULTIPLE CHOICE INSTRUMENT

1. The small, snail-shaped structure known as the organ of hearing is:

   a. the cochlea
   b. the incus
   c. the utricle

2. The ossicles are:

   a. folds present in the tympanic membrane (eardrum)
   b. layers of the eardrum
   c. three tiny bones

3. Components which are traditionally thought to make up aural rehabilitation are:

   a. counseling and vocational rehabilitation
   b. hearing aid evaluation and hearing aid orientation
   c. speechreading and auditory training

4. The severity of hearing loss is generally measured in:

   a. loss of decibels of hearing
   b. a single percentage figure
   c. a pure tone average

5. The type of hearing loss which results from a defect in the nerve cells of the inner ear and demonstrates a loss in both loudness and clarity of sound is a:

   a. central hearing loss
   b. conductive hearing loss
   c. sensorineural hearing loss

6. A disease associated with a malfunction of the Eustachian tube is:

   a. Meniere's disease
   b. otitis media
   c. otosclerosis

7. The condition commonly known as middle ear infection is:

   a. external otitis
   b. otitis media
   c. otosclerosis

B

8. Generally, continuous noise exposure damages:

   a. the hair cells of the cochlea
   b. the ossicles
   c. the tympanic membrane

9. Measurements of how a hearing aid performs, or what it is able to do, are referred to as:

   a. electroacoustic characteristics
   b. levels of tolerance
   c. thresholds

10. Increasing the loudness of a sound from zero decibels to 120 decibels increases the sound power:

   a. 120 times
   b. 1,200 times
   c. a trillion times

11. The portion of the soundwave in which air pressure increases slightly as air particles move more closely together is known as:

   a. compression
   b. oscillation
   c. rarefaction

12. "Self-hearing," the role which hearing has during speech, is important because:

   a. it allows the speaker to place his/her thoughts into spoken words
   b. it acts to monitor and control speech production
   c. it helps the speaker to determine when others are speaking

13. Residual hearing is:

   a. the amount of hearing that has been lost
   b. the hearing levels obtained by use of a hearing aid
   c. the serviceable hearing that remains

14. Tinnitus refers to:

   a. a buzzing or ringing in the ear(s)
   b. a loss of hearing in the high frequencies
   c. a sensation of movement

B

15. Hearing fine differences which assist in the understanding of speech sounds is:

    a. speech detection
    b. speech discrimination
    c. speech reception

16. Stapedectomy, or removal of the stapes bone and replacement with a prosthetic device, is used to treat:

    a. Meniere's disease
    b. otitis media
    c. otosclerosis

17. Surveys have demonstrated that the highest level of community noise is generated from:

    a. household appliances--vacuum cleaners, blenders, garbage disposals
    b. recreational sources--snowmobiles, hunting
    c. transportation related sources--highways, subways

18. In a hearing aid, amplified electrical energy is changed back into soundwaves and transmitted to the ear by:

    a. the amplifier
    b. the microphone
    c. the receiver

19. The two basic characteristics of a soundwave are:

    a. amplitude and wavelength
    b. amplitude and compression
    c. compression and rarefaction

20. The cochlea is the:

    a. balance mechanism of the body
    b. end organ of hearing
    c. middle ear mechanism

21. A sensorineural hearing loss is present if the person:

    a. hears better by bone conduction than by air conduction
    b. hears equally well by air conduction and bone conduction
    c. hears only by air conduction

B

22. Generally, the first change in speech which accompanies a loss of hearing is one of:

    a. articulation
    b. loudness of the voice
    c. quality of the voice

23. Hearing loss is often referred to as "the invisible impairment" since:

    a. a great majority of hearing impaired persons withdraw from the mainstream of life
    b. amplification devices have become so small that they are not easily visible
    c. hearing impairment shows itself in no outward signs

24. A "stress reaction," in which circulation to the extremities of the body--including the ear--decreases and the hair cells of the inner ear are deprived of oxygen, most commonly occurs in:

    a. exposure to noise
    b. middle ear infection
    c. otosclerosis

25. Wavelength of a soundwave is perceived by the ear as:

    a. frequency, or pitch, of sound
    b. intensity, or loudness, of sound
    c. quality, or timbre, of sound

26. Teaching the hearing impaired person to make maximal use of his/her remaining hearing is:

    a. auditory training
    b. hearing aid evaluation
    c. vocational rehabilitation

27. The frequency range between 500 Hz and 2000 Hz is often referred to as:

    a. the consonant range
    b. the high frequencies
    c. the speech frequencies

28. The primitive level of hearing serves to:

    a. assist the listener in comprehending language
    b. provide a background of feeling of the environment
    c. signal the listener to the presence of danger

B

29. The majority of hearing aids purchased today are:

    a. ear level hearing aids
    b. eyeglass hearing aids
    c. in-the-ear hearing aids

30. The most efficient method of hearing is via:

    a. air conduction
    b. bone conduction
    c. tactile stimulation

31. A conductive hearing loss is present if the person:

    a. hears better by air conduction than by bone conduction
    b. hears better by bone conduction than by air conduction
    c. hears equally well by air conduction and bone conduction

32. Hearing loss traditionally associated with advancing age is:

    a. Meniere's disease
    b. otosclerosis
    c. presbycusis

33. To be certain that a particular hearing aid does not become uncomfortably loud for the hearing aid wearer, the audiologist measures the hearing aid wearer's:

    a. level of tolerance
    b. pure tone average
    c. thresholds

34. The inner ear is located deep within the:

    a. occipital bone of the skull
    b. parietal bone of the skull
    c. temporal bone of the skull

35. In a hearing test, the lowest level of loudness that a person is able to respond to 50% of the time is known as:

    a. frequency
    b. pure tone average
    c. threshold

B

36. Once damage has been done to the hair cells of the inner ear:

    a. a hearing aid can be utilized to restore the hearing to near normal
    b. a variety of surgical procedures can be used to restore the hair cells
    c. nothing can be done to restore the hair cells

37. The waxy secretion in the ear canal is known as:

    a. the cerumen
    b. the tragus
    c. the tympanum

38. Presbycusis is characteristically associated with:

    a. central hearing loss
    b. conductive hearing loss
    c. sensorineural hearing loss

39. Amplitude is perceived by the ear as:

    a. frequency, or pitch, of sound
    b. intensity, or loudness, of sound
    c. quality, or timbre, of sound

40. The human ear is:

    a. equally sensitive to noise across the entire frequency range or spectrum
    b. more sensitive to noise that falls above 4000 Hz than at any other frequencies in the spectrum
    c. more sensitive to noise that falls between 1000 Hz and 3000 Hz than at any other frequency

41. A speech message begins:

    a. at a linguistic level, when a thought is formulated in the speaker's brain
    b. when a listener hears the speaker's message
    c. when the vocal folds of the speaker begin to vibrate and sound is heard

42. If the hearing impaired listener does not understand what is being said, the most effective way for the speaker to make himself/herself understood is to:

    a. repeat the message louder
    b. rephrase the message
    c. write the message down

B

43. Vertigo is:

    a. a feeling of fullness in the ear
    b. a ringing or buzzing in the ear
    c. a sensation of motion

44. The part of the hearing aid which transforms soundwaves into electrical energy is:

    a. the amplifier
    b. the microphone
    c. the receiver

45. Articulation is:

    a. the manner in which speech sounds are produced
    b. the rate at which we speak
    c. the vibration we use in our voice

46. The type of hearing loss in which sound transmitting devices of the hearing mechanism are defective and results in a reduction of sound loudness is a:

    a. central hearing loss
    b. conductive hearing loss
    c. sensorineural hearing loss

47. In a sudden hearing loss, speech usually:

    a. deteriorates gradually
    b. remains unchanged
    c. remains unchanged for a short period of time, then rapidly deteriorates

48. In a hearing aid, electrical energy is made louder in:

    a. the amplifier
    b. the microphone
    c. the receiver

49. The portion of a soundwave in which air pressure decreases slightly as air particles move more farther apart is known as:

    a. compression
    b. oscillation
    c. rarefaction

50. Words that look like other words when they are seen on the lips are called:

    a. homophenous
    b. phonemes
    c. consonant blends

APPENDIX D

I. PHYSICS

In order to gain an understanding of the functions of the hearing mechanism, we must first take a look at some of the basics of physics. Although physics is a very extensive branch of science, we will examine some simple concepts here, in order to help us in the understanding of hearing.

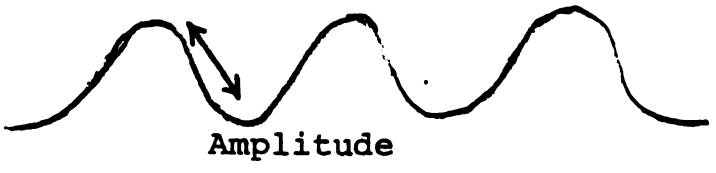
If I asked anyone here to name something which might be heard, you might name a variety of things -- voices, the ringing of the telephone, music, the engine of a car. All of these things may be classified as sound. All sounds share a common beginning -- they are produced by vibrations or movements of an object. Let's consider that we hear a bell ringing. First, of course, the bell is hit. The bell is made from a metal that is somewhat elastic, and this metal moves quickly back and forth, or oscillates, in response to being hit. Of course, air is surrounding the bell, so the air next to the metal moves back and forth quickly also. Air is what is known as compressible gas; when the bell moves outward it slightly compresses or pushes more together, to the air next to it. When the bell moves back, the air is allowed to spread out again and it becomes less compacted, or it rarefies. The air which is next to the bell is next to more air, therefore alternating cycles of compressing and rarefying push against this adjacent air, although these cycles gradually get weaker. These

compressions and rarefactions are transmitted in a gradually widening area, in the same way that circular ripples are spread when a pebble is dropped into water.

If a device that could measure slight changes in air pressure were placed near the bell, with each compression a short increase in air pressure would be measured, and with each rarefaction, a slight decrease in air pressure would be measured. If these slight changes were plotted on a graph of changes in air pressure which occurred with changes in time, the result would look like this:

This graph, resembling a wave, is known as a soundwave. These soundwaves travel through air, and in this manner reach the other ear. How the soundwave is heard by the ear will be discussed later. Now we will discuss some characteristics of the soundwave.

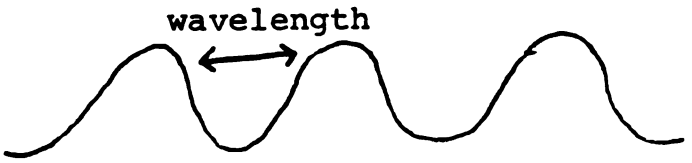
Soundwaves have two basic characteristics -- amplitude and wavelength. Amplitude is defined as the distance between the peaks and valleys of the soundwave:



This amplitude is perceived by our ears as intensity, or loudness of sound. Amplitude is perceived by the ear as how loud or how soft a certain sound may be. This loudness is

measured in decibels. You may recall hearing the term decibel when you had your hearing tested. The decibel will be discussed latter in this session.

The second characteristic of a soundwave is wavelength. Wavelength can be defined as the distance between peaks of the soundwave.



If one were to count the number of peaks to pass a particular point in a given time frame, such as a second, this would give a measurement of cycles per second. Cycles per second is perceived by our ears as frequency or pitch -- that is, how high or low a certain sound sounds. For example, the tone of middle-C on the piano has a frequency of 256 cycles per second. That means, the middle-C vibrates 256 times per second. You may also hear the term cycles per second referred to as Hertz.

As stated before, the way in which the loudness of sound is measured is the decibel. Named to honor Alexander Graham Bell, the Bel was used to represent the amount of energy in a soundwave. The term decibel, or one-tenth of a Bel, came about since the numbers being dealt with were so large, that using the decibel made them much more manageable. The decibel is a logrithmic method which conveniently deals with large numbers. The dB is not an absolute value, but rather a ratio, or a unit of comparison between two sound

intensities. The range of hearing of the human ear is so great that such a method is necessary. If we look at the relationship of dB to energy, the need for this system becomes obvious. If we hear a 10 dB sound, such as a whisper, there is a 10-fold increase in sound power transmitted to the ear. Next, we have a 30 dB sound, such as quiet conversational speech, and one might assume that there is a 3-times greater increase in sound power over the whisper at 10 dB. Recalling this is a logarithm ratio scale, we realize that this 30 dB sound is actually a 1000-fold increase in sound power reaching the ear. A 120 dB sound, such as that from amplified music, results in a trillion-fold increase of sound power. We should remember that this dB scale is a comparison between the intensities of two sounds. Therefore, if I were to tell you that a sound were so many decibels, it refers to the fact that it is more intense than a reference level by that much. If I were testing your hearing and turned the loudness dial on the audiometer from 0 dB to 60 dB, there would be a million time increase in the energy reaching your ear. Of course, this 60 dB sound would still be bearable to your ear.

The physics concepts of decibel and wavelength have very practical applications to having one's hearing tested. Zero dB is referred to as average, normal hearing, or no decibel of hearing loss. This is a relative measurement determined by testing young adults with no history of ear disease and finding thresholds or levels where they can

hear 50% of the time, then averaging these. Thus in hearing testing, a 30 dB loss of hearing means the person needs 30 dB more of sound pressure than the average normal person to hear the sound presented. Hearing loss is best expressed by recording auditory acuity, or ability to hear sounds at certain sound intensities, in decibels for each frequency, or cycles per second of a particular soundwave (its wavelength). This information is plotted on the audiogram, or graph of hearing.

We have covered the very basic physics of sound as the soundwave reaches the outer ear. The last concept to examine in physics is to look at how this energy from the soundwave is transmitted through the ear. We will talk about this in further detail when we discuss the physiology, or functioning, of the ear. Briefly, soundwaves in the form of compressions and rarefactions of air are directed into the ear canal and come in contact with the eardrum. These soundwaves are transmitted via mechanical energy through the bones of the middle ear. The inner ear is filled with fluid. Once this mechanical energy reaches the fluid filled inner ear, it is transmitted via hydraulic, or fluid energy. This hydraulic energy reaches the neural, or nerve pathways that lead to the brain and become electrical energy to transmit the sound signal to the brain. Once these electrical impulses reach the brain, in particular the auditory cortex, they are decoded using psychological or semantic knowledge. This leads to the understanding that although the hearing

mechanism is the receiver and transmitter for sound energy, the brain is actually where hearing occurs, since it is there that these transmitted soundwaves are "understood" or assigned meaning, such as the association between a ring of a bell and realizing that someone is trying to call you on the telephone.

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II. HEARING IN THE PROCESS OF COMMUNICATION

If we examine what happens when two people talk with each other, it is easy to understand how important hearing is in this process of communication. There are generally two major participants in this process -- the speaker and the listener.

First, let us consider the speaker. The speaker's message begins as a thought in the linguistic level in the brain. At this level the idea, thought, or feeling to be communicated is born. The message to be communicated by the speaker is then put into a linguistic or language format by making appropriate selection of words, groups of words, and word sequence, as determined by the speaker's knowledge of grammar. This linguistic message then proceeds to a physiologic or production level. At this level, nerve impulses from the brain alert the nerves that control the organs of speech -- including the lungs, vocal folds or cords, lips, and tongue -- into action. The vocal folds (cords) are set into motion by air pressure from the lungs as small pressure changes occur in the throat and mouth. These small changes in pressure are the same pressure changes as we discussed in our section on physics -- thus they are sound-waves coming from the speaker's vocal folds (cords). These soundwaves are modified by action of the tongue, roof of the mouth (or palate) and lips. These soundwaves are then transmitted from the mouth of the speaker,

where the speech message becomes airbourne on its way to the ear of a listener. This is a very basic explanation of how speech travels from the source, or speaker, to the receiver, or listener. Yet, we must stress that speech and hearing act as a system. Hearing is necessary to monitor the speech message; that is, hearing provides feedback to the brain of the speech message that it has just produced. In this way, the communication system of speech and hearing can be classified as a "servosystem," or it regulates itself. This means the communication process has an automatic control device built into it -- it is sensitive to its own errors, and is able to control its own output.

Early theories on how the communication process works viewed the role of hearing in speech production as a monitoring and feedback device; thus, the ear appeared to "check up" on the signal produced after its production. However, more recent theories suggest that the role of hearing includes that of "self-hearing" during speaking, which actually modifies and controls speech, thus the ear is actually a component of the speaking system and does not act merely as a message receiver. We are dependent, to some extent, on feedback provided by the ear to control rate (how rapidly we talk), pitch (how high or low we talk), articulation (the manner in which we produce speech sounds), and loudness. Say, for example, you are at a party and are trying to carry on a conversation with another person. As you begin to speak, your ear signals your brain as to the

presence of distracting and unwanted sound in the form of background noise, and in turn your brain signals the speech mechanism to increase the loudness of the signal. Your listener may have less trouble picking up your message once your ear tunes into the environmental cues and compensates by increasing loudness of speech.

In considering this example, it becomes easy to understand how a person with defective hearing may lack this type of control. A person with a moderate loss of hearing may not realize the intensity of the background noise, and may, in turn, not compensate by increasing the loudness of their spoken message. Hearing is a vital component to the communicative process whether it is for "self-hearing" to control one's own speech, or to receive the messages of others with fidelity or lack of distortion. In the case of defective hearing, the ability to self-hear is reduced and distortion is already present within the ear, thus fidelity is automatically reduced.

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III. AUDIOLOGY

To understand some basic concepts of hearing and hearing loss, we must examine some of the common terms used in describing hearing and hearing loss.

First, it is important to consider the difference between the terms "deaf" and "hearing impaired." Many persons commonly interchange these terms, although there is a difference. These terms can be defined in a variety of ways, although I will give the most basic definitions. Deaf generally refers to a person who has lost their hearing prior to learning language, such as a baby who is

without sufficient hearing. Deaf may also refer to a person who communicates using sign language. A person may be considered deaf if they have lost their hearing after acquiring normal speech and language development and their loss of hearing is classified as profound - he/she most likely would not have serviceable hearing for speech, may not benefit from a hearing aid and thus their major input would be visual, instead of auditory cues. DEAFNESS IS USUALLY REFERRED TO AS A TOTAL LOSS OF HEARING.

On the other hand, hearing impaired generally refers to a person who has experienced a loss of hearing after he/she has learned normal speech and language, and generally benefits from using some sort of amplification device such as a hearing aid. HEARING IMPAIRMENT IS A PARTIAL LOSS OF HEARING. All of you could be classified as hearing impaired.

The label used to define a person with a hearing loss

is not as significant as determining the type and severity of the loss and what can be done to assist this person in communicating more effectively.

The first thing to consider is the type of hearing loss that a person has. There are two basic types of hearing loss: conductive and sensorineural.

Conductive hearing loss is a problem with the sound transmitting devices, or the outer or middle ear. If a problem lies in either the outer or middle ear, the hearing impaired person's difficulty lies with transmission of sound-waves from the outer ear to the cochlea, or organ of hearing. Wax blocking the ear canal, a middle ear problem such as an infection, or a break in the bones of the middle ear may cause this type of eharing loss. A conductive hearing loss generally results in a loss of loudness of sound, yet once it is made loud enough, the sound is clear and easy to understand. Conductive-type hearing loss frequently responds well to medical or surgical treatment, thus the person with a conductive type hearing loss is well advised to seek medical consultation pertaining to his/her hearing loss. Even if the person with a conductive hearing loss does not benefit from medical treatment, he/she often does very well with a hearing aid, since this loss is generally one of loudness, not clarity.

Sensorineural hearing loss refers to a malfunction in the inner ear. This is sometimes called nerve-type hearing loss, since it is a result of damage to the cochlea, organ

of hearing, or the auditory nerve. Many times the nerve hair cell endings on the cochlea: are damaged or destroyed due to noise exposure, the aging process, diseases such as mumps or meningitis, or certain drugs known to be poisonous to the hearing mechanism. In a sensorineural type of hearing loss, the person not only experiences a reduction in loudness, but the clarity of the signal reaching the inner ear is also distorted, thus the person's ability to discriminate or understand speech is reduced. Although one should seek medical consultation whenever hearing loss is first identified, there is generally little medically or surgically that can be done to treat this type of hearing loss. Amplification is usually the treatment of choice for a person with a sensorineural hearing loss, although a hearing aid can make sound louder, it cannot improve the clarity of the sound. A person with sensorineural hearing loss may also experience tinnitus, or a ringing or buzzing sound in the ear. This sound may be constant or it may come and go -- particularly noticeable in quiet.

Hearing loss may also be of a mixed type. This hearing loss may demonstrate a conductive type at some frequencies and a sensorienural type at some frequencies. A fourth type of hearing impairment which is less common than the others is known as retrocochlear or central hearing loss. In this type of hearing loss, the sound is transmitted normally through the inner ear, then is distorted in the area between the auditory nerve and the brain.

The severity of a hearing loss is usually measured by loss of decibels of hearing as determined by responses to tones presented by an audiometer, the equipment an audiologist uses to test hearing acuity. The results of this test are placed on an audiogram, which all of you have probably seen before. The audiogram is a graph of hearing. It is plotted to show loss areas (show audiogram). The numbers running up and down the side refer to decibels of sound loudness. The numbers running across the top refer to specific frequencies. These frequencies range from very low tones to very high tones -- such as base drum sound to a bird or whistle-type sound. The frequencies in the middle of this graph are referred to as the speech frequencies, since sounds in this range are especially important for the understanding of speech. In plotting the audiogram, the lowest level of loudness (in decibels) that a person is able to hear at 50% of the time is plotted for each frequency. This hearing level is known as the threshold for that frequency. Hearing is reported in the following manner -- less than 26-dB of hearing loss is referred to as normal; 26-dB to 40-dB, mild hearing loss; 41-dB to 55-dB, moderate hearing loss; 56-dB to 70-dB, moderately severe hearing loss; 71-dB to 90-dB, severe hearing loss; and greater than 91-dB, as a profound hearing loss. This loss of hearing is sometimes classified by averaging the threshold results at 500, 1000 and 2000 Hz (the speech frequencies) and determining the severity of the

hearing loss by this. This is useful for getting a thumbnail sketch of a person's approximate communication ability. Of course, more than one classification may be present -- a person's hearing may fall within normal limits in the low frequencies and gradually worsen in the high frequencies. Any combination of classification is possible and it is important to know the configuration, or shape, of the points on the audiogram. The right ear is represented by a red "O" and the left ear is represented by a blue "X."

Hearing is generally tested by both air and bone conduction. Air conduction is tested under headphones. A tone is presented which reaches the inner ear via the outer and middle ear sound transfer. Bone conduction is tested by a small bone conduction oscillator (or vibrator) placed on the forehead or the mastoid bone behind the pinna. If bone conduction thresholds are found to be better than air conduction thresholds, a conductive type hearing loss is present. If bone conduction scores are interweaving with air conduction scores, a normal hearing or sensorineural hearing loss is present.

When a person's hearing loss is described, it is reported by both type and severity of the loss. An example is a person might have a moderate sensorineural hearing loss, or a mild conductive hearing loss.

IV. ANATOMY AND PHYSIOLOGY

In this session, we will look at the anatomy, or structures of the hearing mechanism, and physiology, or how these structures work.

We will begin by examining the anatomy of the ear. This will be broken down into three sections -- the outer ear, the middle ear, and the inner ear.

The Outer Ear:

The part of the ear which is visible on the sides of the head is known as the pinna or auricle. It is made up of cartilidge, except for the very bottom portion, known as the lobule, which is made up of fat. The opening visible in the middle area of the pinna is the beginning of the external auditory ear canal, which leads down to the eardrum. This canal is about one-inch long in adults and the outer half is made of cartilidge, while the inner half is made of bone. The canal is covered with skin and protective hair. Glands are located in the ear canal at the end closest to the pinna which secrete cerumen, or a waxy substance. This wax is necessary to lubricate the skin of the outer ear and to trap foreign materials so they are unable to enter farther into the canal. Many people worry about cleaning wax out of their ears. This is usually not necessary since the chewing motion of the jaw helps the wax work its way out of the ear canal. The old adage -- "Never stick anything in your ear smaller than your elbow" -- still applies. That means no object -- including Q-tips and hair

pins -- should ever be placed in the ear canal. If a person has difficulty with wax building up in the ear canal, he/she should see an otolaryngologist, or a physician who specializes in the treatment of the ear, nose and throat.

The tympanic membrane, or eardrum, lies at the end of the ear canal. It is a semi-transparent membrane consisting of three layers of tissue; the outer skin, the tough fiberous middle layer, and the inner layer made up of mucous membrane. Examining the tympanic membrane can often give a physician or audiologist an indication of the health of the middle ear. This examination is performed by shining a light into the ear canal, which allows for clear viewing of the eardrum. The eardum has some normal characteristics which can be seen by examination. A change in these normal characteristics may indicate a middle ear problem, such as an infection.

The Middle Ear:

Directly behind the tympanic membrane is a cavity about 1 to 2 centimeters in volume. The entire middle ear cavity is lined with mucous membrane, the same type of tissue that lines the nose. There are three ossicles (or bones), two muscles, and air space located in this cavity.

You may have heard the ossicles, or bones of the middle ear referred to as the hammer, the anvil, and the stirrup, since these bones have been thought of as resembling those

objects. These bones are actually called the malleus, the incus, and the stapes. These bones are joined together as a chain which act to connect the tympanic membrane to an opening in the inner ear known as the oval window. The two muscles of the inner ear are attached to the ossicles. The middle ear is ventilated by the Eustachian tube, a tube which joins the middle ear to the place where the nose and throat join in the back of the throat, known as the nasopharynx.

The Inner Ear:

The inner ear is located deep within one of the bones of the skull, the temporal bone. It houses the end organs for both the hearing and the balance systems. This placement deep within the temporal bone gives the inner ear greater protection than almost any other structure in the body.

The inner ear membrane has two openings: the round window, and the oval window. The cochlea, or "organ of hearing," is attached behind the oval window. It is a small, snail shaped structure which is coiled 2½ times. The cochlea is filled with fluid and is lined with very sensitive nerve endings.

The inner ear, as stated previously, is also responsible for balance or equilibrium. This portion of the inner ear is known as the vestibular portion. Three canals known as the semicircular canals contain specialized nerve tissue and act as the organ of balance. These three semicircular canals are attached to a structure known as the utricle which

helps to regulate the body's sense of position, such as standing up or lying down.

Both the hearing and balance portions of the inner ear join together to form a nerve that leads to the brain.

Now that we have discussed the location of the structures of the ear, we will discuss how these structures work, or their physiology. We will do this by looking at how the ear works when a soundwave reaches it.

The Outer Ear:

The function of the outer ear in humans is basically decorative. It is through the opening in the outer ear leading to the ear canal that soundwaves enter the ear.

The Middle Ear:

Once soundwaves reach the tympanic membrane, or eardrum, they cause this membrane to begin vibrating, much like a drum when it is struck with a drumstick. This vibration, in turn, causes the ossicles, or bones, to vibrate. The ossicles major purpose is to preferentially transfer soundwaves from the outer ear to the inner ear. These three ossicles are joined so that their vibration transforms soundwaves from the air to the fluid of the inner ear. The middle ear is often said to transmit these soundwaves via mechanical energy, because they act as a lever between the outer ear and the oval window of the inner ear. The muscles of the middle ear act as a protective device. Since

they act as a lever between the outer ear and the oval window of the inner ear. The muscles of the middle ear act as a protective device, since they act to reduce the movement of the ossicles in the presence of loud sounds. This prevents too violent movements of the stapes bone, which helps to prevent damage to the hearing mechanisms of the inner ear. The Eustachian tube acts to equalize the air pressure on the two sides of the eardrum. This equal pressure between the outer ear and middle ear allows the eardrum to vibrate freely with incoming soundwaves.

As mentioned before, the ossicles transfer soundwaves from the outer ear to the inner ear preferentially. They transfer soundwaves from the environment of compressible air particles of the outer ear to the incompressible fluid of the inner ear. This method of transferring sound is known as air conduction hearing, where the soundwaves reach the inner ear through vibrations of the tympanic membrane and the ossicles. This is the most efficient method of hearing. Sounds may also be transferred to the inner ear via the bones of the skull, thus bypassing the eardrum and the ossicles. This manner of hearing is known as bone conduction.

The Inner Ear:

When the soundwave reaches the oval window via the footplate of the stapes bone, it has reached the fluid-filled inner ear. With each movement of the footplate of the stapes in the oval window, the sound energy is transferred

to the incompressible fluid. Since the fluid is incompressible, each inward movement of the oval window produces an outward movement of the round window. This fluid vibration causes a movement in a membrane in the cochlea, which presses down on the hair cells. This pressure on the hair cells produces an electrical charge which is transmitted to the VIII cranial nerve known as the auditory nerve. These electrical charges enter the brain at the brainstem, where these auditory nerve fibers carry electrical charges up to the cortex of the brain. In the cortex, meaning is attached to the sound. Thus, if a bell is rung, once the soundwave is transmitted through the hearing mechanism, the brain interprets the sound and attaches the name "bell" to it.

This has been a very basic explanation of the anatomy and physiology of the hearing system. If you have any questions, I would be glad to answer them.

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V. PATHOLOGIES OF THE EAR

There are a variety of diseases and disorders of the hearing mechanism that may be familiar to you -- you may have heard of these or have known someone who has had one of these, or perhaps you have read of them. We will examine these briefly in terms of the outer, middle and inner ear.

The Outer Ear:

1. External Otitis - This is an infection of the outer ear, which may be caused by an ill-fitting earmold of a hearing aid or a scratch in the ear canal, as can occur if one tries to remove wax from the ear canal. You may have also heard this called "swimmers ear." This infection is usually treated with medication for the pain and medication to reduce swelling in the ear canal.
2. The outer ear is also susceptible to boils or infections of the hair follicles of the ear canal. These are treated in the same manner as other ear infections.

There are other, relatively uncommon conditions that affect the outer ear. These conditions very rarely result in a significant hearing loss, although any condition affecting the outer ear may be painful and irritating.

The Middle Ear:

1. Otitis Media - The common name for this condition

is known as "ear infection." Ear infections are generally associated with children, although they may affect people of any age.

There are a variety of symptoms that may accompany an ear infection. The acute or simple type of ear infection is generally accompanied by pain, fever, difficulty in hearing, and often follows a cold. This is the type of ear infection generally associated with a child waking up screaming in pain in the middle of the night.

Sometimes this simple type of ear infection works itself into a more chronic, or long-term, problem. These ear infections may result in a build-up of pus in the middle ear cavity in which the Eustachian tube is malfunctioning, bulge, or may result in a tear or performation in the ear-drum. If there is pus in the middle ear cavity, it may be treated by antibiotics or the insertion of tubes to equalize the pressure in the middle ear cavity. If the eardrum is torn, it must always be treated by surgical treatment, such as a skin graft to repair it.

The symptoms of an ear infection may be reduced or minimized by seeking prompt medical attention for any ear pain or for any change in hearing noticed following a cold.

2. Otosclerosis - This is a disease in which new bone is formed on the bones of the middle ear, most commonly the footplate of the stapes. It is thought to be a genetic disorder and in 60% of the people with otosclerosis, a family history of

this disease is reported. The other 40% are thought to have come from families with carriers.

At first the bony growth is soft and spongy, yet as the disease progresses it becomes thick and hard. Since otosclerosis affects the middle ear, it begins as a conductive hearing loss, although if left untreated, it may affect the inner ear, thus causing a sensorineural hearing loss. Hearing loss associated with otosclerosis generally begins in the 20's and gradually progresses until it stabilizes in the 40's. The symptoms of otosclerosis generally worsen with pregnancy. Treatment for this disease should be closely supervised by a physician. Sometimes treatment is surgical in the form of a stapedectomy in which the stapes bone is removed and a prosthetic device, a "fake" or "man-made" stapes, replaces it. Since otosclerosis usually results in a conductive hearing loss, these people are generally successful hearing aid wearers.

3. Head Injury - Any blow or injury to the skull, particularly to the area known as the temporal bone, may result in a fracture causing a loss of hearing. In certain types of fractures, the eardrum may be torn or the ossicles fractured or dislocated.

The Inner Ear:

1. Infections - Any infection of the inner ear may result in damage to the delicate structures of the inner ear. These infections are generally treated

with antibiotics.

2. Meniere's Disease - This is also called endolymphatic hydrops. This disease may affect both the hearing and balance systems and although there are theories pertaining to what causes Meniere's disease, the cause is currently unknown. Estimates suggest that one in one-thousand people have Meniere's disease. It usually begins between the 30's and the 60's in 80 to 90% of the cases. It only affects one side, or is a unilateral disorder.

The symptoms usually include severe attacks of dizziness, a condition known as vertigo, in which the person experiences a sensation of motion; either the environment seems to be moving or the person feels as if he/she is moving in the environment; a ringing or buzzing in the ear known as tinnitus; or a feeling of fullness in the ear. Often the disease begins with nausea and dizziness. This initial attack may be followed by more attacks and in general, hearing abilities decrease with each attack. The duration and how often attacks occur may vary and there may be long periods between attacks. A variety of medical and surgical treatments may be used to attempt to control Meniere's disease. Some attempt to achieve relief from symptoms of an episode or attack by using a sedative, while others try to cure the disease with surgery to destroy the sac containing endolymph fluid within the cochlea,

or organ of hearing. Of course, surgical treatment is only considered when other medical treatment has been ineffective. The major concern is always to preserve as much hearing as possible while giving relief from the disease.

3. Presbycusis - This is the hearing loss associated with advancing age of the hearing mechanism. This hearing loss is generally a sensorineural hearing loss which usually starts in the high frequencies and may become worse with age. Many people assume that advancing age is always accompanied by decrease in hearing abilities. Although recent studies of cultures other than ours may reveal that presbycusis is associated with 3 factors prevalent in our culture: stress, a diet high in fats and cholesterol, and exposure to noise. Currently, the treatment of choice for presbycusis is use of a hearing aid.

4. Noise Induced Hearing Loss and Acoustic Trauma - These will be discussed in Section VIII, Hearing Conservation.

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VI. EFFECTS OF HEARING ON SPEECH INTELLIGIBILITY AND PRODUCTION

The ability to produce understandable speech and the ability to understand the speech that one hears are greatly controlled by the ear. Thus, a loss of hearing may result in problems of being able to understand speech, or in being able to produce speech that is easily understood by others.

If one examines the difficulty that a child born with a serious hearing impairment has in developing normal speech and language skills, it becomes clear that the ear is the natural channel by which we learn to talk. Since the ear serves as a guide in the natural control of speech, a loss of hearing after normal speech and language has been learned may result in degeneration of speech, or a decrease in how clearly and articulately speech is produced. Speech slowly degenerates once the ear no longer serves as a monitor. This degeneration may include a decrease in the sharpness or precision of enunciation, and a monotonous quality to the voice, where speech sounds rigid. In a person who experiences a sudden loss of hearing in both ears, such as that following mumps or meningitis, speech usually remains unchanged for a short period of time then begins to rapidly deteriorate, depending on how severe the loss is. In a gradual hearing loss, such as that with otosclerosis, speech may deteriorate gradually as the hearing loss progresses. Generally, the first change that is

noticeable is a defect in articulation, or the manner in which speech sounds are produced. An example of this type of error is a distortion, or defective production of the correct sound such as a lateralized /s/ (demonstrate), which sounds very "hissy." Another example is that of omission, or leaving out one of the speech sounds -- for example, "shou_" for "shout," leaving off the final "T." These errors are usually found in speech sounds which are low in intensity, or lack speech power, and high in frequency, or have much of their energy concentrated above 2000 Hz; such as /s/, /ʃ/, /tʃ/, /f/, and /θ/. Consonants at the end of words are particularly vulnerable to degeneration. The adult who acquires a hearing loss enters hearing impairment with normal speech habits, thus the task is to teach this person to retain his/her pre-hearing loss speech habits in order to conserve their skills. If training is started soon after the onset of a hearing loss, no deterioration need result. The hearing impaired individual may receive valuable feedback from hearing aid use, and although his/her own voice may not sound "natural," he/she may learn to use this feedback to control his/her speech. Kinesthetic cues, or the way that speech sounds "feel" as they are produced, also help in monitoring production of speech. Speech production may be maintained if the hearing impaired person follows these suggestions:

1. Constantly uses speech in a variety of situations in order to practice self confidence.
2. Uses amplification.

3. Becomes aware of listener needs and helps listener understand by reducing background noise (i.e., moving to a less noisy place).

4. Finds a normal hearing individual willing to be a constructive and empathic listener who is willing to provide critical feedback.

In listening to the speech of others, at first the most distressing factor may be the loss of loudness, but a person with a sensorineural hearing loss finds the quality or clarity of speech is also altered. Speech sounds become distorted, and although the speech may be loud enough, it may sound muddy and unclear. In a sensorineural hearing loss, there is damage to the hair cells in the cochlea and this damage results in faulty analysis of the sound signals that reach the cochlea. Thus, the information that reaches the brain to be processed is incomplete, and auditory discrimination, or understanding, is based on partial or reduced signals. This results in a decreased ability to determine fine differences in auditory signals, such as "thin" from "fin." For some persons, understanding of speech is good in quiet, but deteriorates in the presence of noise.

Speech discrimination involving these fine differences in the understanding of speech sounds usually involves a greater hearing loss in the high frequencies, which is typical of sensorineural hearing loss. Speech sounds are comprised of energy from a wide band of frequencies, and although 500 to 2000 Hz are sometimes referred to as the "speech frequencies" (since many speech sounds are produced in this energy range), recognition of many speech

sounds depends on energy concentrated above these frequencies. The consonants that are characterized by "friction" in which no voice accompanies them, such as /s/, /tʃ/, /θ/, /ʃ/, are referred to as "high frequency" sounds, where their energy is concentrated within high frequency bands of 4000 Hz and above. Although vowels are generally in the low frequencies, certain productions of some vowels may fall within a high frequency band. In addition to being within a high frequency range, these components are weak in the speech power which they carry. Generally, the low frequency components of speech, the vowels, carry the intensity, power or loudness of speech, while the high frequency components, the consonants, provide the cues which make speech intelligible or carry the small differences such as "fin" from "thin."

Often the speech sounds may become so distorted that it is nearly impossible for the listener to identify certain sounds on the basis of hearing alone. This inability to discriminate speech sounds may be more disturbing than the loss of loudness since it is more difficult to compensate for. Amplification may be of little help in the case of poor discrimination and in some cases, speech may sound more distorted with a hearing aid. Of course, a hearing aid may also result in an improvement in the ability to discriminate, not in improving the clarity of the signal but by increasing the loudness of the signal. The hearing impaired person may also rely on their speechreading abilities

and knowledge of the language to assist them in their understanding of speech. Most people, whether hearing impaired or not, rely to some extent on gestures, facial expression, and the visibility of speech sounds on the lips to improve their reception of a spoken message, particularly in non-optimal listening situations such as the presence of background noise. Hearing impaired listeners can develop these skills maximally through practice and training. Also, the ability to figure out words from the context of the message and the knowledge the person has about the structure of language are also vital for the hearing impaired listener. This may be particularly helpful if the listener is familiar with the topic of the message.

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VII. AMPLIFICATION SYSTEMS AND DEVICES

Hearing Aids:

Hearing aids are devices which amplify sound or make sound louder to assist the hearing impaired person in making maximal use of their residual (remaining) hearing. Probably the first hearing aid consisted of the hand cupped behind the ear. The first hearing instrument was known as the "hearing trumpet," a device made from metal or tortoise shell which gathered sound and directed it from the speaker to the listener's ear.

The hearing aids sold today can be described as electrical instruments designed to increase the loudness of sound while distorting the clarity of sound as little as possible. Hearing aids are generally the only proven non-medical treatment for sensorineural hearing losses (although some people with conductive losses benefit from the use of hearing aids). Thus, the major point to remember about hearing aids is that although they may make speech sufficiently loud, they may not be able to make speech necessarily clear. Speech is still being transmitted by way of a damaged ear to the brain for interpretation. Although there are a variety of types of hearing aids available, all hearing aids have similar components.

The three main parts of a hearing aid are the microphone, amplifier, and receiver. The microphone changes soundwaves into electrical energy. The amplifier takes the electrical energy from the microphone and makes it louder. The receiver

changes electrical energy from the amplifier back into soundwaves and transmits them into the ear through a custom-made earmold which couples the hearing aid to the ear.

A variety of personal hearing aids are available to the hearing impaired consumer (show samples). The behind-the-ear or ear level hearing aid makes up the majority of hearing aids sold today. These hearing aids rest behind the pinna, or outer ear, and are attached to the ear by an earmold made from lucite or soft plastic material in the shape of the ear canal and pinna. The earmold is joined to the earmold by a piece of clear plastic tubing. Behind-the-ear hearing aids are appropriate for any degree of hearing loss and most are able to be modified specifically fit the hearing aid wearer's hearing loss.

The in-the-ear hearing aid is the smallest hearing aid available, and all components of the hearing aid (microphone, amplifier, and receiver) fit directly into the ear canal. The earmold is built into the aid, as are any control dials or switches. Until recently, the in-the-ear hearing aid was only used with people who possessed mild hearing losses, yet recent advances in hearing aid technology have developed more powerful hearing aids which may be used for up to severe hearing losses. In-the-ear hearing aids may be custom made for the individual's needs.

Eyeglass hearing aids are available in which a behind-the-ear hearing aid may be built into the temples

of the eyeglasses. Tubing attached to the legs of the glasses attaches the earmolds to the amplification system.

The body hearing aid generally provides the greatest amount of gain (they are the most powerful). These hearing aids are either clipped to the clothing or worn in a harness strapped to the chest. They are attached to the ear with a cord running from the hearing aid to the ear which is attached to a receiver earmold. Since body hearing aids tend to be the most sturdy hearing aid, they are frequently used with young children. They are often useful for persons with disorders such as arthritis, who may have difficulty using the small controls of a behind-the-ear hearing aid.

Hearing aids are powered by batteries and a variety of types and sizes of batteries are available depending on what the individual hearing aid requires.

A variety of makes of hearing aids are available to the person who is interested in purchasing one. A particular hearing aid is selectedon the basis of a variety of characteristics, depending on the individual wearer's needs. These characteristics are referred to as electroacoustic characteristics and are measurements of how a hearing aid performs or what it is able to do. Among the characteristics which should be considered are the following: Gain, or the amount of difference in dB that the input signal is amplified as it reaches the wearer's ear. For example, if the sound signal going into the hearing aid is 50 dB and

the output at the earmold is 100 dB, the gain of the hearing aid is 50 dB. This is an important consideration since a person with a mild hearing loss may experience discomfort if their hearing aid has too much gain, whereas too little gain may do little to improve the wearer's ability to pick up speech. The frequency response of the hearing aid refers to the amount of gain or power available at each frequency. For example, a hearing aid may provide only 30 dB of gain at 250 Hz but 55 dB of gain at 1000 Hz. This is important to consider in relation to the person's hearing loss. If a person ahs normal hearing in the low frequencies but decreased hearing abilities in the high frequencies, he/she will only need amplification in the high frequencies. The maximum power output, or MPO, is the greatest amount of amplification provided by the hearing aid. This is necessary to know. The audiologist must know how loud each person can stand a sound before it becomes uncomfortably loud, bordering on painful. This measurement is known as the uncomfortable loudness level, or level of tolerance, and the audiologist should be sure that the MPO of the hearing aid does not exceed this level. There are a variety of other electroacoustic characteristics which are considered in the selection of hearing aids. These electroacoustic characteristics are measured by the manufacturer, and usually once again by the audiologist or hearing aid dealer prior to fitting it to the wearer. These measurements are made on equipment that simulates how the hearing aid performs in a variety of

situations when in the wearer's ear, and is able to determine if the hearing aid is working satisfactorily. These measurements are called electroacoustic analysis of the hearing aid. If your hearing aid is not working properly, you may have this done to your hearing aid.

There is no specific formula to determine who will benefit and who will not benefit from wearing a hearing aid. The only way for a hearing impaired person to determine if they will benefit from a hearing aid is to try one. After a hearing loss is confirmed, it is the right of the potential hearing aid wearer to see a physician to assure there is no surgical or medical treatment available to correct the hearing loss. Adults over 18 years of age may waive this right. The next step is to undergo a hearing aid evaluation with an audiologist. During this evaluation, a number of hearing aids are tried on the potential wearer and both objective and subjective results are considered in selecting the appropriate hearing aid. Of course, the best test of a hearing aid is for the potential wearer to try it out in their everyday listening situations -- at work, at home, etc. A 30 day trial period is guaranteed for any potential hearing aid wearer, so that a full refund for the hearing aid can be obtained if the person is not satisfied with the hearing aid. In some states, a person may purchase a hearing aid directly from an audiologist who dispenses hearing aids. In Michigan, a hearing aid may be obtained in one of two ways:

1. After a hearing evaluation, the audiologist writes a prescription which the person takes to a hearing aid dealer to be filled; or

2. After a hearing evaluation, the audiologist recommends a hearing aid and the person sends for the aid through a mail order hearing aid dealer. This aid is sent to the audiologist who fits it to the wearer's ear.

The cost of a hearing aid varies with the type, make and options available. Typically, a behind-the-ear hearing aid costs between $200 and $500 or more, depending on where it is purchased. Since hearing aids are a large investment, one should make sure they are well informed about his/her hearing aid. There are many myths about hearing aids which should be cleared up before a person decides to purchase one. First, a hearing aid, although it can make speech louder, does little to improve the quality of the sound the ear hears. Also, it is vital to realize that although one wears a hearing aid, and may hear better while wearing the hearing aid, hearing neither improves or is damaged from wearing a hearing aid. If a person chooses not to wear a hearing aid, he/she must realize that although their hearing may deteriorate from normal aging processes or exposure to noise, for example, this deterioration is by no means related to not wearing a hearing aid. Of course, the audiologist should carefully instruct the hearing aid wearer as to the correct usage and care of his/her hearing aid and if questions arise, the audiologist should be available to answer them. Appropriate maintenance of the hearing aid can help to prolong the life of a hearing aid. The hearing aid wearer should avoid exposing his/her hearing

aid to high or low temperatures; it should be kept dry and free of dust and dirt; and the aid should always be turned off with the battery case open when not being worn.

Hearing aids are only one device available to the hearing impaired person in order to improve their communication with the world around them. Certain routine daily activities such as the need to be awakened, answering the door, or talking on the telephone, may be difficult, if not impossible for some persons with a hearing loss. Watching television or listening to the radio may also be things that the hearing impaired person believes he/she can no longer enjoy. But, there are devices available to assist in all of the activities just mentioned:

Alarm Clocks - Alarm clocks of many forms are available. For persons with a high frequency hearing loss, clocks with low frequency buzzers are available. Other clocks are available which, instead of relying on an auditory signal, utilize a light flasher to inform the user of the time. Pillow alarms are available where the user is awakened to gentle vibrations sent through the pillow.

Doorbells - Doorbells are vital for independent living. For some mildly hearing impaired persons, hearing the doorbell is not difficult until they are in a room of the house not near the buzzer. In the case of a high frequency hearing loss, a low frequency buzzer can be installed. Flashing light signals may also be useful to alert the person that someone is at their door.

Telephone Communication - Persons with a hearing impairment frequently demonstrate difficulty understanding communication over the telephone, and for most, additional money must be paid to have telephone amplifiers or some other device installed. For some, hearing the ring of the telephone is more difficult than communicating on the phone. The phone company is able to install a low frequency ring, or a light flashing device. As for altering communication on the phone, amplifiers may be installed either within

the phone or as a portable unit that attaches to the phone and many find it useful to pick up the magnetic spillover on the telphone while adjusting their hearing aid to the T or telephone switch, although this spillover is not picked up on all telephones, depending upon the company.

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VIII. HEARING CONSERVATION

The term "noise pollution" may be familiar to some of you. Each day the average person is exposed to many situations with high levels of noise. Many assume that exposure to noise only affects persons who work in factories, yet certain recreational activities, such as snowmobiling or hunting, or even certain things around the house such as lawn mowing, using a highspeed blender, or listening to music, can expose the listener to unacceptable levels of noise. In the 1960's, the U.S. Public Health Services announced that the problem of hearing loss was the nation's most chronic handicapping disability, and unfortunately it still is. Part of this problem may be related to exposure to noise. We will examine what the problem is and things that may be done to avoid it. Once damage has been done to the ear, nothing can be done to restore it, therefore prevention is the key to the problem of noise.

It is difficult to determine exactly how much abuse the human ear can withstand before malfunctioning. The type of hearing loss incurred by exposure to noise is generally sensorineural in nature, with damage resulting to the hair cells of the cochlea, the organ of hearing. Noise may damage hearing in two ways. First, intense soundwaves can blast away the hair cells of the inner ear. Secondly, intense sound may provoke a "stress reaction" in which the blood pressure in the trunk of the body rises, while the circulation of the periphery of the body (extremities including

the ear) decreases -- if this occurs for more than a few minutes, the ear lacks oxygen and thus the hair cells may become more prone to inner hair cell damage from noise.

The only difference between a hearing loss caused by exposure to noise and any other sensorineural hearing loss is that noise induced hearing loss may be prevented.

One may ask how to tell if a noise level is dangerous. There are some guidelines that may be used. If it is necessary to shout to be heard above the noise, if the noise leaves a ringing or feeling of fullness in the ears, or if the listener's own voice (or the voices of others) begin to sound dull or hollow (as if the sound is in a barrel), then it is very likely that the noise may be at a level that is damaging to hearing. Some people suggest that they get used to intense sounds, but they don't realize that the sound may no longer bother them because they have already begun to lose their hearing.

There are two types of noise induced hearing loss. In the first type, hearing loss occurs gradually over a period of years. In the second type, hearing loss is attributed to one single brief, but intense, exposure to noise such as an explosion. This type of one-time exposure is known as acoustic trauma. Noise exposure produces both temporary and permanent effects. The most common way to describe effects of noise on hearing is to note auditory thresholds. If you will recall, thresholds are the results obtained to testing with pure tones and speech, which are recorded on an audiogram.

Two types of changes in thresholds, or threshold shifts, are observed in cases of noise induced hearing loss. The first of these is a temporary threshold shift, where the person's thresholds are elevated (or hearing abilities have decreased - the person cannot hear as well) and after a period of time away from noise exposure, which may be hours or months, the person's hearing returns to its normal, pre-noise exposure levels. In the case of temporary threshold shift, the person's hearing improves or he/she recovers his/her hearing after exposure to the noise is stopped. The other type of shift in the auditory threshold is the permanent threshold shift. In this type of shift, the hearing abilities decrease, yet no improvement is witnessed, even if exposure to the noise is stopped. In this case, once the exposure to noise is stopped, the person's hearing will become no worse, due to noise induction. Of course, other factors such as aging, may cause further loss in hearing.

Sources of noise may come from a variety of sources, including industrial machinery, traffic, chain saws and home appliances. There are two important things to consider when thinking about how hazardous a particular noise is to one's hearing. The first of these is the frequencies in which the noise falls within. Noise is made up of energy which is at a variety of frequencies -- this is known as the spectrum of noise. The human ear is more sensitive to the energy falling between 1000 and 3000 Hz than it is to noise energy concentrated below 500 Hz or noise energy concentrated

above 4000 Hz. So, two noise spectrums at the same loudness may not be equally damaging if one is concentrated in the low frequencies and one is concentrated between 1000 and 3000 Hz. In this case, since the ear is more sensitive to noise energy between 1000 and 3000 Hz, this may prove more damaging. The second thing to consider is the total amount of time which the person is exposed to the noise. Of course, loudness of the noise must be considered with time -- generally the louder the noise, the less time a person can be exposed to it before sustaining damage to his/her hearing.

A variety of legislation has been passed pertaining to noise and noise exposure. In the industrial setting, it is generally viewed as the employers responsibility to prevent noise induced hearing loss either by keeping noise down to acceptable harmless levels (as established by the Occupational Health and Safety Administration - OSHA), or to provide hearing protection for the employees. Of course, the most effective means of reducing noise is to reduce noise at the source. If not practical, the administration may be able to schedule frequent interruptions in noise exposure rotating employees between "noisy" and "quiet" jobs, or minimizing the number of employees working in "high noise" jobs. Hearing or ear protectors are essential for anyone working in a high noise area. The ear protector attempts to reduce the sound reaching the inner ear by presenting an abstacle to sound transmission to the outer and middle ear. There are two types of ear protectors: ear plugs (insert type), and ear

muffs. Ear inserts can either be custom made or formable. The custom made type generally are made from ear impressions and are meant to last. The formable type are made of fiber-glass, or soft plastic, and conform to the wearer's ear; these are disposable and meant for short-term use. Ear muffs resembling headphones enclose the outer ear with a hard wall enclosure which is filled with a cushion of plastic foam, air, or some liquid, and is held in place by a spring steel band. Both types of ear protection are available commercially and capable of reducing the vast majority of noise exposure to a safe level.

Many people assume that only those exposed to industrial noise run the risk of a noise induced hearing loss. But, everyday exposure to noise can also reach the hazardous level. For example, a ride on a subway in New York City exposes the rider to noise levels greater than 90 dB. Surveys have shown that transportation-related sources, such as highways, are responsible for the highest level of community noise. It is estimated that the music in disco's is approximately 110 dB at a distance of one to twenty feet from the speaker -- this exposure in an excess of 30 minutes may be hazardous. Hobbies of hunting, snowmobiling, and using power equipment, may emit dangerous levels of noise. Even household appliances such as high speed blenders, vacuum cleaners, garbage disposals or lawn mowers may produce high levels of noise.

So, we need to ask ourselves, what can we do to protect

our hearing? Of course, anyone who works in a high noise situation or participates in a noisy hobby should wear appropriate hearing protection. If possible, we should avoid any product that produces excessive noise. People often associate noise with power and production. Recently, a lawn mower manufacturer produced a new lawn mower that was marketed as the quietest model of its kind. It was found that people who purchased the mower complained it was not as powerful as the older, louder model -- actually it was just as powerful. We must realize that technology can now produce powerful, efficient equipment that is quieter than their former counterparts. Writing to manufacturers of produces that produce excessive noise, may have positive results, once manufacturers become aware that consumers are aware and bothered by this.

Other measures can be taken in addition to avoiding noise exposure to protect one's hearing. Care should be taken as to keep the ears healthy and no foreign object should ever be placed in the ear. Proper medical care should be obtained in the case of an ear infection. Certain diseases -- measles, scarlet fever, meningitis -- are particularly dangerous to the hearing mechanism, so one should avoid contracting these and obtain prompt and proper medical treatment if they are contracted. Some very powerful drugs may cause irreversible damage to the inner ear and should be avoided, if possible -- one should consult his/her physician about possible side effects before taking any medication.

Adequate nutrition and maintaining a good physical health are also excellent ways to help ensure healthy hearing.

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IX. EFFECTS OF HEARING ON SELF-CONCEPT AND SOCIAL ADJUSTMENT

The ability to hear well is something in life that most people take for granted, until some of this ability is affected by the loss of hearing. The loss of hearing effects different people in different ways. For persons with a moderate high frequency hearing loss, they may lose their ability to perceive environmental sounds, such as the hum of an air conditioner, and may find their hearing loss annoying when unable to hear the phone ring from a different room. Persons with a more severe hearing loss may find that they have difficulty understanding the speech of others, thus their hearing loss affects their communication ability. Yet, this is not to imply that the severity of a person's hearing loss is the only factor that affects how a person will react. A variety of factors -- when hearing loss occured, how it affected their work abilities, the state of general health, among others -- may all join together to determine how any one individual may react to loss of hearing. In this session, the effects of hearing on self-concept and social adjustment will be examined.

Hearing impairment is the major chronic medical problem in the United States today, and is frequently a seriously handicapping condition. Even those with relatively mild hearing losses may experience great difficulty in understanding the speech of others in a group of people or if a lot of background noise is present. Unless one utilizes sign language as his/her major form of communication and is

able to use this in communicating with friends, family and co-workers, human communication is generally expressed via oral language which relies on speech and hearing. Thus, this form of communication may prove difficult for the person with a hearing loss. The loss of hearing is often referred to as "the invisible handicap" since it shows itself in no outward signs such as blindness or other physical handicaps.

Some hearing impaired persons do not utilize amplification, or the amplification is well concealed, and the hearing impaired person generally resembles the normal hearing person. Thus, they are expected to communicate like the normal person. This expectation, coupled with a hearing loss, can cause a serious breakdown in communication, particularly in noisy situations or in groups. This breakdown in the communicative process often causes the hearing impaired person to withdraw from social situations, or to avoid meeting new people.

In examining this information, I do not want to imply that all hearing impaired persons can be categorized or generalized or pigeon-holed into fitting into certain behaviors or traits. Of course, we realize that each person is an individual and the presence of a hearing impairment does not ignore each person's individuality. Yet, some reactions have been discovered to commonly occur with persons who have developed a hearing loss.

Hearing impaired persons may become suspicious of those

around them, including family and friends. They may miss out on certain comments or innuendos, and may feel as if other people are talking about them. Some people may fear being labeled as stupid, particularly to strangers, since they may not be able to catch on to what the person has said or asked, especially if that person was not facing them or if there is a lot of background noise. It may seem easier for some hearing impaired persons to avoid certain situations than to attempt to communicate in these frustrating, less than perfect, circumstances. Of course, if the hearing impaired person does avoid these situations, a feeling of isolation may result and the person may, in turn, avoid trying to develop new relationships or to maintain old ones. Of course, hearing impaired people may develop certain strategies to assist them in social situations. The hearing impaired person may be able to find a position in either group situations or meetings which may assist him/her in being able to understand more of what is being said. Generally, in large group meetings, the closer one sits to the speaker, the easier it is to hear, since the signal is louder and the noise is less, or a better signal-to-noise ratio exists. Although all people, whether they have impaired hearing or not, rely to some extent on non-verbal cues, such as gestures, facial expression, and "lipreading," the hearing impaired adult may learn to use these cues to his/her benefit to maximize his/her understanding.

When trying to carry on a one-on-one conversation in

either a noisy or crowded room, moving to a quieter spot instead of attempting to communicate in such a situation may be the best suggestion. Many hearing impaired people find that if they are able to explain to family and friends about their hearing loss and explain their needs, their communicative problems are minimized. For example, many people assume that if a hearing impaired person does not understand a statement or question, it is helpful to repeat the same statement or question, only louder the second time. This may go on and on until the speaker is yelling, and both the speaker and listener become frustrated. If the hearing impaired person explains that a sensorineural hearing loss is not just a loss of loudness but also a loss of clarity, and that instead of repeating the same words louder, rephrasing the statement at the same intensity may provide greater communicative success. It may also be helpful to inform certain acquaintences of one's hearing loss. This need not be done in a manner which draws attention to the hearing impairment or subjects the listener to the speakers pity. For example, I worked with a client who was totally deafened at 22 years of age, and although her speech was near perfect, she relied solely on "lipreading" (speechreading) as her form of understanding speech, since she was unable to benefit from amplification. In the grocery store, the cashier carried on a conversation with her yet she had no idea what was being said, since the woman usually looked down as she spoke. One day, my client told the cashier that although she would like to speak with her, it was

difficult when she was unable to see her face and that she was hearing impaired, therefore relying on lipreading. The cashier responded very favorably to this information and my client found that in addition to being able to converse with the cashier at the grocery store, she was encouraged to use the same tactic on others with whom she was in frequent contact -- the bank teller and the mechanic.

Many people adjust very well to their loss of hearing and are able to adapt very well. Generally, though, this process takes a period of time. The loss of hearing is often accompanied by denial, rejection, and anger. At the beginning of this section, it was stated that most persons with normal hearing take their hearing for granted. Yet, the loss of hearing is just that -- a loss. It is not uncommon for a person who has experienced a loss of hearing, particularly if it is sudden, to undergo a period of grief. This grief process, as with any type of grief, may be classified into these stages:

1. Rejection or denial of the hearing loss
2. Acknowledgement of the hearing loss
3. Acceptance of the hearing loss.

In the rejection or denial stage, a person may deny any problem with his/her hearing, even after this loss is confirmed. You yourself, or someone you know, may have been this way. Many people tell me the only reason they are getting their hearing tested is because their husband/wife has been nagging them about their hearing. These clients suggest they

can hear their spouse just fine, but are ignoring him/her. Many people first detect a possible hearing loss by needing to ask the speaker on the phone to speak louder, or to turn up the volume on the television set, although they attribute this to too much noise -- grandchildren playing, cars outside, etc.

Once the person either confirms their loss of hearing to themself or is told by an audiologist that they have a loss of hearing, they may enter the acknowledgement stage. In this stage, the person may either say "yes, I have a hearing loss and I'm going to do something about it," which we will discuss shortly, or "yes, I have a hearing loss and that's how I'll be, nothing can help me." If this person reacts in the second manner, they may view themselves as a hearing impaired person rather than a person with a hearing impairment. They may pity themselves and although they will recognize their impairment, they may do little, if anything, to compensate for it. If a recommendation for a hearing aid evaluation was made, the person may choose to ignore the recommendation as something that will not help them.

In the acceptance stage, the person has decided to say "yes, I have a hearing loss, and I'm going to do something about it." He/she views himself/herself as a person with a hearing impairment and are willing to attempt to compensate for the loss of hearing so that he/she can lead a communicatively normal life.

These stages are not labeled as good or bad, yet just as part of a process of acceptance of loss. Some persons pass easily from one stage to another; for others, it may take a great deal of time before they can accept the loss of hearing, and some people may never fully accept their hearing loss. Persons working with the hearing impaired should be understanding of these feelings and hearing impaired individuals should feel as if they are able to discuss their feelings about the hearing loss with these individuals (audiologists, otologists, hearing aid dealers).

As discussed earlier, a variety of feelings may accompany the loss of hearing. Studies have shown that the loss of communication is not the hearing impaired person's only or most serious loss. In order to comprehend this, we should examine the three psychological levels of hearing which the normally hearing person experiences. These three levels are:

1. Unconscious level or auditory background level - this level allows the listener to stay in touch with their environment. This includes hearing sounds such as the chirp of birds, the tick of a clock, the hum of an air conditioner; if these background sounds are missing, the listener may feel as if the world were dead. This level, although described as unconscious or primative, may serve as what is known as a background of feeling. This background of feeling may be diminished or disappear even in the presence of a relatively mild hearing loss. The loss of hearing at this level may lead the hearing impaired individual to feel depressed and realize that something is missing, although they may be unable to pinpoint exactly what has been lost.

2. The signal level, which is utilized as a warning system and is important for survival. Sounds at this level include the sound of a siren or the buzz

of an angry bee. These serve to alert us of adjustments made in daily life, and lack of hearing at this level may interfere with one's natural ability to protect one's self (such as moving away from an angry bee), and may cause feelings of anxiety or insecurity.

3. The most obvious level of hearing may be that of the symbolic level, in which words are symbols for objects and actions. This is the method in which we comprehend language. Lack of hearing at this level may interfere with the communication process which may result in feelings of isolation, frustration, or even depression for the hearing impaired person.

A person who has sustained a loss of hearing during adulthood may face many changes in everyday life, but perhaps an understanding of these levels of normal hearing and what the loss of any of these levels may mean, may help the hearing impaired individual to gain a better understanding of their loss. For many people, it becomes frustrating and depressing to constantly expend extra effort to understand oral communication. Hopefully, this person can learn successful coping skills, coupled with effective rehabilitation efforts, which will assist him/her in continuing to pursue active personal and social relationships with others.

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X. REHABILITATION OPTIONS AVAILABLE TO THE HEARING IMPAIRED ADULT

Once a person has been identified as hearing impaired, there are a variety of options available to that person in order to assist them in communicating as effectively as they possibly can. Of course, wearing a hearing aid or utilizing a special amplification device may be very useful. There are also other things available to assist the hearing impaired person which will be discussed here.

The type of services available may be classified under a variety of names including aural rehabilitation, auditory rehabilitation and communication training. Basically, these skills focus around rehabilitation which refers to restoring communication functions that have been normal prior to the loss of hearing. The goal is to restore these functions as far as possible. Although aural rehabilitation is generally referred to as encompassing speechreading and auditory training, it should incorporate all procedures and needs of the hearing impaired person as they relate to communication.

Whether a person is fit with a hearing aid or not, auditory training is vital in assisting the hearing impaired person to improve his/her communicative abilities. Auditory training refers to teaching the hearing impaired person to make the maximum use of their residual, or remaining, hearing. Auditory training is usually a service provided by an audiologist and instruction may be presented individually or in a group (class setting). Some who participate in

auditory training instruction are hoping to improve their hearing aid use, while others may have losses that don't warrant the use of a hearing aid, but still experience difficulty communicating in a variety of situations. This instruction focuses around the speech perceived (heard) by the hearing impaired person. The hearing impaired person may practice learning to identify unfamiliar speech sounds that are not available due to use of amplification. This may be accomplished by practice in listening to vowels and consonant sounds in syllables and words: even with a hearing aid, severely hearing impaired individuals only perceive part of the speech signal. In daily situations, these people rely on their knowledge of sound and word sequencies of language to recognize speech. They communicate by piecing fragments of the message together and making predictions as to what was said, and occasionally checking it out with the speaker. For a person in this situation, auditory training instruction may focus on special practice in predicting word sequences or language patterns and making decisions about partially perceived spoken messages. Also, practice of these skills in less than optimal situations, such as a noisy background, may also be stressed in auditory training. Auditory training may also focus on teaching the hearing impaired individual social strategies which may assist them in more effective communication. These social skills may include decreasing the distance between the listener and speaker which enhances the speech while reducing the background noise and improves

the ability to understand spoken messages; or assisting the hearing impaired person to develop a willingness to ask the speaker to repeat the message, to clarify the message, or to speak louder.

Instruction in auditory training alone may assist the hearing impaired individual in improving his/her communication. Yet, if auditory training is taught in conjunction with speechreading, another skill which may be taught as part of rehabilitation, the hearing impaired person may experience increased communicative success. The term speechreading has replaced the term lipreading, since the focus is not merely on the lips -- lip movements, facial expressions, gestures, and body movements contribute to the understanding of speech. This skill enables the person to understand language by attentively observing the speaker, and is utilized to some extent by all listeners whether their hearing is normal or impaired. Think of the person who states that they "hear" better with their glasses on; when better able to pick up on visual cues, the listener may pick up added information to assist in piecing together the message. Historically, lipreading was broken down into two methods of training -- the analytic method which emphasizes looking at each individual movement, and the synthetic method which emphasizes examining the message as a whole. Currently, the trend in speechreading is away from that of strict unalterable lessons of these methods and towards an eclectic approach, or combining bits and pieces of a variety of skills

and methods to find whatever works for that person. Speechreading training today may focus on instruction and practice designed to increase the hearing impaired person's visual communication and combine both auditory and visual cues to gain a maximum understanding of speech. Depending on the person providing the instruction, usually an audiologist, a variety of activities may take place. The person may be taught to examine individual speech sounds as they are produced -- consonants are generally more visable on the lips than vowels, yet some consonants are basically indistinguishable from each other. For example, "B," "P" and "M." If one were relying totally on lipreading, certain words would look like other words on the lips. These are known as homophenous words, and an example would be the words, "pear," "bear," and "mare." The hearing impaired person may also concentrate on speechreading in a synthetic manner in order to put the word groups together, instead of viewing sounds or small units. As in auditory training, knowledge of the structure of language and word sequences can assist the speechreader in predicting what has been said. This is useful, since some sounds such as /g/, /k/, and /h/ are not visible on the lips at all. Practice will focus on both visual and auditory cues alone, then combine them with varying levels of distraction, such as background noise, and poor lighting and increasing the distance between the speaker and the listener/speechreader.

Although auditory training and speechreading are thought

to be the traditional components of aural rehabilitation therapy, there are many other services available to the hearing impaired person in order to assist him/her in meeting his communicative needs. Group education programs, such as this one, may be offered to assist the hearing impaired person, and often his/her family/friends, in gaining more information about hearing and hearing loss. This is often offered in conjunction with enrollment in individual/group hearing aid orientation in which the new hearing aid wearer is taught to use amplification most beneficially. It is often useful by merely exposing new hearing aid wearers to each other, since it is helpful to discuss difficulties and discoveries with each other and to share problems and solutions. As discussed in the section of the effect which hearing has upon speech, speech conservation or training to maintain speech skills is important to the person who has lost their hearing as an adult, and this may also be a focus of aural rehabilitation. Some hearing impaired persons seek either personal or vocational counseling from a psychologist or rehabilitation counselor in order to assist them in adjusting to their hearing loss.

Although the availability of aural rehabilitation services is often not stressed, these services may prove useful for the hearing impaired adult. These services are generally available from audiologists or speech and hearing clinics, and a hearing impaired person may learn more about these services by contacting these clinics.

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APPENDIX E

PRE AND POST PROGRAM RAW SCORE DATA LISTED FOR THE DENVER SCALE OF COMMUNICATION FUNCTION LISTED BY QUESTION

EXPERIMENTAL SUBJECTS	1		2		3		4		5		6		7		8		9		10		11	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	6	2	5	2	6	5	7	7	1	1	1	5	7	7	5	2	1	4	5	1	1	1
2	5	5	4	3	4	3	5	3	5	2	4	3	5	4	4	2	1	1	1	1	4	4
3	4	1	1	1	1	1	7	3	1	1	1	1	7	1	1	1	1	1	1	1	1	1
4	7	7	1	1	1	1	7	7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	7	7	2	1	5	1	6	1	1	1	1	1	6	2	1	1	1	1	1	1	1	1
6	6	2	5	2	1	1	6	6	4	2	1	1	5	1	1	1	5	2	1	1	1	1

PRE AND POST PROGRAM RAW SCORE DATA LISTED FOR THE DENVER SCALE OF COMMUNICATION FUNCTION LISTED BY QUESTION

EXPERIMENTAL SUBJECTS	12		13		14		15		16		17		18		19		20		21		22	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	1	1	1	1	1	1	6	6	1	7	7	4	1	4	1	6	7	4	7	7	7	5
2	1	1	5	3	1	1	5	2	5	4	1	1	1	1	7	5	1	1	5	3	1	1
3	1	1	1	1	1	1	7	5	7	1	1	1	1	1	7	1	1	1	1	1	1	1
4	1	1	1	1	1	1	2	1	7	7	6	1	6	1	1	1	1	1	2	1	2	1
5	1	1	1	1	1	1	6	6	5	2	1	1	1	1	2	2	1	1	1	1	1	1
6	1	1	1	1	1	1	7	5	7	5	2	2	2	2	7	5	6	4	1	4	5	7

PRE AND POST PROGRAM RAW SCORE DATA LISTED FOR THE DENVER SCALE OF COMMUNICATION FUNCTION LISTED BY QUESTION

EXPERIMENTAL SUBJECTS	23		24		25	
	Pre	Post	Pre	Post	Pre	Post
1	1	1	1	3	7	5
2	1	1	3	1	5	2
3	1	4	1	1	1	1
4	1	1	1	1	2	1
5	1	1	2	1	1	1
6	1	5	1	1	6	5

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