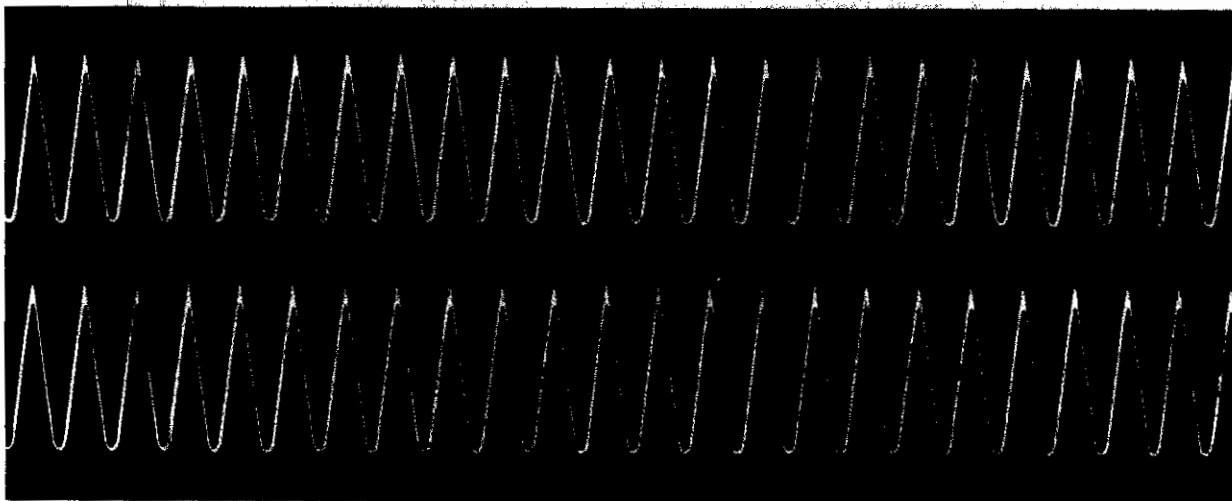


A Conference on Hearing Aid Evaluation Procedures



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**A Conference on
Hearing Aid Evaluation Procedures**

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A Conference on Hearing Aid Evaluation Procedures

CONTENTS

Introduction— <i>Herbert J. Oyer</i>	i
Preface: Keynote Address— <i>Donald A. Harrington</i>	ii
Background Information— <i>William E. Castle</i>	1
Tests and Measurements— <i>A Report on the Discussions of Panel I</i>	5
Hearing Aid Procurement and Characteristics— <i>A Report on the Discussions of Panel II</i>	14
Procedures for Children— <i>A Report on the Discussions of Panel III</i>	27
Procedures for Adults— <i>A Report on the Discussions of Panel IV</i>	39
Follow-Up Procedures— <i>A Report on the Discussions of Panel V</i>	48
Professional Qualifications and Standards— <i>A Report on the Discussions of Panel VI</i>	57
A Summary Recommendation— <i>The Subcommittee</i>	67
Appendix A: Minimum Requirements for Hearing Programs Offering Guidance in Selection of Hearing Aids.....	69

INTRODUCTION

Numerous procedures have emerged for evaluating the effectiveness of hearing aids for the hearing handicapped. To determine what procedures clinics across the nation are using, and to provide bases for guidelines, the Committee on Research of the American Speech and Hearing Association appointed a Research Subcommittee on Hearing Aid Evaluation Procedures to analyze current hearing aid evaluation procedures. This subcommittee—through a grant from the Children's Bureau, Department of Health, Education, and Welfare—was able to conduct a survey of facilities providing hearing aid evaluation services and to hold a conference for considering the data derived from that survey and for judging its value in light of other relevant knowledge and of the experience of the conferees. The following report has been developed from the conference discussions.

Each chapter of this report summarizes the discussion of a different group of from 10 to 12 specialists. The chapters serve as a partial guide toward the improvement of hearing aid evaluation procedures.

The report suggests areas for research which may lead to further improvement in electroacoustic amplification for those with hearing impairments. It sets forth important observations to be considered by professional associations and governmental agencies in their continuing efforts to refine existing standards.

A special word of appreciation is extended to Ira Ventry, William E. Castle, and Joan Jacobs. Ventry was the project director in its initial stages and Castle saw it through to completion. Jacobs acted as a research assistant. Warm acknowledgement is given to the support of Children's Bureau and the counsel and assistance of its staff member, Donald A. Harrington. Sincere gratitude is also expressed to the many who participated in the survey; to those who participated in the conference; to the members of the subcommittee, who, with their recorders, are chiefly responsible for this report; and to Doris Morton, who helped with the technical editing of the report.

Herbert J. Oyer, Chairman
Research Subcommittee

PREFACE

KEYNOTE ADDRESS

DONALD A. HARRINGTON

*Consultant, Speech and Hearing
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The Children's Bureau expresses its appreciation to each of you for the time, effort, and wisdom which your participation brings to this study. We are especially grateful to the Subcommittee and to Ira Ventry and William Castle and the members of the project staff who have had the responsibility for the successful progress of this study.

Since each of you has been selected for your knowledge and experience in hearing aid evaluation, I do not plan to review the see-saw of arguments related to some of the questions you will be discussing.

However, it does seem pertinent to describe the kinds of programs the Children's Bureau supports and in that way give you a frame of reference for a reply to the question, "Why has the Children's Bureau supported this study?"

The Children's Bureau administers three basic grant programs—maternal and child health, crippled children's services, and child welfare services—all authorized by Title V of the Social Security Act of 1935. In partnership with the states, the Bureau seeks to extend and improve preventive health services for mothers and children; to identify and treat children with crippling conditions or conditions which could lead to crippling; to see that children with social problems, or those who are neglected or abused, get the kinds of help which could ameliorate these conditions and, wherever possible, preserve family life for them.

Recently, these basic grants programs have been supplemented by amendments to Title V of the Social Security Act, providing for programs of research related to maternal and child health, to crippled children's services, and to child welfare services.

Congress also has given us a new mandate to extend by 1975 the maternal and child health and crippled children's services to children in all parts of each state. In addition to these basic grants, two new special project grants programs have been authorized. First, the 1963 Maternal and Child Health and Mental Retardation Amendments established the Maternity and Infant Care project grants program, making it possible for state and local health

departments to provide good maternity care for mothers in low-income families, and their infants.

Second, the most significant of the 1965 Amendments to Title V of the Social Security Act is the new authorization for special project grants to improve the health of preschool and school age children. These grants for comprehensive health services for children and youth will make possible maximum use of the community resources for the medical, dental, physical and emotional, and other health problems of a given child population.

Within these programs concerned with the total health of the child, the Children's Bureau focuses on specific problems of interest. For example, as long ago as 1943 the Children's Bureau undertook to encourage the states to increase their health services for hearing impairment by making a special grant for demonstration purposes to the Maryland State Department of Health. Since then, other states have received special funds for this purpose.

Arthur J. Lesser, Deputy Director of the Children's Bureau, noted the effect of this grant five years later. He said:

Since the inception of the program in 1943, there has developed a considerable interest on the part of many State health departments in providing comprehensive programs for these children. It is only the lack of sufficient funds and trained personnel that is now hindering the nation-wide development of comprehensive preventive and treatment services for children who are hard of hearing.

More than 20 years later, there still is a lack of sufficient funds and trained personnel, but progress has been made. Through the steadily increasing appropriations by Congress for the basic grant programs administered by the Children's Bureau, it has been possible for many states to increase their services for speech and hearing impairments. Presently, 41 states employ full-time speech and hearing specialists in their departments of health or crippled children's agencies. These states and others, which use part-time consultants, conduct programs for the discovery, diagnosis, and treatment of children with communication disorders of speech and hearing. Treatment includes medical and hospital care, hearing aids, auditory training, and speech therapy. In 1964, 45 state health departments reported testing the hearing of over 5 million children and referred well over 100,000 for further evaluation and treatment. The state crippled children's agencies reported giving treatment services to about 30,000 children with hearing impairments. Information about the number of hearing aids provided by all the states is not available, but a sample of a few shows that during 1965 Massachusetts, Michigan, Tennessee, Washington, and the District of Columbia provided a total of 771 aids at a cost of approximately \$105,000.

The newly increased authorizations for the Children's Bureau programs will permit an even greater development of hearing and speech services in the states. In addition, the new project grants for comprehensive health services for children and youth make it possible to provide additional services for speech and hearing impairments.

One of the requirements of the grants-in-aid program is that the state submit a plan. Frequently, states which are reviewing their administrative procedures and standards look to the Children's Bureau for technical assistance and suggested guidelines. Thus, the publications of the Children's Bureau have been an important part of the grants programs. In the field of hearing impairment, the Children's Bureau has produced, recently, *Services for the Child Who Is Hard of Hearing*, *The Child Who Is Hard of Hearing*, *Choosing a Hearing Aid*, and *Guidelines for Calibration of Audiometers*.

With the aim of developing guidelines for the use of maternal and child health and crippled children's programs the Children's Bureau has supported this present study of hearing aids. The study could have been supported by the Vocational Rehabilitation Administration on the same basis for their grants-in-aid program also provides services for hearing impairment.

Hearing aids are purchased for children in nearly every state using the funds administered by the Children's Bureau for maternal and child health and crippled children's services. Additionally, hearing aids can be purchased by the medical assistance programs in welfare agencies using funds administered by the Bureau of Family Services, the Department of Health, Education, and Welfare. Each state uses its own criteria and procedures: some of you may have had an opportunity to help in establishing your state's standards for purchasing and selection of hearing aids.

While the Children's Bureau does not require states to adhere to standards in purchasing hearing aids, it would influence those standards by the guidelines it might promulgate. Thus, the results of your deliberations here may influence the guidelines of all federal and state agencies in their efforts to promote more effective and efficient selection and purchasing procedures for hearing aids.

As you know, the Medicare provisions of the Social Security Amendments of 1965 excluded payment for hearing aids. We can only wonder whether hearing aids might have been included had there been guidelines which were widely accepted.

As you begin your evaluation of the more than 25 tables of data collected from audiology centers by the project staff, we hope that such factors as self-interest, unwarranted generalizations, and irrelevant personal opinion will be excluded from your discussion and that when the conference has ended you will feel that the conclusions are the best that can be made.

CHAPTER 1

BACKGROUND INFORMATION

WILLIAM E. CASTLE

Editor

The primary purpose of hearing aid evaluation procedures is to select the most appropriate electroacoustic amplification for those hearing-handicapped individuals who can profit from such amplification. Depending upon the philosophy of the evaluator, the procedures may include: (a) determining which individuals need amplification; (b) evaluating the performances of these individuals with one or more wearable hearing aids, using such measures as speech reception threshold, speech discrimination, tolerance, and so on; (c) assessing the hearing aids themselves for ruggedness, appearance, price, or for the quality of sound which they produce; and (d) specifying the maximum gain, frequency response, and distortion characteristics of the aids.

Otologists, audiologists, hearing aid manufacturers, and hearing aid dealers are all active in hearing aid evaluation procedures in one way or another. This report is concerned with the ways in which audiologists are involved in such procedures.

In the last two decades, the professional literature in audiology has demonstrated that audiologists do not agree completely on the kind of administrative or clinical roles they should play in hearing aid evaluation procedures (Carhart, 1950, 1965; Jeffers, 1960; Shore and Kramer, 1963; Zerlin, 1962). The literature has also shown that they do not completely agree about the efficacy of some of the tools used in hearing aid evaluation procedures (Anderson and Black, 1951; Carhart, 1965; McConnell, 1960; Shore et al., 1960).

In spite of these controversies, audiologists continue to play an important role in hearing aid evaluations. Recognizing the extent of that role, the Executive Council of the American Speech and Hearing Association approved an official document in 1952 entitled *Minimum Requirements for Hearing Programs Offering Guidelines in Selection of Hearing Aids*. This document, as it was revised in 1964, is reproduced in Appendix A.

Realizing further that hearing aid evaluation procedures performed by au-

diologists across the United States had never been assessed in detail, ASHA, in 1963, appointed a Research Subcommittee for Hearing Aid Evaluation Procedures to study current practices and the needs for research relative to such procedures. (This committee shall from here on be referred to simply as "the subcommittee.")

With financial support from the Children's Bureau, Department of Health, Education, and Welfare, the subcommittee implemented its study in three steps: (1) developing and processing a questionnaire dealing with hearing aid evaluation procedures; (2) conducting a conference; and (3) preparing the present report.

THE QUESTIONNAIRE

Most of the subcommittee's work in its first year was devoted to the development of a questionnaire.

Copies of a first-draft questionnaire were pretested in two ways: (1) four were pretested at audiology clinics in the Washington, D.C., area with an on-the-spot interview technique; and (2) thirty were sent out to clinics in other parts of the country.

The questionnaire was revised on the basis of results and suggestions obtained from the pretest facilities. The questionnaire was designed primarily to determine the following about audiological facilities where hearing aid evaluations are performed: (a) types of administrative units in which the facilities were to be found; (b) sources of referral; (c) age groups served predominantly; (d) professional services used for the evaluations; (e) specific test procedures used; (f) methods used for procurement of hearing aids for shelf inventories and for clients; (g) methods used for comparative evaluations of aids; (h) procedures used regarding recommendations; (i) follow-up procedures used; (j) sources of dissatisfaction for the evaluators; and (k) needs for research.

Before the questionnaire was sent out, an initial survey of 1,304 facilities was made to determine whether their personnel performed hearing aid evaluations. The list of these facilities was compiled from: (a) ASHA's addressograph information about speech and hearing clinics, training programs, and private practitioners; (b) the *1964 Directory of Rehabilitation Facilities* prepared by the Association of Rehabilitation Centers; and (c) references from state departments of health or education. A postcard was sent to each facility to inquire whether hearing aid evaluations were performed there. In all, 855 postcards were returned, with 452 facilities indicating that they performed hearing aid evaluations.

To the list of these 452 facilities, another 285 facilities were added from: (a) lists sent to ASHA by the Veterans Administration and the National Association of Hearing and Speech Agencies; (b) referrals indicated on postcards returned in the survey; (c) some speech and hearing clinics and training pro-

grams that had not responded to the postcard inquiry; and (d) lists found in the *American Annals for the Deaf* (Doctor, 1964) and the *Archives of Otolaryngology* (Downs, 1961).

Copies of the questionnaire were sent out to 737 facilities. Thirty-one had to be discarded either because they were incorrectly addressed or because they were duplicates. In the end, 706 separate facilities received copies of the questionnaire.

Questionnaires were returned from 572 facilities. Of these, only 396 were used for data processing. The other 176 facilities either did not perform hearing aid evaluations, did not choose to answer the questionnaire, or failed to return their questionnaires by the deadline required.

The information from the 396 usable questionnaires was coded for computer processing. Straight tallies were processed for each question and cross-tab tallies were processed for given pairs of related questions. For ease of evaluation of the data obtained, all tallies were tabulated. In the chapters that follow, frequent allusion will be made to "the questionnaire." In every instance, the allusion is to the questionnaire just described.*

THE CONFERENCE

A Conference on Hearing Aid Evaluation Procedures was held in Chicago, February 4-6, 1966. The purposes of the conference were threefold: (a) to evaluate selected portions of the data obtained with the questionnaire; (b) to determine needs for research on hearing aid evaluation procedures; and (c) to evaluate and to recommend revisions for the existing minimal requirements for hearing programs that offer guidance in hearing aid selection.

The conference was structured around six panel groups. As a rule, each panel group remained together throughout the conference period, though on occasion an individual from a given panel was invited to serve on another panel as a resource person. Each panel dealt exclusively with one general topic, as follows: Panel I: Tests and Measurements; Panel II: Characteristics and Procurement of Hearing Aids; Panel III: Testing of Children; Panel IV: Testing of Adults; Panel V: Follow-up; Panel VI: Professional Qualifications and Standards. A detailed agenda was presented to each panel before discussions got underway.

Each panel was made up of a chairman, a recorder, and eight to ten panelists. The chairman for each panel was a member of the subcommittee. The recorders and the panelists were chosen for their authority on the general topic with which the panel dealt. All but one participant were Members of the American Speech and Hearing Association. The panelists spoke as individuals from the profession and not as representatives of any given agency.

* None of the tabular data nor the questionnaire is included in this report because of lack of funds. However, both the complete set of data and the questionnaire are available at the National Office of the American Speech and Hearing Association.

THE REPORT

The chairman and the recorder for each panel group developed a first-draft report on their group discussions. This draft was prepared as soon after the conference as possible and was sent to each member of the panel for evaluation. All six reports were revised by the chairmen on the basis of comments they received from their panelists. The revisions were submitted to the editor in charge of the report, who collated them for overlapping content and adapted them to a consistent format. The editor's work was reviewed by the subcommittee and ASHA's Committee on Research and Publications Board before publication.

The ideas and conclusions presented by the six panel groups are presented in the chapters that follow. *It must be kept in mind that ideas which emanated from the conference or from specific panels are presented in this document as reviewed and interpreted by the panel chairmen; they are not necessarily a consensus of all panelists involved nor a reflection of policy positions held by the American Speech and Hearing Association; and, unless otherwise indicated, they are not attributable to any given panelist.*

A document of this sort cannot be absolutely internally consistent. Opposing viewpoints and ideas which occur among panels and sometimes even within a given panel are presented here to give a perspective on some of the complexity of the issues involved.

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CHAPTER 2

TESTS AND MEASUREMENTS

A Report on the Discussions of Panel I

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In relating to the data obtained by the survey of hearing aid evaluation procedures*, Panel I discussed the effectiveness of tests currently used for hearing aid evaluations; how test procedures employed for various age groups differ; the different environments, materials, and equipment employed by various centers for tests and measurements; and the importance of measuring the physical parameters of hearing aids used in evaluations.

TESTS AND MEASUREMENTS IN CURRENT USE

Basic Objectives

Tests and measurements used for a hearing aid evaluation should help determine (a) a patient's need for amplification and (b) his ability to use amplification and should be both valid and reliable measures of a patient's ability to perceive speech at conversational levels. Currently those tests used to determine a patient's need for amplification include measurements of pure-tone air-conduction threshold and a speech reception threshold for each ear separately. Tests for determining a patient's ability to use amplification include tests of speech discrimination in quiet and noise, and tests of tolerance.

Other tests are often administered to a patient in order to get more information for audiological evaluation, for medical diagnosis, for legal purposes, or for research purposes; but they are not basic to determining either need for or usefulness of amplification. These tests may include Bekesy audi-

* See footnote in Chapter 1, page 3.

ometry, a test for the Short Increment Sensitivity Index (SISI), loudness balance tests, and tone decay tests.

Usefulness of Current Tests

All of the existing speech tests can be used for establishing speech detection thresholds. The materials used should not contain energy peaks which are excessive.

Spondaic word lists are suitable stimuli to ascertain the speech reception threshold (SRT). The gain function of these lists, reported as 10% per decibel (dB), makes them satisfactory for such a task. Other existing speech tests with similar gain functions could also be used in speech threshold determinations.

The main purpose of speech discrimination tests is to predict a person's ability to understand discourse at a given sound pressure level (SPL) compared to a similar performance by an average person with "normal" hearing. Tests now being used most commonly for this purpose are the recorded Central Institute for the Deaf (CID) W-22 lists and the Rush Hughes lists, which are known to have different levels of difficulty, but which have phonetic balance as a common denominator. Administration of tests employing these lists may not yield adequate estimates of the ability of a person to perceive conversational speech.

In a hearing aid evaluation procedure, discrimination tests are used for both unaided and aided measurements, and comparisons between the two conditions should be made. Tests used should allow for such comparisons. Furthermore, comparisons between various hearing aids with the same tests are desirable.

Some Problems

Tests used for measuring sensitivity can be routinized within a given clinic, even though methods for administering and scoring them are not standardized. Yet unless standardized techniques for administering and scoring tests are always employed, a clinic has no basis for evaluating its results.

Similarly, minimal need for amplification is often established on the basis of the specific amount of sensitivity loss. This is not a fruitful approach, since psychological, social, or vocational factors are also involved. An audiologist needs to evaluate all of these factors in addition to audiometric results, and to present his evaluations to the patient and let the patient or guardian decide whether he will use amplification or not.

DIFFERENT TEST PROCEDURES FOR VARYING AGE GROUPS

When audiologists want to determine the need for amplification for children under five, they usually use pure-tone tests, a Galvanic Skin Response (GSR) test, an Electro-Dermal Response test (EDR), or play audiometry, along with a careful medical evaluation. Yet there is a lack of satisfaction with these techniques (see Chapter 4). Audiologists claim that the aged also pre-

sent many special problems for administration and interpretation of different tests (see Chapter 5). There is, in fact, an urgent need for the development of special techniques to solve the testing problems encountered in evaluating the hearing of the very young and the aged (see Chapters 4 and 5).

For speech testing, live voice presentation of stimuli may be a good technique, for it allows the examiner to cope with the special problems of response of either the very young or the aged patient. An experienced audiologist should be able to monitor his output in such a manner as to produce a consistency that would enable him to make valid decisions based upon the responses of the client. An alternate and favored approach is to always use carefully controlled, recorded, and standardized stimuli.

TEST ENVIRONMENT, MATERIALS, AND EQUIPMENT

Variations in the materials, equipment, and test environment can reduce the reliability of hearing aid evaluations and the chance for repeating results from patient to patient in a given center and from center to center. Yet throughout the United States various speech stimuli are employed for speech testing, including running conversational speech, lists of spondaic words, phonetically balanced word lists, or lists of speech stimuli that were locally constructed. These materials are sometimes delivered to patients via disc recordings or tape recordings, sometimes by live voice through a microphone and speaker, or sometimes by the tester speaking in the same room as the listener.

Methods for presenting stimuli that are prerecorded involve a tremendous range of equipment—from locally constructed tape and playback devices to the most recent commercial instrumentation, with wide differences in precision, excellence, and calibration. The testing environments employed during the evaluation procedures are extremely varied. Some rooms have no sound treatment, some are locally constructed with some sound treatment, and some are commercially available sound-treated rooms with specified acoustical characteristics.

Test materials, equipment, environment, and procedures should be uniform. If audiologists are to accomplish hearing aid evaluations in a competent, ethical, and professional manner, uniformity must be given a high priority.

Careful calibration of all equipment used in hearing aid evaluation procedures is important. Calibration equipment must be immediately available to all centers, and the performance of calibration procedures must be in the hands of well-trained personnel.

DEVisING NEW SPEECH TESTS

Because speech tests currently in use are not completely satisfactory, new tests should be devised. An informal summary of the background regarding criteria for devising new tests was presented, as follows, by one member of the panel*:

* Arthur S. House

The phonetically balanced word lists—namely the Harvard Phonetically Balanced (PB) lists (Egan, 1948), the CID W-22 lists (Hirsh et al., 1952), the Michigan Consonant-Syllabic Nucleus-Consonant (CNC) lists (Lehiste and Peterson, 1959; 1962), the North-western test list (Tillman et al., 1963)—represent attempts to provide easily presented and easily scored speech materials that stand for connected discourse in the test situation. The so-called “phonetic balance” in these lists was imposed so the materials would reflect the speech sound distribution found in large samples of connected discourse (or written materials thought to resemble such discourse). The length of the lists was stabilized at 50 words as a direct consequence of the desire to achieve this balance.

The Harvard lists, however, were developed in the tradition of “articulation” testing, where the effect of a transmission system on subject response was the primary interest. In this application, the talkers and the listeners were trained, and the lists were both learned over time and used in their entirety. Experience with lists of this type in audiologic contexts where the speech reception ability of the listener is the primary question has raised a number of issues. There is some evidence, for example, that the diagnostic power of such lists may depend upon the talker characteristics—the Hughes-Hirsh problem. Furthermore, in clinical contexts the listeners do not have time to become well acquainted with the list vocabularies before fatigue interferes with the procedures. Inevitably some rather informal uses of lists have been made, such as using part of lists, and so on. In general, the testing situation is not well standardized, not only in application but in administration, since some clinicians use live-voice methods, others use disc recordings, others use tape recordings, and so forth.

These considerations and others have encouraged the development of speech materials. Innovators have worked primarily on the reduction of test length and the stabilization of responses by providing a response ensemble. In some instances the balance in the Harvard-type lists has been maintained and in others it has been abandoned.

The multiple-response lists developed at Ohio State University (Black, 1957) represent a closed response-set test. Schubert and his colleagues have done considerable work with a closed-response form of standard PB lists.

The Fairbanks Rhyme Tests (Fairbanks, 1958) represent a complete departure from the idea of balance, coupled with an implicit limitation in response imposed by the materials themselves. A modification of this idea, using a closed response-set, has been described by House and others (1965).

A number of attempts have been made to shorten standard Harvard-type lists, but with varying degrees of success. The 50-word form of the original lists was announced by Egan to be a minimum for balance; efforts to shorten such lists without modifying average-response tendencies would appear to be nonproductive. The rhyme-type tests, however, may lend themselves to changes in length since their phonetic make-up is arbitrary, merely being equated from form to form.

Another means of developing short lists has been described by Stevens (1962) and Hecker and Phyfe (1963). This method is aimed primarily at diagnosing problems in communication systems, but it may lend itself to certain test situations of interest to audiologists. It involves the use of short lists tailored to determine whether or not one or two simple linguistic features are confused. In one list, for example, nonsense syllables or monosyllabic words using stops or fricatives are used, while in another the ability to distinguish high vowels from low vowels is under test. These methods are rapid and highly diagnostic.

The ultimate development of appropriate audiologic instruments for testing speech reception will depend to a large degree upon standardization of administration and scoring of tests. It seems to me that failure to use standard procedures has made it very difficult to determine what needs to be done to improve the present situation. One gap in our knowledge, for example, is the general lack of error response data in clinical situations. Before better speech testing methods can be found, we will need to analyze data that have been collected under standard conditions in a number of places.

Perhaps it is time to reject the notion that a single discrimination test is sufficient to yield all of the necessary information about a listener's pattern of responses. Multiple tests seem indicated as a better means of achieving more

complete analyses, such as competing message tests and use of tests done in noise.

MEASURING PHYSICAL PARAMETERS OF AIDS

Since existing speech tests are often not satisfactorily able to differentiate the performances of various hearing aids, it seems of great importance to know the electroacoustic characteristics of the various aids. Although the American Standards Association has published standard methods for the measurement of the electroacoustical characteristics of hearing aids (ASA S 3.3-1960), this standard does not specify a precise method for reporting the results of these electroacoustical measurements. Consequently, graphical representation of the frequency response of hearing aids may be misrepresentative. Some attempts have been made, in the United States and in Europe, to establish standard procedures for publishing the results of electroacoustic measurements on hearing aids. In this country the Hearing Aid Industry Conference (HAIC) has been instrumental in establishing such standards (Lybarger, 1961). Still, the HAIC recommendations have not been adopted universally and a direct comparison of the performance of two different hearing aids is not always possible.

Knowledge of certain acoustical characteristics of hearing aids is necessary for an evaluation. Therefore, the three following considerations should be taken into account: (a) manufacturers' specifications may be incomplete or unavailable; (b) if not available, these specifications must be reported by the centers; and (c) if the center can not determine the characteristics of an aid through its own equipment and personnel, then some arrangement must be made to secure the necessary data. Ideally, all specifications, appropriately measured and reported, can be secured through an agreement with manufacturers.

At the present time the various test procedures used are extremely time-consuming. For any given patient, repeated measurements are made with several hearing aids; and often the performance of an aid falls far short of what is anticipated from the results of the unaided tests. How much such poor performance is due to certain physical characteristics of the aid is not known usually. If more were known about the exact electroacoustic characteristics of an aid and the interaction of its distortion with that of a hearing impairment, then the selection of a hearing aid could be greatly improved. The methods employed would involve less trial and error than do current methods.

RECOMMENDATIONS

Specific Test Procedures

The following analyses of specific test procedures resulted when Panel I considered the possibility of setting up a standard procedure for hearing aid evaluations.

Aided Pure-Tone Testing. This technique might have some special value in trying to test a very young child, someone who does not speak English well,

or someone with an unusual loss pattern. In the last case the test might give an estimate of the gain of the aid. Such a test should really only be done when the absorption coefficient of the test room is sufficient.

Aided SRT. The aided speech reception threshold is useful in ascertaining whether or not a given instrument provides sufficient gain for the individual at hand. Gain setting of the instrument, however, is critical and difficult because of the various performance characteristics of different gain controls. (Further discussion of gain setting follows later.) However, if a satisfactory speech threshold cannot be obtained, or if it is necessary to set the gain control of the aid at maximum in order to achieve a satisfactory aided SRT, the instrument in use probably should not be considered further.

Aided Discrimination Tests. The best use of discrimination tests in quiet is to gain a base line for comparison with future administration of such tests in noise. The use of aided discrimination tests is felt to give maximum information when the tests are administered either in noise or with a competing message.

Tolerance Tests. Tolerance tests may be helpful to delimit the choice of aids. Knowing the client's reaction to a hearing aid and also how much usable gain he will tolerate is important.

Other Procedures. The client should have a chance to react to the various instruments under test in an environment other than a sound-treated test room.

Ear Molds. Custom ear molds should be used since the mold is really an integral part of the instrument. If this is impractical, a stock mold may be used along with some suitable packing for making a good seal.

Recommendation of Aid. If all of the procedural problems could be solved, the characteristics of the aid needed would be known, and a prescription could be used. The manufacturer would have specifications that would enable him to supply that particular hearing aid. Until this is possible, only general recommendations can be made about hearing aids.

One of the major drawbacks to successful comparisons of hearing aids during current evaluation procedures is the lack of knowledge about the gain settings of the aids. In order to assure that the gains of the various aids under tests are equated, it is necessary to have markings of all gain controls as well as information relating to gain control taper characteristics. Until this is possible, the Carhart (1946) method for gain control setting should be used.

Standards for Equipment and Environments

Speech Audiometers. The American Standard Specifications for Speech Audiometers (Z 24.13-1953) defines the "essential elements" of a speech audiometer, and outlines standard methods for calibration. This standard is concerned exclusively with instrumentation and procedures for measurement of the intelligibility of speech materials while the listener is wearing earphones. Since audiometric tests used for the evaluation of hearing aids are accomplished

in a sound field, Panel I recommended that the next revision of this standard include sections devoted to instrumentation, calibration, and test procedures for measurements of speech intelligibility in a sound field.

Specifically, Panel I recommended that revision of American Standard Specifications for Speech Audiometers, or the most recent replacement by USA Standards Institute, should require two earphones and should include provision for two-channel operation with independent inputs, gain controls, and attenuators for each channel. Channel 1 should meet current specifications for speech audiometers. Both channels should provide inputs for tape recorders and other external sources. Requirements for the second channel should be the same as for channel 1 except that provisions for live-voice audiometry need not be made in channel 2, and provisions need not be made for playback of disc recordings in channel 2. The second channel should provide a noise source (white noise and/or speech spectrum noise or other noise capabilities) for masking the nontest ear rather than that it be optional as by the current standard. Switching arrangements should allow for delivering stimuli in channel 1 and in channel 2 to either of the two earphones separately or to the same earphone. Interchannel separation should be specified by paragraph 3.5.2 of the American Standard Specifications for Speech Audiometers.

Loudspeaker provisions also should be part of the speech audiometer system. Two loudspeakers should be provided with the same switching arrangements and other factors as are required for earphones. Specifically, two loudspeakers should be provided, one for each channel, with the same switching arrangements and other requirements specified by current standards. Loudspeaker characteristics, location, calibration procedures, and so on, are discussed in the following recommendation.

Loudspeakers Used for Speech Audiometry. A minimal frequency-response that is acceptable should be established for any loudspeaker that is to be used with a speech audiometer. Variations in the sound-pressure output or the acoustic power produced by such a loudspeaker (when the input voltage or electrical power is held constant) should fall within specified limits at least over the range of frequencies from 200 to 5000 Hz. If practical, this range should be extended to include frequencies from 150 to 7000 Hz.

The calibration procedures for specifying the level of speech materials delivered by the loudspeaker should include specifications for the measuring stimulus (e.g., white noise, speech spectrum noise, one octave band or bands of noise, one-third octave band or bands of noise) and the position and location of the microphone.

The position of the listener with respect to the loudspeaker, or loudspeakers, should be specified. This standard should specify the azimuth and elevation of the direct radiating diaphragm and also the minimum allowable distance from the cone of the loudspeaker to the closest reflecting plane. The front of the loudspeaker should be located at least $\lambda/4$ away from all surfaces in the test room (including the head of the listener). In this appli-

cation λ would be defined as the wavelength of the lowest frequency of interest or as the center frequency of the lowest frequency band of interest.

A standard should be established for the maximum permissible distortion for the complete sound-field system. This standard should specify methods for measuring and reporting harmonic, intermodulation, and transient distortion. The transient characteristics of the sound-field transmission system are related not only to the transient response of the loudspeaker in its enclosure and to the damping provided by the source impedance of the power amplifier, but also to the reverberation time of the test room. Therefore, the specifications concerned with the acoustic characteristics of test rooms may need to be used for sound-field testing.

The results of all physical, electrical, and acoustical measurements should be reported in terms of the coherent System International d'Unites (SI) as adopted in 1960 by the 11th General Conference on Weights and Measures.

Background Noise in Audiometric Test Rooms. The American Standard Criteria for Background Noise in Audiometric Rooms (S 3.1-1960) specify the maximum sound-pressure level of the background noise that is allowable in rooms used for audiometric tests.

These criteria were established for the measurement of minimum-audible pressures while the listener is wearing earphones.

Since audiometric techniques used for the evaluation of hearing aids are accomplished in a sound field, and under these conditions, the listener is not afforded the noise attenuation provided by earphone cushions, Panel I recommended that the next revision of this standard include sections devoted to criteria for the sound-pressure level of background noise that is allowable in sound-field, audiometric test rooms.

Specifically, consideration should be given to:

1. Maximum sound-pressure level of background noise allowable for audiometric tests that employ speech, noise, and pure-tone signals in the sound-field environment.
2. The minimum permissible volume of the test room.
3. The minimum average permissible sound-absorption coefficient of all surfaces of the test room, over the frequency range of interest.
4. The uniformity of absorptive treatment for the surfaces of the test room.
5. The maximum sound-pressure level of background noise allowable in the *control room* for presentation of speech materials by the "monitored" live-voice technique.

Although Panel I did not endorse the use of pure-tone signals for sound-field hearing aid evaluations, consideration of specifications for two types of test chambers may be more realistic: one in which the stimuli would be limited to speech, noise spectra, and bands delivered in the sound field, and one in which pure tone in the sound field also could be used.

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CHAPTER 3

HEARING AID PROCUREMENT AND CHARACTERISTICS

A Report on the Discussions of Panel II

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Some audiologists consider hearing aid selection by the audiologist to be a logical and necessary step in the rehabilitation of the hard of hearing. Others think the patient should be referred to the hearing aid dealer for selection of a hearing aid.

Both these attitudes were reflected in the questionnaire data used as a basis for this conference; of the 396 facilities responding, whose questionnaires were data processed, 78% had a hearing aid inventory and 22% did not. Both attitudes were also reflected in the discussions of Panel II. Opinions of panel members ranged widely on the subject of hearing aid evaluations and hearing aid inventories.

HEARING AID SELECTION BY AUDIOLOGISTS

Discussion "Pro"

Many audiologists believe that to predict the degree to which a hearing aid will be helpful to the patient, one must try hearing aids on the patient. Therefore, many private, community, and university clinics conduct hearing aid evaluations utilizing a hearing aid inventory.

Usually, a representative inventory of hearing aids is obtained on loan from local dealers and is maintained in the clinic so that several appropriate aids may be selected for trial with a patient. Basing his judgement upon the results of listening tests used and the individual's subjective evaluation of each hearing aid, the audiologist advises a particular aid. Some variations in policy arise regarding recommendations. Some audiologists simply note the

ear to be fitted, the manufacturer, and particular model of hearing aid selected from the aids tried; others list frequency response, gain, and maximum power output adjustments, along with any other information believed necessary. The patient is directed to take the information to the dealer in his community representing that manufacturer.

Contributing to the opinion that hearing aid evaluations should be conducted utilizing actual hearing aids is the knowledge that there are differences between hearing aids and even significant variations within models. A study recently conducted at the Auditory Research Laboratory of the Veterans Administration showed that the average gain of hearing aids in an inventory differed as much as 15 to 20 dB from the specifications submitted by the manufacturer (Kasten and Revoile, 1965). Mishandling in shipping, aging of components, and inadequate quality control may be influencing factors in producing changes of such magnitude. It should be noted that these differences were not present in the aids of every manufacturer. Granting the wide range of performance within and between models, many audiologists feel that interaction between electroacoustic properties of hearing aid and hearing problem, including considerations of coupling, impedance match, and so forth, requires clinical measurement of performance on the individual. In many instances, administrative problems prevent the individual from receiving the specific instrument on which the recommendation is based. This shortcoming has led some to condemn selection procedures generally.

There is need for better tests and measurements for relating electroacoustic characteristics to hearing aid performance on the individual (see Chapter 2), and for better training of both audiologists and dealers (see Chapter 7). In face of these needs, those who favor hearing aid evaluations by audiologists argue that audiologists must continue the trial of aids and must utilize present knowledge and tests to better advantage, while striving to improve and to make progress in this field. Instead of eliminating test procedures because they are judged inadequate, they feel that the present stimuli available for discriminating between aids should be utilized in more meaningful ways such as presentation of stimuli at faint sensation levels, with noisy backgrounds, and with competing messages.

In a hearing aid evaluation procedure which calls for the trial of several aids, the goal is simply to improve the probability that an individual will receive more benefit from the aid finally selected than he might otherwise through chance purchase. The "pro" school of thought argues that the audiologist, with his knowledge of the hearing mechanism and hearing aids, his ability to administer tests and interpret results, and his experience in handling the problems of the hard of hearing population, is better able than a dealer to represent the patient's interest.

Discussion "Con"

Some audiologists believe that hearing aid selection should be left to dealers. Several reasons have been proposed for this attitude: (a) the cost in man-

hours of professional time; (b) the administrative difficulties in maintaining an inventory of hearing aids; (c) the opinion that present clinical materials do not distinguish between aids; (d) the cost to the dealer or manufacturer in assigning aids to clinics throughout the country; and (e) the belief that dealers are qualified to perform the service.

Some argue that there are no such distinctions as "good" and "bad" among aids. One view is that, if hearing is examined thoroughly, and if proper recommendations are made regarding acoustic characteristics, any hearing aid meeting the specifications will be satisfactory. Another view is that there are no significant differences among aids of the same model produced by a given manufacturer. Furthermore, some believe that the ear is not sensitive to small differences between aids. The ear has a coding system which changes over periods of time according to its condition. With any hearing aid, the ear will require a period of time in which to learn a new coding system in place of the old one. Training, counseling, and adjustment to wearing a hearing aid may take the place of any modifications in performance which the audiologist can achieve. In addition, some state that it is better for the dealer to select and adjust the proper aid since: (a) the methods for measuring all electroacoustic characteristics of aids are not yet standardized; (b) the specific relations between electroacoustic characteristics and performance of individuals with hearing aids are not fully known; (c) the specifications provided by manufacturers are often ignored or misinterpreted by audiologists; and (d) present tests being used by audiologists to differentiate between aids are neither discriminative nor reliable. The dealer is far more familiar with his aids than is the audiologist and, therefore, is better able to assist in hearing aid selection and to make proper adjustments. According to this view, the province of the audiologist is limited to the areas of examination of hearing function, counseling, and rehabilitative services.

Those who favor hearing aid selection by dealers recommend that audiology clinics offer a Hearing Aid Information Service instead of making specific recommendations for aids. One way to accomplish this is to determine a patient's need for an aid, advise him to buy one, and give him a list of dealers he may visit in order to select an aid. After purchasing the aid, the patient may return to the clinic to determine the adequacy of his selection.

Some use a rotation method for selecting the dealer to whom a patient will be sent. From a list of several dealers, the individual is given the name of a particular dealer to whom he is directed for purchase of the aid. The proponents of this plan believe that, since all the dealers on the list are equally able to help any hearing-impaired individual, the rotation-referral method ensures equity to dealers and eliminates choice of dealer by popular reputation or hearsay only.

Master Hearing Aid

At a few audiology clinics, trial of aids has been replaced by the use of a master hearing aid, an instrument constructed to obviate an inventory by

simulating various combinations of frequency responses, maximum power outputs, and gains which are normally found in a representative hearing aid inventory. After the individual's hearing is assessed, appropriate settings to compensate for the particular hearing problem are determined by means of the master aid. Later, a dealer selects and adjusts a hearing aid accordingly. The basic assumption underlying this technique is that the particular type and degree of amplification achieved by the master aid can be reproduced in a hearing aid.

The group in favor of hearing aid evaluations contends that the amplification achieved by the master hearing aid settings cannot be reproduced in a conventional hearing aid. According to a study completed in 1959 which compared test results achieved with a sample of conventional hearing aids and a master hearing aid adjusted to duplicate performance of the sample aids, complete reproduction of response characteristics in regular aids by the master aid was not possible. Acoustic differences and distortion present in conventional hearing aids are some of the factors which may have accounted for consistently higher discrimination scores with the master hearing aid as measured by CID Auditory Tests W-22.

Evaluation of an individual with a fairly mild loss using a relatively good system, such as a master aid, may result in a false impression of the value of a hearing aid. With an amplified, relatively distortion-free signal, an individual's mildly impaired hearing may function significantly better than it would with amplification from a regular hearing aid which has a degree of distortion and other variables not present in a master aid. However, the point was made that the master hearing aid, properly used, represents an estimate of what can be achieved with selected amplification characteristics for a given loss, ignoring the effect of learning to use a particular aid. This is, of course, valuable information in the evaluation of aided hearing in general, no matter what system of actual selection of aids is used.

HEARING AID PROCUREMENT

General Guidelines for Inventory Management

A hearing aid inventory should be solicited from dealers rather than from manufacturers in order to obtain a close relationship with the patient's eventual supplier. Further, the audiologist should maintain professional relationships with dealers who are known to have experience, training, ethical conduct, and a cooperative attitude.

If a clinic decides to maintain a current, functional inventory, certain other guidelines are appropriate. A hearing aid inventory must contain a representative selection of the types (body-worn, eyeglass, behind-the-ear, and so on) and power categories (mild, moderate, strong) of aids, including some with special attributes, for example, automatic volume control.

A careful record should be kept of the number of trials and the number of recommendations made for each aid. This record will demonstrate which hearing aids are most frequently recommended and those which are rarely

recommended. Utilizing this plan, a clinic may at least minimize unfounded biases toward certain aids by permitting all aids in an inventory to have equal chances for trial. This plan also encourages a clinic to keep its inventory current and to limit the number of aids to a functional, yet representative, selection. A rotating system, whereby a dealer periodically replaces the loaned instrument with a newer one, is recommended.

A clinic should obtain new models of aids routinely for a trial period. It could be arranged, for example, that each new model be included in an inventory for a three-month period. During that time, the aid would be tried whenever appropriate. On the basis of the number of times it was recommended, this aid would be found useful or not useful to retain in the inventory. This kind of arrangement not only facilitates the acquisition of a current, functional stock of hearing aids, but also provides a continuous evaluation of the stock's effectiveness.

But what constitutes an adequate inventory?

The number of aids in the inventories of the 308 facilities maintaining inventories and replying to the survey questionnaire varied widely (see Table 1). Some audiologists believe that the public can be served as well, or better, with a small inventory of hearing aids as with a large one. However, dealers often exert pressure upon clinics to carry as many different models of their lines as possible. The overall effect, of course, is to reduce the number of times each particular aid in stock is tried and to increase the financial burden of the dealer in maintaining his aids in the clinics' inventories.

TABLE 1. Inventory representation within reporting facilities.

<i>Number of Different Models in Inventory</i>	<i>Percent of Facilities</i>
1 — 4	2
5 — 9	13
10 — 20	36
21 — 30	20
31 — 40	13
40 +	15

The most important consideration regarding an inventory is that all aids in it receive purposeful use. To illustrate, the following hearing aid procurement plans in use in selected clinics are described:

Plan A. A community clinic, located in a large metropolitan area and conducting over 400 hearing aid evaluations a year, possesses a stock of 24 hearing aids. Through charitable gifts, the clinic also maintains a supply of "loaner" aids. The caseload is comprised of a preponderance of "senior citizens" and of referrals from a school for the deaf. With these individuals the formal hearing aid evaluation is only one part of the lengthy process of training in the utilization of sound for communication. Counseling with family members and giving the patient an opportunity to gain experience with a hearing aid before

he buys one are very important in prognosticating whether such individuals will be good or bad hearing aid users. Arrangements are sometimes made with dealers for hearing aid rentals by the patient for a specified period, with no stipulation that the aid be purchased.

Dealers receive a monthly report of the number of times their instruments are tried and recommended. A prescription-like directive is given to the patient to buy an instrument like the one that was most successful in the clinic. The patient is also asked to return for a retest one week after purchase of the aid to ensure that a satisfactory selection has indeed been made.

Plan B. Each year the Veterans Administration selects 16 to 18 hearing aids for use in its clinics. The aids are selected on the basis of certain electro-acoustic and psychoacoustic characteristics and other factors (Johnson and Causey, 1956). Each clinic is provided a sufficient number of aids of each model on contract. A veteran is issued the instrument which performed most satisfactorily in the testing situation. A replacement for that instrument is then added to the stock. This technique acts as a safeguard against possible variations among the identical models supplied by hearing aid manufacturers. These variations may be significant enough to result at least in a different subjective evaluation by the wearer, if not in a change in aided speech reception thresholds and/or discrimination scores.

Plan C. A county public health clinic with a small caseload, primarily children, maintains an inventory of only 10 instruments. This provides a nucleus of hearing aids that are representative of the various type and power categories. Additional hearing aids with characteristics particularly appropriate for an individual can be requested from a dealer when necessary. When a recommendation is made for purchase of an aid that has performed satisfactorily on clinical tests, the audiologist returns the aid to the dealer who holds it aside for two weeks. The patient is given the type, model, and serial number of the aid which has performed best. He is advised that that particular instrument is the one which should be purchased and that the dealer will hold it for only two weeks. The percentage of patients buying an aid as a result of this specific kind of recommendation is high. Furthermore, this system provides a safeguard against possible variability in performance between instrument recommended and instrument received.

Plan D. A university clinic does not maintain a hearing aid inventory, yet offers a hearing aid evaluation service. To accomplish an evaluation with no inventory on hand, the clinic asks the patient to make two clinic visits. On the first, the hearing problem is evaluated, and an ear impression is taken. The audiologist then borrows, from several dealers, aids with particular gain, maximum power output, frequency response, and other characteristics appropriate to the individual's hearing impairment. Upon fabrication of the ear insert, a hearing aid evaluation is then conducted with the borrowed instruments. The aid selected on the basis of superior performance is given to the individual who goes to the dealer to make purchase arrangements. In situations where

hearing aid evaluations are conducted infrequently, this type of system can be an administrative and professional asset.

Regardless of the plan used, inventories should be maintained only if there is a need for them in a particular clinical situation, and management of the inventory should receive far more critical attention than it now gets. Voluntary placement of instruments in clinics by dealers should be acknowledged by careful stewardship on the part of clinic staffs. Neglect of the instruments operates to the detriment of all, especially the patient.

Interprofessional Relations

The dealer-audiologist relationship, sometimes the least-considered facet of a clinic's operation, should receive far more attention than it has in the past. All too often enmity, bitterness, and misunderstanding develop because of insufficient feedback from one to the other.

The audiologist improves communications when he recommends a specific hearing aid if, along with basic information regarding gain and maximum power output, battery voltage, receiver number, ear to be fitted, and so on, he also provides other pertinent facts regarding the individual's hearing problem. If there is a tolerance problem, if one ear is indicated when the other seems to be the better candidate, if the ear insert should be specially fabricated, the dealer should be aware of the facts in order to better satisfy the patient. Conversely, if a dealer feels that he might be able to improve performance by using a different setting than that prescribed he should call the audiologist to discuss the matter. Meetings between clinic representatives and dealers foster exchange of ideas, mutual respect, and a better understanding of problems.

HEARING AID CHARACTERISTICS

Definitions

A brief review of the electroacoustic characteristics under discussion follows. The descriptions are designed to give, where applicable, a summary of the specifications of the American Standard Methods for Measurement of Electroacoustic Characteristics of Hearing Aids (ASA S 3.3-1960; Lybarger, 1961 b and c) and the Hearing Aid Industry Conference (HAIC) procedures (Lybarger, 1961 a). Comments reflecting the opinions of the panel members regarding these characteristics are also included.

Gain. Gain is the difference, in decibels, between the free-field input sound pressure level to the hearing aid microphone and the output sound pressure level of the hearing aid receiver in a coupler. Gain is specified at the "full-on" level using a 50 decibel sound pressure level (50 dB SPL) input with the gain control of the aid at its maximum setting. This full-on gain value is given for every aid regardless of the level of harmonic distortion present in the system. Average gain, HAIC method, is the average of the full-on gain values at 500, 1000, and 2000 Hz.

Saturation Sound Pressure Level. With the gain control of the aid at the full-on setting and the input sound pressure level raised until the output of the

aid can no longer increase, the maximum sound pressure level that the aid is capable of producing is obtained (regardless of how intense the input signal may become). This is designated as the saturation sound pressure level or maximum power output. The term *output* in the HAIC standard is defined as the average of the 500, 1000, and 2000 Hz values of the saturation sound pressure level. Because the user of an aid may suffer further destruction of hearing as a result of over-amplification, Panel II recommended that in addition to the average saturation output figure submitted by the manufacturer, the frequencies at which peak values occur also be noted or a curve of output versus frequency be supplied.

Frequency Response. The frequency response curve depicts the area of amplification provided by a hearing aid. The "basic frequency response" is obtained using a 60 dB SPL input. The gain of the aid is set to achieve a 100 dB SPL output at 1000 Hz. The response of the aid is plotted from 200 to 5000 Hz. As an optional item, additional response curves may be obtained, with the gain of the aid held constant, at 50, 70, and 80 dB input levels, or with any other input levels that are deemed necessary to portray a comprehensive family of response curves. The curve obtained with the 60 dB SPL input, however, is always to be considered as the "basic frequency response." The HAIC frequency range is derived from the basic frequency response curve.

Harmonic Distortion. Harmonic distortion produces a waveform different in shape from the input waveform. It results from the nonlinearity of the device through which the waveform has passed. This characteristic is measured with an input to the aid of 75 dB SPL at the frequencies of 500, 700, and 900 Hz. The gain of the aid is set to achieve, as closely as possible, an output of 80 dB (5 dB of gain). Distortion is measured at the individual harmonics of the three frequencies and can be expressed as a percentage value or as the sound pressure level of the individual harmonics. The gain control is then turned up and distortion is measured according to the American Standards Association (ASA) standard, "...at a sufficient number of coupler sound pressure levels, including the maximum available, to define the curve of harmonic distortion..." The result can be expressed as the percentage of total harmonic distortion at any given output setting. No provision is made in the HAIC standard for the measurement or reporting of harmonic distortion.

Since distortion occurs above 1000 Hz in most ear level hearing aids, use of the ASA recommended frequencies can result in missing significant distortion at higher frequencies. Use of the frequencies, 400, 1000, and 1500 Hz, recommended by the International Electrotechnical Commission (1959) for measuring harmonic distortion will produce more valuable information for ear level aids.

Signal-to-Noise Ratio. This characteristic is not specified in the ASA standard. The measurement of the signal-to-noise ratio is an attempt to quantify the amount of internal noise present in an aid. The Veterans Administration

currently calls for this measurement to be made with the gain of the aid set to the highest level that can be achieved without having total harmonic distortion exceed 10% at any frequency. The input to the aid is a 1000 Hz tone set at 60 dB SPL. The output of the aid is recorded, the input signal is discontinued, and the output of the aid is again recorded. The signal-to-noise ratio is the difference between the two output levels. Ambient noise must be extremely low for this measurement to be valid.

Intermodulation Distortion. Intermodulation distortion is also not specified in the ASA standard. Distortion of this type is the result of one tone modulating another and producing sum and difference tones of several orders. When one considers the acoustic complexity of a speech signal, the difficulties created by this type of distortion can be imagined. No single measurement method has been accepted as the best technique for use with hearing aids. Some of the available techniques are as follows: Society of Motion Picture and Television Engineers (SMPTE) method (Peterson, 1949), the International Telephonic Consultative Committee (CCIF) method (1937), Notch Test proposed by Burnett (Corliss et al., 1965), Band Rejection - Band Pass procedure proposed by Bang (1963), and High Pass Filtered Noise procedure in use in Sweden (Hearing Aids Committee, 1963).

Transient Distortion. Again, there is no specification in the ASA standard for transient distortion. This phenomenon is present whenever the hearing aid is unable to duplicate the initial attack or sudden decay of a sound. There is often an alteration or lingering of the waveform that results in what is called "ringing." No standardized methods have been proposed for the measurement of transient distortion. One of the major problems relative to this measurement has been to develop a loudspeaker that is free of transient distortion. Observation of frequency responses can be used to obtain some indication of transient distortion since the presence of sharp peaks indicates the likelihood of transients.

Improving Measurements of Performance

When facilities request specific hearing aids for their inventory, performance characteristics are usually the prime criteria for selection. However, of 396 centers responding to the survey questionnaire, only 27 indicated that they have the necessary equipment to measure acoustic performance characteristics of hearing aids. In addition, according to the data obtained by the survey questionnaire, manufacturers' specifications that are sent to the clinic are, generally, the primary basis by which aids are selected for inventories; and furthermore, they are the largest single criterion for preselecting an aid for use in a hearing aid evaluation.

Since most clinics performing hearing aid evaluations rely upon manufacturers' specifications of aid characteristics, manufacturers should adhere to standardized methods of measurement, should participate in research to develop better methods, and should supply sufficient meaningful information. The need for a high degree of quality control has already

been illustrated. Frequently a single set of specific electroacoustic characteristics accompanies all aids of a particular model. The clinic staff thus assumes that all the aids of this model are so similar that no individual set of performance characteristics is necessary. However, such an assumption is doubtful and Panel II recommended that hearing aid manufacturers be requested to provide not only a typical response for an aid, but also a range of responses for instruments of that model. Consideration will have to be given to the establishment of a standard method for estimating variability. The audiologists will still have to use the mean of the distribution to estimate best a given aid's response, since he will have no way of knowing where that aid falls in the parent distribution. However, this recommendation emphasizes the need for increased product uniformity and also encourages electroacoustic characteristics of hearing aids.

Although no accepted standardized method of determining "usable gain" has been established, it would be helpful if such a figure were available.

To succeed in the development and the standardization of measurements and methods of reporting results, manufacturers and clinical and research audiologists must combine their efforts. Panel II recommended that the following minimum specifications be provided for all instruments by hearing aid manufacturers: (a) frequency response curves (ASA method); (b) HAIC gain figures; (c) HAIC saturation output figures; and (d) distortion information.

Considering the vast quantity of continually changing information associated with even the most ideal hearing aid inventory system, the clinic should maintain a handbook containing performance characteristics, adjustments, and battery data in a usable form. An example of the type of information that should be compiled by audiologists in doing hearing aid evaluations follows:

Hearing Aid X (On-the-Body)

Specifications

Gain:	59 dB. (1000; 1500; 2000 Hz average)
Maximum power output:	130 dB. (500; 1000; 2000 Hz average)
Frequency response:	Range: 210-3200 Hz; Peak: 9 dB at 800 Hz.
Receiver(s):	A-1 (standard), B-2 (bone vibrator).
Battery:	2 - type 401 (i.e., 2.8 volts) or 1 - 401 (i.e., 1.4 volts) plus dummy cell in upper battery compartment.

Settings and Adjustments

- External:**
1. On-off-telephone switch combined.
 2. Volume control.
 3. Tone control (see Internal, 1).
- Internal:**
- 1: Frequency response adjustments:
 - a. *Low frequency screw In* - normal response
 - b. *Low frequency screw Out* - low frequency reduction re: condition a.
 - c. *High frequency screw In* - normal response
 - d. *High frequency screw Out* - high frequency reduction re: condition c.
 2. Gain and power adjustments:
 - a. Gain: adjust red pointer from 1 to 5 to obtain additional gain. Accord-

ing to manufacturer, maximum gain (70 dB) is obtained at setting #5 with 2.6 volts, and minimum gain is 36 dB at setting #1 with 1.4 volts.

- b. Output: adjust screw (second from left inside lid of battery compartment).
 - (1) *Screw Out when using 1.4 volts.*
 - (2) Screw In when using 2.8 volts.

The indicated data represent the mean value of the physical measurements made on samples of this hearing aid model according to ASA and/or HAIC procedures. Gain and maximum power output are specified with a tolerance of plus or minus 2 dB. Measures of frequency response are specified with an accuracy of plus or minus 5%.

Italicized items denote those settings and adjustments used in the electroacoustic measurement procedure to obtain the reported statements of gain, maximum power output, and frequency response.

RESEARCH NEEDS

The panel recognized that the issues in hearing aid evaluation will not be satisfactorily settled until research provides further information. Panel II recommended that research be done specifically: (a) to determine the most suitable method of specifying harmonic distortion in hearing aids, and (b) to make possible the interpretation of transient distortion measurements of hearing aids.

The relation is not yet known between specific aspects of transient distortion on the one hand and signal deterioration, listening annoyance, and discomfort on the other. The intent of this recommendation is to encourage the exploration not only of methods of measuring transient distortion, but also methods of obtaining usable jury judgments of hearing aids (or comparable systems) with varying amounts of transient distortion. Listening studies to assess the effects of distortion should include juries of both normal and hearing-impaired listeners. Experience may show that only the latter group of listeners yields directly applicable information. At present, however, a "representative" set of listeners for the hearing loss population of interest would be difficult to establish.

These particular kinds of distortion are selected with the full realization that other characteristics of the aid as a transmission system may be equally important. Present knowledge shows, however, that these two somewhat independent kinds of distortion probably do covary with listening performance, particularly for speech. In addition, one of these is already measured in fairly standardized ways, and at least some equipment is commercially available for measuring the other.

SUMMARY

Two general points of view concerning hearing aid evaluation were represented in the panel on Hearing Aid Procurement and Characteristics. One group believed that an audiologist, utilizing an inventory of hearing aids and selected test procedures, should make specific recommendations regarding a hearing aid based upon his evaluation. The other group maintained that the function of the audiologist should be to assess the need for amplification and to set forth specifications such as stipulation of gain, saturation output, fre-

quency response, and so forth. The dealer, then, would assist the patient in selecting an appropriate hearing aid based on these specifications. The following constitute points of agreement reached by the panel members:

1. There must be increased investigations which would attempt to relate electroacoustic performance of hearing aids to clinical performance.
2. Manufacturers should supply certain minimum electroacoustic information concerning their aids, including the tolerance limits for the cited measures.
3. If clinics are going to conduct hearing aid evaluations utilizing inventories, definite guidelines for establishment and maintenance of hearing aid inventories are essential.
4. Clinics should maintain readily available data sheets on all models of aids in their inventories.
5. The data obtained during hearing aid evaluations should be collected and organized in such fashion as to be worthwhile research material to better relate physical performance to subjective response.
6. Clinic-dealer relations should receive far more attention than they have in the past.

The panel recognized that it was handicapped in its deliberations because of insufficient evidence. One reason research has provided so little information in the last 20 years about the relationship between electroacoustic performance and auditory behavior is the difficulty inherent in such a research task. Indeed, our complacency regarding the clinical management of selecting hearing aids for the hard of hearing has resulted from lack of awareness of the depth of the problem. Hopefully, increased interest will be focused on this area by teams of research oriented and clinically oriented scientists. Neither can accomplish the task without the other.

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CHAPTER 4

PROCEDURES FOR CHILDREN

A Report on the Discussions of Panel III

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Hearing aid evaluation procedures for children fall into three divisions: procedures pertinent to children under 2 years of age, 2-5 years of age, and 5-13 years of age. Certain aspects of hearing aid evaluations are important irrespective of the age of the patients; these include the adequacy of the facilities for making the evaluations; the most appropriate tests for use in the evaluations; the stock of aids that should be maintained for conducting the evaluations; the competencies that should be expected of individuals who make the evaluations; the follow-up programs that a center would recommend in the light of the testing procedures employed in evaluating; and the research needs that must be met.

AGE GROUP UNDER 2 YEARS

Sufficiency of Facilities

Young children needing hearing aid evaluations face a striking lack of facilities. There are few centers that adequately evaluate young children suspected of being deaf or that specialize in diagnosis and treatment for such children. Even in populous urban areas, reliable centers are not always locally available.

The dearth of established, equipped, and staffed centers for working with aural habilitation of young children tends to perpetuate itself since future professional workers, now in training, are unable to envisage—much less observe—high quality audiologic management of deaf infants. More immediately, this dearth contributes to the distressing situation that some hearing-handicapped children attain school age without having had any previous audiologic evaluation or management. Although the fault might seem to lie with a

lack of information among the adult population, a more significant cause lies in the paucity of audiological service in the communities.

Hearing aid selection is practical for a child just as soon as the audiologist can establish that the child has a reduction in hearing sensitivity, and when medical contraindications to amplification have been ruled out. The ideal center would be able to select an aid for a child at the earliest possible age, and follow his behavior during daytime activities with a close approximation to "continuous monitoring." The procedures of trying an aid (i.e., having the child use it under one adjustment and then another; watching the child react to it both momentarily and from one activity to another; and having the child under observation during feeding, playing, and sleeping) are designated here as *prognostic therapy*. This service provides for the trial use of alternative aids, molds, and settings, as well as training. Certain combinations may produce an obvious and immediate effect in the behavior of the child, which one will wish to avoid in later trials. Even so, the distinctive response can be meaningful, important, and rewarding to the teacher, audiologist, pediatrician, or otologist, who may be either assisting in diagnosis or already managing a program of prognostic therapy.

Test Procedures

Any tests of hearing for young children should be related to the development of auditory and language skills. Generally, this development is predictable in the normal baby. A number of tests are appropriate in the handling of infants who are suspected of having a hearing impairment. These and the related responses follow:

A. Basic observations:

1. moro reflex
2. undifferentiated response to sound
3. differentiated response to sound
4. sound localization
5. interpretation of stimuli
6. imitation
7. responses to gross sound stimuli
8. responses to selective sound stimuli
9. audiometry—pure tone, EEG, EDR, speech, play show, etc.
10. trial evaluation of hearing aid
 - a. acceptability
 - b. tolerance

B. Behavior at six months:

1. makes reflex responses to sound
2. turns toward source of sound
3. cries differentially
4. interrupts on-going behavior in response to auditory stimuli
5. engages in sound-play with consonant-like components

6. responds differently to environmental sounds
7. quiets under comforting vocal productions from another person

C. Behavior at 12 months:

1. demonstrates understanding of environmental sound through appropriate behavior
2. demonstrates understanding of some words through appropriate behavior
3. demonstrates understanding of simple commands, gestures
4. has some consistent meaningful vocalizations
5. responds to difference in tone of voice and intonation patterns
6. attempts to initiate communication by sound, word, or gesture
7. responds differently to voice and environmental sounds

D. Behavior at 24 months:

1. follows simple sentence commands given without gesture
2. can follow verbal commands involving two components, without gesture
3. can identify familiar objects when named
4. names familiar objects
5. names pictures of familiar objects
6. initiates meaningful sentences of two or more words
7. initiates sentences of two or more words meaningful to others

Stock of Aids

To carry out a hearing aid selection program based on prognostic therapy, the facility should maintain a stock of hearing aids. The stock should be up-to-date and include nationally recognized instruments that represent a variety of gain, output level, and frequency-response characteristics. The normal stock would probably double or triple this number. Variety in the frequency-intensity characteristics of the stock of aids is desirable, and there should be some that include low-frequency amplification extended to frequencies below 100 Hz (Ling, 1964). Moreover, the presence of these frequencies, as well as the other spectral characteristics of the aid should be periodically tested with proper equipment. The same equipment will subsequently be used in repeated measurements of the characteristics of the same aid. The alternative of accepting a manufacturer's specifications as a reliable long-term description of the aid may be unsatisfactory (see also Chapter 3).

A master hearing aid is inappropriate for use with very young children who must be free to move about naturally as a prerequisite to the audiologist's obtaining the full cooperation of the child. This freedom of action is readily available with any body-type hearing aid.

Competencies Needed

The management of the young deaf child who is being taught to live with amplified sound under continuing trial conditions may become the focus of a new professional interest group. The few specialists in this field today began as

teachers, teachers of the deaf, audiologists, pediatricians, psychologists, or perhaps otologists. Training in these specialties, however, hardly prepared them for making the crucial decisions that accompany prognostic therapy. They had, of course, the requisite fundamental, factual information: the behaviors that attend normal child development, the nature of normal hearing, the workings of a hearing aid, the symptoms of mental retardation, the development of speech and language in an individual, the psychology of learning, and so on. These are standard materials for audiologists and teachers of the deaf and at least overlap the studies pursued by psychologists, otologists, and pediatricians.

Yet there is more required of the manager of the young deaf child than comes from this background. For the present, this "more" can only be designated *clinical experience* and probably can only be learned through internship with someone who has considerable experience in management of this kind. For the future, syllabi are envisaged, based on analyses of the work and decisions of successful practitioners in centers practicing prognostic therapy. As implied above, specialization is anticipated. The product of such specialization will be a manager of therapy for special kinds of children. Should he become an administrator of a facility, he would be filling a different post from the one envisioned here.

Principles of Management

The objective in working with a child who is hearing impaired is minimization of the developmental gap between this child and a normal-hearing one. Ideally, representatives of several professions are involved in narrowing this gap: the audiologist, teacher, otologist, pediatrician, and psychologist. But all are powerless until the child is brought to their attention. Meanwhile, the developmental deficiency can be emerging insidiously, hidden, perhaps, by parental solicitousness, or, at another extreme, societal indifference. A developmental gap of one degree or another is always present by the time a child is discovered to have an auditory impairment and a manager of habilitative auditory services takes over. Confronted with a developmental gap, the manager of therapy becomes a pragmatist. Whatever works to alleviate the gap is good; that which is more effective than an alternate is to be preferred. However, he draws upon his experience to avoid simple trial-and-error. He tries one aid and another, and tries one setting and another, but not randomly. He works ingeniously to furnish an auditory sensation to the child. He strives to establish associations between the experience and the source and advises the parents about how they can provide helpful experiences for the child.

At this preverbal level, variety is sought in stimuli, and little can be expected in immediate responses other than attentiveness accompanied by degrees of muscular tone. Again, working pragmatically, the manager searches for the aid that elicits the auditory-vocal behavior that pleases him, for the setting and for the ear mold that respectively elicits behavior that pleases him, for the stimulus that seems to "work"—the voice of the mother being

especially important. These are conditions that lead to optimal development of early language and vocal skills. Subsequently, the same pragmatic rules may dictate other conditions.

The complete monitoring, described earlier, can not be done by the manager of prognostic therapy; nor can the young child remain permanently in an auditory habilitative center. Trained parents should be relied upon to help the child to hear, to reinforce the child's responses, and to become assistant managers in a program of developmental training using the same pragmatic methods of the manager of therapy. The parental training should include extensive observation in a center. Parents should be taught to recognize the limitations imposed by a hearing loss and the limitations of a hearing aid. Their indirect therapy becomes more and more important as the nature of the program for an individual child becomes established and as the manager sees the child with less frequency. The manager should continue to assess the child's progress, to counsel the parents, and to check the frequency-response of the hearing aid every few weeks or at least every four or five months (these are minimal requirements).

Parents of some severely hearing-impaired children need to be guided to an appreciation for multisensory stimulation. They can be taught how to use this approach to encourage both language and auditory development. While the bulk of present-day research indicates that vision and hearing complement each other in every day oral communication (Oyer, 1966), the use of hearing alone in certain training procedures is recommended by several panel members who work with young children, i.e., Downs, Griffiths, and Ling (see Ling, 1959).

For the child under two years of age, future educational needs often cannot be determined. A mild loss of hearing sensitivity is unlikely to have been discovered by parents at this early age. If he has reduction enough to be classified as hard of hearing, he may be able to fit into the regular classroom when he reaches age six, provided he has had appropriate education before that time. Regular classroom placement at first grade is a quite unrealistic goal for youngsters who are severely hard of hearing, severely deaf, or profoundly deaf (Rushford, 1964).

"Is what I am doing successful? Am I helping this child to acquire adequate auditory-vocal skills that prepare him for 'regular classroom instruction', i.e., the academic environment that best suits his needs and potential? Is this child in the mainstream with his hearing peers or is he an isolated deaf child?" Here are important questions for the manager of a training program to consider. With these questions in mind, his methods throughout prognostic therapy should be pragmatic.

Research Needs

Solutions in three problem areas are urgently needed: (1) improved tests for identifying the hard-of-hearing and deaf baby; (2) hearing aids with wider

range acoustic response curves and less distortion; and (3) a durable hearing aid that will withstand the wear and tear of children's activities.

The fact that babies and young children are hearing aid users has apparently had minimal effect upon the construction of the aid; it seems to be considered exclusively as a piece of adult equipment. Researchers of various professional interests need to examine the packaging of the aid, including the mold, receiver, and cord, and the engineering of the system from the microphone to the receiver to accommodate the body-size of the infant, his activity, his irresponsibility, his state of "little knowledge," as well as his state of being a "rapid learner." Also, the help of groups that have creatively tackled similar new kinds of problems should be sought. For example: National Aeronautics and Space Administration; manufacturers of prosthetic devices; toymakers; and others, all of whom have had to meet special needs with respect to ruggedness.

Considerable progress has been made in detecting deafness in younger children. The professional journals in speech pathology and audiology reflect continuing and growing interest in research in this field. Good as these signs are, there is no occasion for complacency. As the tools and methods of research improve, continuing attention must be given the problem of identification audiometry. No possibility exists for narrowing the development gap between a deaf child and normal-hearing children until the deaf child has the opportunity to hear the sounds of his world at the same age as normal-hearing children. With such experience, the deaf child can be expected to use his residual hearing for receptive and expressive language and speech development along with the visual, kinesthetic, and tactual senses. Oral communication is a realistic goal and worth all the effort it takes to establish it but it must be initiated early. At present the deaf child is detected as a consequence of delayed development or bizarre behavior; in other words, after the gap has opened. Preventive service requires the alternative. Instead of assuming that a child can hear until he proves otherwise, a more desirable assumption might be that no child hears until he proves that he does. With this principle in mind, workers and researchers should use more frequently the tests of hearing that have already been devised for testing infants at birth (Eisenberg et al., 1964; Downs and Sterritt, 1964; Wedenberg, 1965; Parr, 1962; and Murphy, 1962).

Currently there is a battery of available auditory stimuli which may or may not elicit responses. The significance of these responses should be studied as in, for example, EEG auditory testing using evoked responses with summing computers. All available behaviors and recordings of these behaviors should be explored.

AGE GROUP 2-5 YEARS

Sufficiency of Facilities

One result of the presence of special facilities, as noted in the preceding section, is an awareness in the community of the symptoms of the related

"malfunction." In other words, facilities call attention to such a problem as hearing impairment within a community. One is almost certain that if the facilities for handling hard-of-hearing or preschool children were in sufficient evidence, deaf children would receive help and advice early. As a point of fact, however, the typical deaf child 2-5 years of age has a development gap compared to his normal-hearing peers that is impossible to close and scarcely possible to reduce. Consider this: administrators of schools for the deaf and of public schools tell of deaf students appearing on the opening day of school without previous counseling or testing! The cost of such development gaps to society is in some instances inestimable.

Another evidence of insufficiency of facilities relates directly to inadequacy of facilities. The distinguishing feature of children of the 2-5 year preschool age group is their aptitude and skill with language. Normally, they have acquired language. Yet the facilities that test the hearing of these preschool children are ill-equipped in experience and materials to administer verbal aural tests.

On the positive side, many children are diagnosed as deaf within the age group 2-5 years. Frequently, this is because a tendency toward indifference or a tendency not to respond has become a trait that can no longer be ignored by parents or doctors. The parents seek help. Among the possible influences that affect the outcome may be the family physician, a neighbor, a trusted friend, a relative, a hearing aid dealer, an advertisement in the newspaper, the yellow pages in a telephone directory, or a school teacher. Were there sufficient facilities for making hearing evaluations for children within the community, this list would be shorter.

Test Procedures

Preschool children, ages 2-5, can usually be induced to wear headsets. The pure tone of the audiometer, if it can be heard, will ordinarily elicit a response. This is more apt to be so if it is preceded by the mechanical tone of a tuning fork, applied perhaps to the temporal bone early in a testing session, again provided the tuning fork can be heard. Conventional play conditioning or operant conditioning are important and useful. Additionally, play audiometric techniques can be used with normally intelligent youngsters at this age. When multiple handicaps are present, voluntary tests should be used as well as tests that evoke startle responses or elicit changes of posture or of attitude of the head or body. Often, these children are verbal if they hear and are of normal intelligence; hence, they should be called upon to make phonemic distinctions, to identify words, and to repeat phrases and sentences revealing a stage of development in handling syntax, including function words. In these instances, the universal type of standardized material makes it necessary that the audiologist report the exact material used and the manner in which it is used, in order that other audiologists may subsequently make comparative evaluation.

Stock of Aids

In a center that serves preschool children, ages 2-5, most of the major brands and models sold and serviced in the community should always be on hand for the testing-training periods. The important difference that distinguishes the preschooler, after 2, is language. In general, he can talk if he can hear. He has a vocabulary—not always intelligible speech—if he can hear. He can use appropriate intonation if he can hear. In short, language readiness is present. Since his use of language is so completely dependent upon hearing, no corner should be cut. The hearing aid or aids should be completely fitted, checked again and again, refitted as often as necessary, and made as comfortable as possible. A successful test aid ought then to become the child's personal aid. If this is not possible, a new aid should be tried in a series of comparative tests at the center.

Master hearing aids can be used in the testing session with these preschoolers. The advantage would be to find whether or not there is a special spectrum-level combination that yields even better speech reception than does any of the aids under trial. If so, the course is clear: search for the aid that matches the characteristics of the master hearing aid, even if it has to be specially fabricated.

Competencies Needed

The age 2-5 preschooler normally develops fluent conversation and reading readiness. With this achievement as the main objective, the manager of training should vary his stimulus materials to achieve many functions of language. Throughout, he should try to make oral language interesting. Of necessity, then, the manager himself should be engaging, outgoing, personable, vital—essentially interesting!

Importantly, the manager of training and the parents, while excited about the challenge to be met, must find ways to insure that the child assume responsibility and be as independent as his normal-hearing peers and siblings. The role of the parents will continue to be considerable; the manager should guide them away from baby-talk, pampering, and indulgence, and toward objectivity with respect to the hard-of-hearing or deaf child. The parents must know how to talk to the child, how to instruct him, and how to control his behavior.

Principles of Management

The preschool deaf or hard-of-hearing child, when properly managed, is really in school. He is learning to be one of the group. He is learning to conform in schedule and behavior. Since a regular school program lies ahead, he should be immersed in linguistic experience. This includes language structures, even transformational grammar. If the program which he is to follow includes normal-hearing peers, he must master language. In any event, it is sometimes possible to make recommendations regarding appropriate educational placement on the basis of community resources and the child's ability to

handle language. Most urban schools have an "open door policy" so that the hearing-handicapped child can receive the kind of education that will meet his individual needs throughout his academic career. Regular classroom placement can be realistically recommended when the child can compete comfortably and adequately. When he arrives at school, he will already have experienced the teacher-student relationship, the formalized routines of the classroom, and will have yielded to the teacher's principles of gaining attention. He will actually be ahead of his hearing peers in several ways.

Research Needs

Language is all-important, both hearing it and speaking it. The older preschooler should be subjected to as many of its subtleties as possible. The one-channel versus two-channel receiving systems present an argument that has not been resolved in terms of the impact of language and ease of listening for the person who wears one or the other system. Also, the Y-cord has neither been ruled in nor out as an improvement over a single receiver. These are topics for research with both babies and preschool children (Harris, 1965).

The design of the ear mold, as well as the optimum material for ear molds, should be studied continuously. New dimensions, configurations, cul-de-sacs, surfaces, and hardness—these can be studied for their effects on frequency response as well as comfort.

Older preschool children, although increasingly responsible year by year, continue to need hearing aids that will withstand playground activities, the insecure grasp of small hands, personal irresponsibility and forgetfulness, and all of the other behaviors of their age—in short, child-proof aids.

One of the greatest research needs is for standardized testing materials for preschool children who have language. Language development is the principal reason for the aid and should be the substance of primary tests for older preschool children. There are many opportunities to develop speech reception tests and nonword tests (both distorted and undistorted speech), and to standardize these tests.

Here's a pertinent and recurrent question: Is residual hearing endangered through the use of continuously applied amplification? The research is inconclusive. Some of it, conducted by members of the panel that contributed to this chapter, indicates that there is no deterioration as evidenced by test results. However, it is axiomatic that the milder or more moderate a hearing loss is, the greater should be the care taken in making a properly conservative fitting. There may be deterioration beyond the sensitivity of our tests. The question never ceases to be asked and needs to be resolved. This topic intermingles with the uniqueness of rates of progression for hearing loss. These differ even within a family, and a "fast" rate of progression for one person may be attributed to some alleged casual matter such as amplification. Relevant research should be carried on continuously.

AGE GROUP 5-13 YEARS

Sufficiency of Facilities

Children in the elementary schools with hearing losses fall into three principal groups: (a) deaf and very hard-of-hearing children, the severely impaired ones of our previous divisions (age groups under 2 and 2-5) who have now grown older; (b) hard-of-hearing children who need some special education; and (c) children who are, in many ways, indistinguishable from normal-hearing ones.

Facilities are available for the deaf school-age child in the United States; nearly anywhere in the country he can go to a school made up of individuals like himself. Alternatively, in many states he can attend special classes in the schools of his home community. In either instance, his teachers usually are trained as classroom teachers and, additionally, as teachers of deaf children. Likewise, the hard-of-hearing child is given special attention in many urban schools. Similar advantages are lacking in most rural and small school systems.

A group that often receives no special attention and for which facilities seem to be insufficient is the one comprised of mildly hard-of-hearing students who are sometimes indistinguishable from their classmates. These children miss the assignments, hear fragmentary explanations in class, misunderstand directions, and suppose that there is no difference between their partially received messages and the ones heard by their classmates. These students never dream they are hard of hearing. Parents, teachers, and classmates treat the mistakes as carelessness and stupidity, and teachers report to parents in terms of erratic and inconsistent performance. Behavior problems may ensue. Currently there are few facilities for these children. They probably require more than special seating in a classroom. Although amplification may be needed in the classroom, it will not be on the playground. Perhaps these children could be made the special charge of an itinerant teacher whose responsibilities would include checking that children with a hearing loss, whether or not they were given special preschool educational treatments, are achieving at a level compatible with their ability.

Test Procedures

School-age children need a wider assortment of hearing tests than they did when they were younger. All the recorded phonetically balanced lists, spondaic words, tests of tolerance, the access to Bekesy equipment, delayed sidetone, and so on, are important. The panel drew a convenient distinction between a deaf child and one who is severely hard-of-hearing. The former was considered to have no auditory awareness of his own speech. The latter, when wearing a hearing aid, was considered to have auditory feedback. With this distinction in mind, the panel considered delayed sidetone equipment as being contributory in diagnoses of hearing impairment.

Stock of Aids

Older school children introduce additional considerations into the evaluation of a hearing aid. Children are responsible and have a pride in ownership. Cosmetic features are important to both girls and boys. The coupling at the ear can be hidden or disguised, and the use of eyeglasses for mounting the aids becomes a real possibility. These added dimensions require an increase in the number of aids that should be stocked. The tentativeness of many school-age children in making up their minds and expressing their preference also adds to this need. It is a good plan to have a supply of aids that will permit the child to wear one "loaner," perhaps a second, and then choose a single style with certainty. Additionally, the manager may gather cues relative to auditory training through these repeated experiences with the child and the "loaner" aids.

The master hearing aid, when used in the diagnostic testing of school-age children, makes available a variety of spectra and levels that cannot be achieved with a stock of aids. Thus, it yields a standard or an optimum toward which the patient and audiologist can work as they try different aids. This matching of the ideal may either increase the stock of aids or reduce it—except for demonstration purposes—depending on the criteria for "matching."

Competencies Needed

The manager of the deaf and hard-of-hearing school-age child must be sensitive to the adolescent's desire to keep up with his peers, to conform, and to achieve in those activities in which his classmates also strive to achieve. He must not be allowed to fall behind in his classwork and must be monitored closely to detect any need for tutoring.

Insofar as possible, the auditory training program should draw upon school materials, making all of the student's work in communication skills an integrated activity.

Principles of Management

The school-age child is to be encouraged to be an active child, to participate in the activities of school and playground and in social affairs, and to assert himself among his classmates.

The child should have intensive training at the audiological center until his needs are met. Then his visits should be made at regular intervals, not less often than every three months, for evaluation and continuing counseling and care. The number of visits and when they should be made will depend upon the child's needs as determined by the manager. The manager usually confers with a school-age child individually. This develops because the several deaf and hard-of-hearing children who come under one manager become increasingly identified as individuals, not as members of an auditorially similar group. In keeping with this principle, more and more of the lipreading lessons and auditory training exercises are handled individually. The uniqueness of the child is also stressed in the continuing program of counseling parents.

Unilateral hearing losses deserve special attention among school-age children. Although hearing deficits should never be ignored, one-ear losses do not seem to be handicapping for preschoolers, for they may still have "normal" experiences with language. In school, however, this kind of loss may penalize the child in his achievement and make the use of a hearing aid in the classroom desirable, if the kind and degree of loss allow it. Reports of the advantageous use of hearing aids for children with losses as low as 10 dB average (ASA) indicate that no minimum loss is definable for the use of a hearing aid. Each case must be carefully evaluated on its own merits.

Research Needs

The form and substance of the hearing aid mold for preschoolers as a focus for research is all the more important for school-age children. In the rough give-and-take on the playground the meatus can be damaged with a hard mold. A somewhat similar practical problem relates to the apparel on which the aid is supported. This in turn, is dependent on the size, shape, and contour of the aid itself. All of these are related extensions of the single requirement—ruggedness—which is a prime requisite of the hearing aid for the preschool child.

Longitudinal studies of school-age children are suggested in: (a) frequency discrimination, (b) comfort level and tolerance, and (c) the discrimination of the words in noise.

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CHAPTER 5

PROCEDURES FOR ADULTS

A Report on the Discussions of Panel IV

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In relating to the data obtained by the survey of hearing aid evaluation procedures*, Panel IV discussed procedures for adults: evaluating the need for a hearing aid; evaluating the usefulness of a hearing aid; special tests for geriatric persons; test environment, materials and equipment; follow-up; research needs; and standards.

At the outset, it was decided that a hearing aid evaluation is best defined as a procedure which includes testing the patient with wearable instruments. Whether the term *counseling* or *evaluation* be chosen to describe the procedures is relatively unimportant. Responsibilities of the audiologist include recommending specific hearing aids, advising against the use of a hearing aid if indicated, and assuring appropriate follow-up procedures.

EVALUATION OF NEED FOR AN AID

A number of factors should be considered in assessing an adult's need for amplification. Factors considered by Panel IV were: otologic diagnosis and prognosis; configuration and severity of loss; speech discrimination ability; recruitment and other special problems; unilateral or bilateral loss; other physical and emotional disabilities; and age, occupation, economic, social, and intellectual status of the patient. This list of factors represents only a part of a constellation of possible factors, some of which may not as yet be recognized.

Any attempt to rank order these factors would be totally arbitrary. Severity of loss may be most important for one patient while age and occupation may

* See footnote in Chapter 1.

be most important for another. All factors in determining need for amplification are important, and tabulation of the relative importance of specific factors is not possible. Assessing need for amplification involves evaluating specific needs of an individual, not merely listing factors in terms of importance.

Any audiologic evaluation should include tests of hearing sensitivity for pure tones and speech, as well as suprathreshold tests of speech discrimination. These tests are essential. Other tests, such as Bekesy audiometry, the SISI test, and loudness balance procedures, may be necessary in order to obtain a more complete picture of the patient's problem. The conduct of such additional tests is the professional responsibility of the audiologist.

As a corollary to conducting an audiologic evaluation, the audiologist must assure himself that a thorough otologic examination has been conducted prior to audiologic testing. At times, referral information on a patient may include not only the results of otologic examination but also audiologic results of the type mentioned above. If, in the opinion of the audiologist, the audiologic data obtained from the referral source are complete and current, he can immediately proceed with the hearing aid evaluation.

EVALUATION OF USEFULNESS OF AIDS

Test Procedures

Essential tests to be used in evaluating performance with a hearing aid are speech threshold tests and suprathreshold speech discrimination tests. Certain discrimination test materials, particularly the CID Auditory Test W-22, are frequently not sufficiently difficult to show the differences in hearing aid performance which do exist (see Chapter 2).

In instances where CID W-22 lists must be used as discrimination tests, they should be conducted against a competing background signal as an additional procedure. Tests of speech discrimination in quiet are useful with some patients for pointing out significant differences among aids, thus eliminating the need for certain other testing. However, discrimination tests in quiet often fail to show differences that are clinically important (Jerger, Carhart, and Dirks, 1961; Tillman and Carhart, 1963). Difficult listening conditions are often necessary either to determine a patient's potential as a hearing aid user or to demonstrate more subtle differences among various aids. Such tasks might consist of testing discrimination against a background of noise or some other competing signal. The basic need here is to test with interacting stimuli in such a way as to simulate disturbing influences that might be imposed upon the hearing aid user in normal, everyday listening situations. If noise or some other competing signal is used, the audiologist must choose the characteristics of the competing signal, how it should be presented and at what levels, and he should employ the chosen methodology consistently. In conducting a hearing aid evaluation, the audiologist should be perceptive in his selection of tests for evaluating how a patient functions in a difficult listening situation, particularly in discriminating against a competing signal.

In the evaluation of monaural versus binaural hearing aids, the physical arrangements of the test situation must be carefully monitored to ensure that the seeming advantage of binaural over monaural conditions is not imposed artifactually. For example, to rule out the possibility of a head shadow effect when evaluating monaural aids in competing sound, a monaural aid should be placed so that it is directly exposed to the primary speech source when the patient is seated between two loudspeakers, one of which is emitting unrelated sounds.

Recommendation Procedures

In the consideration of procedures for recommending the use of a hearing aid, two questions are important: Is it the ultimate goal of a hearing aid evaluation to recommend a specific aid? If so, what procedure must be used in making the recommendation?

If the ultimate goal of a hearing aid evaluation is to provide the patient with the best professional advice, this is best achieved by recommending a specific instrument. Hearing aids may have similar gain, output, and frequency-response characteristics, and still differ considerably in distortion and other unidentified parameters which can adversely affect hearing aid performance (see Chapter 2). An audiologist should be willing to say that hearing aid "A" offers as good help as any aid that can be recommended, based on his experience and knowledge of the characteristics of the hearing aid and on the results of tests with the particular patient. To offer such advice is his basic professional responsibility. Giving nonspecific recommendations in which a patient is told to purchase any aid meeting certain general requirements, or recommending that the patient purchase an aid and bring it to the clinic to be tested is not sufficient. Because of variations in quality control procedures in the manufacturing of hearing aids, there is no assurance at present that a patient will be able to purchase a hearing aid identical in performance to the one that is recommended at a clinic. For these reasons, among many others, it may be necessary to consider a more direct role on the part of the audiologist in dispensing the particular aid with which the patient was evaluated (see Chapter 7).

In addition, considerations other than test scores must be evaluated; for example, the patient's economic status, his motivation to use an aid (including type of aid), his age, and the integrity and availability of the dealer.

SPECIAL AUDIOLOGIC PROCEDURES FOR THE GERIATRIC POPULATION

As a rule, the speech discrimination ability of the geriatric population is poorer than that of younger adults (Melrose et al., 1963; Heffler, 1960; Bloomer, 1960; Gaeth, 1948). Also, regardless of test procedures used, a slower pace may be necessary to obtain reliable results, to allow a longer period of adjustment to an aid, and to provide for more than one test period for the evaluation of aids. Greater care must be exercised as well in the choice of the instrument so that it will be appropriate for the everyday activity of the patient.

Consideration must also be given to the patient's ability to handle the aid as a mechanical device. Elderly patients frequently have difficulty adjusting the small, closely spaced controls, particularly on ear-level instruments, and inserting and removing the ear mold.

Because of the motivation factor in geriatric patients, counseling plays an important role. The role of the patient's family is probably more important than with younger adults. Speechreading and auditory training are also probably more important to this age group.

Tests for threshold determination and speech discrimination may need to be modified in scope of difficulty, length, and method of presentation when used with the aged patient. Live-voice testing offers greater flexibility than recorded techniques (Creston et al., 1966). Also, some methods, such as presenting accelerated speech material, may shed light on particular problems in handling speech (Bocca, 1958; Harris, 1960). The use of such techniques may bear fruit if we can assume that geriatric patients have a greater breakdown in handling speech in their everyday environment with hearing aids than do other populations. Geriatric persons may also have greater difficulty in processing lengthy speech materials.

In general, it is necessary to be realistic in what can be expected from the geriatric patient when tests are administered. As always, the audiologist must be selective in his tests and use only those that will provide meaningful information. As an example, the CID Auditory Tests W-22 may be entirely adequate for some persons in this age group.

An audiologist probably does not need to have special training for conducting unaided tests with the aged. But he must possess the interest and necessary skills for counseling and offering aural rehabilitation, since these skills differ from those used with younger persons. Unless the audiologist possesses such skills and is willing to take the time for adequate counseling both prior to and following the hearing aid evaluation, he should not accept responsibility for working with the aged.

TEST ENVIRONMENT, MATERIALS, AND EQUIPMENT

Environment

The type of facility in which a clinic is located, as well as its personnel, will determine to a large extent whether hearing aid evaluations should be conducted. Procedures with adults need not be restricted to particular clinics. Frequently, the location of a clinic and the kind of population it serves will dictate the services it offers. Any clinic must be able to evaluate its capabilities and limit its activities to these capabilities.

Hearing aid evaluations should be conducted in both controlled and non-controlled environments. Important differences among aids can be demonstrated by having a patient compare aids outside of the formal test environment.

Sounds from various nontest environments should be recorded and their presentation should be standardized, making it possible for aids to be evaluated

in a controlled situation but with familiar, everyday background signals. One must always keep in mind, however, that a patient may subjectively evaluate an aid on the basis of loudness level or quality and not on the basis of speech intelligibility.

Test rooms should be sufficiently sound absorbent to avoid problems in reverberation and sufficiently sound isolated to prevent interference from outside sources. They should be large enough to permit sound field stimulation from at least two loudspeakers situated at different azimuths. Control rooms should be of such quality as to avoid reverberation problems in live-voice testing and should be sufficiently sound-treated to prevent noise from entering the test room (see Chapter 2).

Materials

The choice of specific test materials and methods of presentation should be based upon the professional judgment of the audiologist, and should be made with knowledge of the information that the test can be expected to yield. In general, materials which aid in closely approximating everyday situations should be used for testing. However, materials as difficult as the Rush Hughes recording might provide valuable information about potential usefulness of various aids. A consistent method of test presentation should be maintained for each patient when considering test procedures.

Equipment

All test equipment should be calibrated by methods recognized as scientifically sound to permit specification of output levels, frequency response, and other physical characteristics of the system. The total system should be checked at intervals to ensure that calibration standards are maintained. The electroacoustic characteristics of the amplification system should be such that its frequency response substantially exceeds the frequency response for any hearing aid to be evaluated. Harmonic distortion of the system should be at a minimum at all output levels that are used. Amplification should provide for at least 110 dB SPL with minimal distortion at maximum output (see Chapter 2).

FOLLOW-UP PROCEDURES

Procedures designated by the audiologist as "follow-up" have not always been considered a part of the hearing aid evaluation, and therefore have not always been looked upon as a necessary part of clinical hearing aid services. However, the majority of the panel expressed the viewpoint that follow-up should be an integral part of any hearing aid evaluation program. The audiologist should never assume that his role terminates with the recommendation of an aid, but should make every effort to prepare a patient for optimal use of the aid. This should involve training which will ensure, as far as possible, that the patient and the aid are functioning as a unit. If properly conducted, follow-up procedures should allow the audiologist not only to monitor his

own work and that of the hearing aid dealer, but also to monitor and control, in part, the patient's success with the recommended aid.

Four necessary ingredients of an adequate follow-up program are outlined below.

First, a hearing aid recheck should be performed with the aid purchased by the patient. This should be done as soon as possible after the aid is acquired. If, for any reason, the aid is not showing adequate performance and a lengthy period has elapsed before the recheck, the patient may become disenchanted with the aid and may develop attitudes towards hearing aids in general that are not conducive to successful use of amplification. (One participant suggested possible advantages to having two hearing aid rechecks. The first would serve to provide the immediate check of the recommended aid. The second, which would be conducted later, would serve to monitor the patient's performance with the aid after he has worn it for an extended period of time, as well as to examine benefits gained from aural rehabilitation procedures.) The following points are suggested for inclusion in a hearing aid recheck:

1. A thorough examination of the patient's instrument, including cord, connections, tubing, controls, switches, batteries, battery compartments, etc.
2. Examination of the fit of the patient's ear mold, and the conformance of the ear insert to the recommended type (standard, vented, acoustic modified, etc.).
3. Comparison of the recommended tone and volume control settings with those the patient is using at the time of the recheck.
4. Determination of the patient's aided performance on repeat speech audiometric tests.

If the patient has purchased the recommended hearing aid, but not the one with which he was evaluated, and his aided performance on speech audiometric tests is poorer than would be expected from the initial evaluation, the recheck should also include a retest with the original aid. Where performance with the purchased aid is considerably poorer than with the one with which he was evaluated, this fact should be brought to the attention of the dealer and the necessary adjustments made.

A second aspect of the follow-up procedure should be the hearing aid orientation program. A certain amount of selectivity is necessary here because not all patients need comprehensive help of this type. The audiologist may find a brief counseling session on the use and care of hearing aids to be adequate for some patients, such as previously successful users or patients with conductive losses. Others may require more extensive help in adjusting to the aid and learning to use it effectively. One panel member expressed the feeling that one of the major goals of hearing aid orientation is to help the patient achieve emotional adjustment to the use of hearing aids. If a patient can be shown that the recommended aid offers a reasonable solution to his hearing problem, it is unlikely that he will blame the aid for unrelated problems, as so often happens.

A third part of the follow-up program should involve periodic re-evaluation of the patient's hearing, both aided and unaided. This would provide a check on the function of the patient's hearing aid, as well as a means of detecting changes in hearing level that ultimately might necessitate the recommendation of an instrument with greater gain or different frequency response characteristics.

Finally, aural rehabilitation must be considered an integral part of any follow-up program. A full therapy program built around aural rehabilitation concepts, such as speechreading, speech conservation, and auditory training should be made available to any person needing these procedures.

Every clinic which offers hearing aid evaluations as part of its program should recognize its responsibility for the above services. This is not to imply that all such services must be carried out directly by the facility which makes the hearing aid recommendation. In those instances where the clinic conducting the hearing aid evaluation cannot provide the necessary service, patients who require hearing aid orientation or aural rehabilitation should be referred to other sources which the audiologist has determined to be competent and reliable.

The overall importance of the audiologist's role in counseling patients cannot be overestimated. Counseling at the time of the evaluation is critical, because in many instances the patient cannot or will not return to the clinic for further help. Thus, the audiologist should give the patient as much information at that time as possible regarding his hearing loss. Additional information should be given about proper use and care of the aid. Frequently, tests used in hearing aid evaluations are interpreted to the patient in terms of potentially successful use of the recommended aid. Additional time should be spent indicating possible limitations to hearing aid usage rather than only dwelling upon probable successes.

Unless the audiologist assumes the responsibility for the thorough counseling of a patient, less qualified persons may attempt to guide the patient in questions of education and rehabilitation, as well as in matters concerning amplification. It was generally agreed among the panel members that some hearing aid dealers are not well informed about audition or about the needs of the hearing handicapped and thus may inadvertently undermine the recommendations of the audiologist. If the audiologist allows this to happen he is shirking his responsibility to the patient.

In order to develop a successful follow-up program, an effective and firm understanding of the program's importance must be established with all concerned. Hearing aid dealers, physicians, and referring agencies should be informed of each phase of the program, and every effort made to enlist their help in soliciting and maintaining the patient's participation. The program should be explained clearly to the patient and his family so they, too, fully recognize the value of these procedures to successful hearing aid use. In some instances, it might be beneficial to work through the patient's employer

to gain the patient's cooperation. Regardless of what approach is taken, full patient cooperation must be achieved as the initial step in developing a meaningful follow-up program (see Chapter 6).

RESEARCH NEEDS

Some progress has been made recently on research questions about hearing aid evaluation procedures, but considerably greater effort must be expended to answer many vital questions. Research needs to be done to:

1. Determine the extent to which current hearing aid evaluation procedures result in reasonable recommendations for amplification;
2. Find auditory measures that possess greater sensitivity for demonstrating significant differences among hearing aids;
3. Determine the relative usefulness of amplification with adults who have minimal hearing loss and experience difficulty only in restricted situations;
4. Evaluate the worth of standardization of speech discrimination test material by pooling research information from laboratories and clinics engaged in such research;
5. Investigate the feasibility of developing a master hearing aid as an acceptable substitute for wearable amplification in hearing aid evaluation procedures for adults;
6. Determine the feasibility of using English speech discrimination materials with foreign-speaking adults, or the possibility of developing alternate materials;
7. Determine the parameters which interfere with speech intelligibility of the hearing-impaired adult;
8. Compare current calibration techniques with the aim of standardizing the methodology;
9. Determine the validity of speech discrimination test results as presently obtained from adults for simulating their performance in everyday listening situations;
10. Determine the important design and performance characteristics for hearing aids, with the aim of helping the manufacturer produce instruments with appropriate amplification;
11. Determine the relationship between the physical parameters of hearing aids and hearing aid evaluation test results obtained with successful and unsuccessful hearing aid users;
12. Determine the most appropriate methods for introducing new hearing aid users to amplification;
13. Determine the important parameters of hearing aid orientation;
14. Determine the significant parameters of auditory training and their relative importance to varying types and degrees of hearing loss;
15. Investigate the kinds of auditory rehabilitation services available in various clinics in relationship to the qualifications of the clinician or audiologist offering them;

16. Determine the needs for auditory training in relationship to the duration of hearing aid use by the patient;
17. Determine special needs of the geriatric patient in terms of physical characteristics of aids, problems in speech discrimination, and rehabilitation;
18. Investigate the various methods of frequency transposition in wearable hearing aids to meet the needs of selected problem groups;
19. Determine the degree to which presbycusis is related to breakdown in everyday listening situations;
20. Investigate further the relative merits of monaural versus binaural amplification;
21. Investigate the physiological and psychological processes of successful adjustment to hearing aid use; and
22. Investigate the effects of ear inserts on hearing aid response characteristics.

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CHAPTER 6

FOLLOW-UP PROCEDURES

A Report on the Discussions of Panel V

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Data from the questionnaire* sent out prior to the conference served as background for the discussions on hearing evaluation follow-up procedures. These data gave an indication of the strengths and weaknesses of procedures presently employed in such programs. In general, the findings showed that: (1) the number of clients who follow clinic recommendations regarding purchase of hearing aids varies greatly from facility to facility; (2) most clients do not return to the audiology facility following the recommendation for obtaining a hearing aid, even though they are advised to return; (3) in most cases when clients return to the audiology facility after obtaining a hearing aid, the performance of the aid is evaluated by routine speech audiometric tests including speech reception threshold and discrimination in quiet; and (4) most facilities are equipped to offer counseling, speech therapy, speech-reading, auditory training, and hearing aid orientation to hearing-handicapped persons.

With this information at hand, Panel V discussed goals, methods, and problems in follow-up after hearing aid evaluations; differential follow-up procedures for various age groups; aural rehabilitation; counseling and community services; special classes; research needs; and minimum standards.

When and where follow-up procedures begin is difficult to determine. There appears to be no clear line separating hearing aid evaluations from follow-up procedures. Therefore, Panel V decided to focus attention on all procedures employed after the time an audiologist informs a patient of the outcome of his hearing aid evaluation.

* See the footnote in Chapter 1.

GOALS, METHODS, AND PROBLEMS

To be successful a program of follow-up should be oriented within a set of goals. Such goals should be broad enough to encompass much more than the traditional areas of speechreading and auditory training. The following is a discussion of goals and the methods for achieving them.

Goal 1. Modifying Patient Behavior

Ideally, modification of a patient's behavior will occur as a result of the administration of follow-up services, such as prognostic therapy, hearing aid reevaluations, counseling, auditory training, speech conservation, hearing aid orientation, speechreading, and related services. Evaluation of the behavioral modification is of primary importance. The extent to which a patient's receptive behavior changes should be determined.

Receptive Behavior. Tests for assessing receptive behavior should include: (a) the usual diagnostic tests; (b) tests of localization; (c) tests of behavior with respect to various psychoacoustic parameters, such as discrimination for temporal patterning, loudness, pitch; (d) tests of listening, such as the *Co-operative Sequential Test of Educational-Listening Progress* (n.d.), Brown-Carlson (n.d.); (e) tests of auditory synthesis; and (f) auditory-visual presentation of speech stimuli, such as presented in the *Semi-Diagnostic Test* (Hutton et al., 1959).

Expressive Behavior. Measurement of the changes in the status of expressive behavior is important, as are some tests of the intelligibility of speech assessment of vocal quality, and rhythm and intonation. Tests of language that provide measures of mean length of response and extent of vocabulary also are significant. In addition, tests such as *The Illinois Test of Psycho-linguistic Ability* (McCarthy and Kirk, 1961) and the *Peabody Vocabulary Test* could prove to be helpful.

Psychosocial Behavior. To assess changes in psychosocial status, trying the *Scale for Self Assessment of Hearing Handicap* might prove useful (High et al., 1964). Other appropriate measures of social and self-adjustment might also be beneficial. Visitation and interviews with peers and family, and observation of the patient with either of these are useful approaches.

Educational Achievement. For children, at least, assessment of educational accomplishment is important. Measures of intellectual capacity, reading speed, comprehension, and vocabulary are helpful. Teacher interviews can be quite beneficial.

Vocational Adjustment. The adult patient's vocational adjustment should be evaluated. For this purpose, interviews with employers and vocational rehabilitation counselors as well as reports from the patient concerning his vocational success, and tests for his level of aspiration are useful.

Goal 2. Insuring Consumer Protection

Audiologists must, in some cases, provide assurance to government agencies that a given patient has received services that have been contracted for by the

agency. Audiologists also advise patients about the adequacy of the hearing aids they have purchased. They should encourage both patients and the public to avail themselves of the services of their local Better Business Bureau and to report unethical business practices to local officers or the Attorney General.

Goal 3. Assuring a Coordinated Total Follow-Up

If audiologists are not usually responsible for administering all phases of aural habilitation or rehabilitation, they should at least assume responsibility for implementing certain recommended procedures, such as hearing aid orientation, auditory training, speechreading, checking on classroom seating, and so on.

A number of local religious, state, fraternal, and educational agencies may also play an important role in habilitation or rehabilitation of hearing-handicapped persons. For these agencies to work successfully, however, someone must coordinate their contributions. In some community settings audiologists fill this function.

Goal 4. Assessing Usefulness of Specific Procedures

Each person lives a unique life made up of a series of experiences in a variety of environments determined by his job, his family organization, and his social responsibilities. Therefore, aural rehabilitation must necessarily be thought of as continuous diagnostic procedure involving frequent reevaluation and modification of therapy techniques and/or goals for each individual.

Problems with Respect to Children

Family. Most family members do not understand the problems of the hearing-handicapped child, and efforts must be made to interest and motivate them to work cooperatively with the aural habilitation or rehabilitation programs. Considerable time should be spent counseling the parents. The child's behavior and attitudes are affected by the attitudes, expressed and implied, of those he looks to for direction and affection. Such psychological dependence in childhood by hearing-handicapped children needs to be impressed on parents through counseling. In fact, the largest proportion of time in follow-up with children should be devoted to parental counseling (see Chapter 4).

Finances. In many situations the cost of follow-up service is a barrier that interferes with attainment of goals. Transportation can be a problem. In some cases, participation in aural habilitation and rehabilitation programs produce serious inconveniences to families in which there are other youngsters.

Physicians. Sometimes physicians are not aware of, or do not reinforce the need for, aural habilitation or rehabilitation, thereby creating barriers to effective programs.

Delayed Language Development. Attaining the goals of follow-up procedures is considerably complicated when a child's language development has been retarded and limited in quantity and quality as a result of hearing loss (see Chapter 4).

Difficulty in Differential Diagnosis. The outlining of a specific habilitation program for children must usually await differential diagnosis. To arrive at a precise diagnosis with children suspected of a hearing loss is frequently difficult (see Chapter 4).

Incidence of Multiple Handicaps. Not only does the existence of multiple handicaps increase the difficulty of differential diagnosis, but several kinds of follow-up services may be required. The adequacy of a program that provides services with help from numerous staff members or agencies is in part determined by the adequacy of the coordination of the services. The administration of multifaceted programs requires a high degree of organization in order to provide optimal conditions for behavioral changes.

Cumulative Effects of Sensory Deprivation. Early severe hearing loss not only precludes development of language but also produces cumulative effects that may affect concept formations developed through interpersonal relationships. As hearing-handicapped children enter school they may encounter difficulties in developing relationships with their peers and those in authority. Audiologists should outline programs that will minimize such effects.

Unavailability of Appropriate Educational Facilities. A significant problem in achieving the goals of follow-up for children is related to the lack of community or state facilities for educating hearing-impaired children (see Chapter 4). If no facilities are available within a reasonable distance of the audiology clinic, the program planned by the audiologist will be weak in a very significant area.

Problems with Respect to Adults

Other Professionals. If other professionals (such as psychologists, physicians, and vocational counselors) involved with hearing-handicapped adults fail to point out the benefits of aural rehabilitation, or if such professionals minimize the benefits of such a program, a disservice is done the patient.

Finances. The cost of follow-up services is a problem for adults and can interfere with attainment of goals. The hearing-handicapped geriatric group may have both financial and transportation problems.

Work-Rehabilitation Conflict. Unless the audiologist's program of follow-up is flexible, it may not serve large segments of the adult hearing-impaired population effectively. Generally, the hearing-handicapped geriatric group can participate in all phases of the program during the day. However, the largest group of hearing-handicapped must receive certain services of the rehabilitative program—that is, auditory training or speechreading—in the evening, because it is too costly for them to participate during working hours.

Unrealistic Attitudes of Client. Many adults with hearing impairment are fearful of the effects of their loss on their social and vocational status and aspirations. Many refuse to admit to themselves and others that they have a handicap. Such fears and pretenses—whether conscious or not—whether realistic or not—are detrimental. In many cases patients resist follow-up because

they have exaggerated and unrealistic expectations about the communication benefits to be derived from hearing aids. There are some clients who disdain nonmedical rehabilitation. Even when advised by a medical specialist that corrective medical or surgical procedures are not available, some continue to spend considerable time and money in pursuit of medical restoration of hearing. Such patients present counseling problems to the audiologist engaging in follow-up procedures.

Problems with Respect to Audiologists

Audiologists, too, often do not seem to be interested in follow-up procedures, which is a general problem not specifically related to children more than adults. Unless the audiologist is committed to the necessity of follow-up he will not have a full rehabilitation program. Until audiologists realize the need for and the place of aural rehabilitation among the services offered by centers performing hearing aid evaluations, this will continue to be one of the main problems in attaining the four goals discussed above.

Solutions for Expressed Problems

Solutions to all problems involved in follow-up are not readily available. They require coordinated efforts by training institutions, professional organizations, and state and Federal agencies.

The Role of Training Institutions. Most training institutions must change their attitudes toward aural rehabilitation and train students in the areas of aural rehabilitation. Most training programs pay lip service to aural rehabilitation and few offer students more than token training.

The Role of the American Speech and Hearing Association. The training centers' lack of emphasis on aural rehabilitation is reflected in the standards of the American Speech and Hearing Association. It is, for example, possible for audiologists to receive the Certificate of Clinical Competence with no experience accumulated in the area of aural rehabilitation. Steps should be taken by the American Speech and Hearing Association to assure the inclusion of clinical practicum in aural rehabilitation as a requirement for the Certificate of Clinical Competence in Audiology. Publication in the professional journals of articles relating to aural rehabilitation should also be encouraged. An attempt should also be made to carry out a sustained program of public education.

The Role of Other Agencies. Public agencies at all levels should be encouraged to support the development and expansion of the concept of aural rehabilitation.

The Role of Audiologists and Audiological Centers. Practicing audiologists and audiology centers need to give increased commitment to aural rehabilitation. A rehabilitation program extending beyond the recommendation of an aid can be initiated by making definite appointments for patients to return to the center whether they purchase an aid or not. During the interval between the recommendation to purchase the aid and the return visit, the patient

should be given specific steps to follow with respect to hearing aid adjustment. The initial revisit to the center should, in part, consist of an evaluation of the obtained aid, hearing aid orientation, and counseling geared toward the amplification, adjustment, and communication problems of the patient. Additional follow-up appointments should be made or a concentrated program of aural rehabilitation should be planned and scheduled. If a patient has not obtained the hearing aid at the time of his revisit, the dynamics involved should be discussed in order to help him gain better insight into his problem and its effects on his family and his employment. Additional appointments should be scheduled, as necessary, as mutually agreed upon by the patient and the audiologists (see Chapter 5).

AURAL REHABILITATION

Following are enumerations of specific rehabilitation services that should be available in an audiology program, of criteria for recommending services uniquely provided by the audiologist, and of differential criteria for group and individual aural rehabilitation.

Even though a number of services should be available in aural rehabilitation programs, certainly the audiologist need not be able to perform all these duties, and the audiology center need not provide all these services. The important point is that the services should be readily available, and competent people should perform them. However, the audiologist should be in close touch with each of the services.

Such services include: (a) counseling—both client and/or parental and/or family; (b) hearing aid orientation; (c) auditory training; (d) speechreading; (e) speech therapy; (f) speech conservation; (g) preschool and other classes for deaf and hard-of-hearing children; (h) psychological evaluations; and (i) vocational counseling. These services do not represent distinct areas of rehabilitation with clear lines of demarcation between them. Counseling, for example, is an integral component of the services. Speechreading, auditory training, speech conservation, and therapy are not distinct categories in the rehabilitative process. They are listed here separately with the intention of specifying the various components of an aural rehabilitation program.

Experienced audiologists realize that not all aural rehabilitation services beyond the recommendation of a hearing aid may be necessary for all patients, and that there are certain relevant criteria for determining the need for such services. The criteria important in recommending hearing aid orientation, speechreading, auditory training, speech conservation, and therapy are discussed below.

Hearing Aid Orientation

All hard-of-hearing patients who receive hearing aids, whether the first hearing aid or a change of aid, should receive hearing aid orientation. This orientation familiarizes the patient with the operation and care of an aid so that he may derive maximum benefit from amplification. It is a process that

should continue throughout an aural rehabilitation program. The manipulation of the various controls must be mastered for maximum effectiveness, including gain and tone controls and telephone pick-up coils, if available.

Speechreading

Speechreading is recommended for all patients who fail to achieve optimal auditory comprehension with or without a hearing aid and who exhibit poorly developed speechreading ability.

Auditory Training

Hard-of-hearing people who have adequately developed language often need auditory training. Auditory training is recommended for: (a) those clients having previous or present unsuccessful experience with a hearing aid; (b) all children with hearing loss; (c) those clients who have significant residual hearing problems of speech discrimination, of hearing in noise, and localization; (d) those clients whose scores on a combined auditory-visual task are no better than the scores on a comparable visual task; and (e) those clients whose social or self-adjustment suggests need for auditory training.

Speech Conservation and Therapy

Speech conservation is recommended for those who can, on the basis of hearing loss, be expected to develop speech and/or voice deviations. Speech therapy is recommended for those having articulatory and/or voice defects.

Whether aural rehabilitation services should be offered on an individual or group basis cannot be decided arbitrarily. There are obvious advantages and disadvantages to either approach. The decision of group versus individual should be made on the basis of the problem and individual needs. Sometimes, however, it would appear that the decision is made independently from these group-individual dynamics, and is made pragmatically on the basis of the availability of staff. An urgent need exists for an increase of professional persons to work in aural rehabilitation to meet both group and individual needs.

COUNSELING AND COMMUNITY SERVICES

Aural Rehabilitation Counseling Qualifications

Counseling should be directed toward those areas of the patient's problems that appear to interfere with effective communication and training, and also those areas directly related to communication disorders. The patient should also receive counseling in the areas necessary for his general adjustment to life. The audiologist may give counseling in those areas for which he is professionally trained, but should refer his clients to competent sources for other necessary counseling.

The audiologist counseling the hearing-handicapped adult should have the American Speech and Hearing Association Certificate of Clinical Competence in Audiology. Hopefully, the requirements for this certificate will be broadened to require training and experience in all phases of aural rehabilitation, including that of counseling.

The person working with language impairment resulting from hearing loss should meet special qualifications. The outlining of the requirements for such a person is outside the scope of this conference. However, it was recommended by Panel V that a multi-disciplinary conference be planned for the future to define such qualifications.

Community Agencies Assisting in Follow-Up

Listing all the agencies that can provide assistance in rehabilitation of the hearing handicapped is not possible. The dynamics and the organizations in different communities vary widely, but the following agencies would appear representative of the services available in most communities large enough to support an audiological facility: (a) public, parochial, and special schools; (b) vocational rehabilitation and employment agencies; (c) guidance and family service centers; (d) recreation and character-building organizations; (e) medical and health agencies; and (f) mental health centers. The audiologist should attempt to develop relationships between the audiology program and all agencies available in the client's community. He should become an active member of the interagency council (Council of Social Services, for example) wherever there are such coordinating groups.

SPECIAL CLASSES IN THE FOLLOW-UP PROGRAM

Special classes are defined as the special activities that audiologists recommend for children with hearing handicaps. Generally, there would be two types of special classes for the benefit of children. One of these would be for parent education and the other for the children themselves, at both the preschool and school-age levels. The potential advantages of both types of classes for the hearing-impaired child are obvious and need not be outlined here.

Audiologists should act as referral sources for such special classes and should pursue active follow-up of the children, providing reevaluations periodically and other services as indicated (see Chapter 4).

RESEARCH IN AURAL REHABILITATION

Follow-up procedures discussed in this chapter require attention in order to validate existing methods and to develop new ones. Research is needed for:

1. Development of valid and reliable tests of speechreading;
2. Development of valid and reliable tests of communication ability with a stress on combined auditory-visual stimulation;
3. Development of methods for evaluating communication ability in the activities of daily living;
4. Determination of dimensions related to adjustment in people with hearing loss, including the factors that determine the handicap, i.e., the development of a hearing handicap quotient;
5. Development of measures of adequacy of auditory training;
6. Development of tests of psychosocial adjustment and methods of modifying it;

7. Development of valid methods for use in various areas of aural rehabilitation including auditory training and speech conservation, and including the determination of the validity of presently employed methods;
8. Determining through an epidemiological study the prevalence of hearing impairment and disability;
9. Evaluating psychological and personality characteristics of the hearing impaired;
10. Studying the attitudes of normal-hearing persons toward impaired persons;
11. Studying how language development is affected by hearing impairment;
12. Studying the effect of audiologist-client relationships on auditory rehabilitation;
13. Development of tests, procedures, and environments for evaluating hearing aid performance in life-like situations;
14. Development and solution of criteria for determining the need for aural rehabilitation;
15. Studying the effects of aging on hearing handicaps.

Research in aural rehabilitation should be conducted not only in universities supporting audiology programs, but also other centers employing audiologists should be encouraged to participate in certain phases of this research as determined by their orientation, interests, and needs. Joint research should be encouraged, especially efforts that involve universities; the National Association of Hearing and Speech Agencies; state departments of health, education, and welfare; the American Speech and Hearing Association; the Children's Bureau; the Vocational Rehabilitation Administration; and others.

Research results should be implemented through dissemination of information in a variety of ways including presentation in professional journals, through workshops, and through demonstration projects.

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CHAPTER 7

PROFESSIONAL QUALIFICATIONS AND STANDARDS

A Report on the Discussions of Panel VI

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The agenda proposed for discussion by Panel VI was structured in accordance with a general outline which would lead to an examination of the qualifications for audiologists engaged in hearing aid evaluations and of the standards related to conducting such evaluations. In relating to the proposed agenda, Panel VI suggested that all that might be needed was an improvement of the existing system used for hearing aid evaluations. It did not take into account the possibility of major departures from that system. On the basis of preliminary discussions, Panel VI concluded that a major change in the existing system for hearing aid evaluations should be made.

The issues involved were discussed in the context of the past history, the present status, and the future course of the profession of audiology regarding hearing aid evaluations. One central concern guided the panel in its discussions: audiologists must strive to insure that habilitation and rehabilitation of the hearing impaired be of the highest quality.

BACKGROUND

The panel strove to identify both the strengths and the weaknesses of various approaches to aural rehabilitation in the light of past and present experience. The central issue in the appraisal of aural rehabilitation was the place of the hearing aid in the total needs of the hearing-handicapped individual. The panel agreed that hearing aids are rarely the only things needed by such persons. Indeed, these are only a part of a total program of patient care. The panel agreed that appropriate medical treatment is the first important factor to be considered in the proper management of the impaired individual.

After it has been determined that medical or surgical management of the patient cannot offer a satisfactory solution to the problem, a hearing aid may be indicated. For many patients the wearing of a hearing aid will be an adequate solution to their problem, or at least a significant help. Patients who present habilitative or rehabilitative problems of a more complex nature need a thorough professional evaluation before a decision about proper amplification can be made. An equal or even greater amount of professional counsel is often essential after an aid has been purchased.

Intensive professional guidance is needed at all stages of habilitation for the hearing-impaired child. The many factors involved in the child's care require professional training for all who make decisions about his management (see Chapter 4). This is recognized by public and private agencies charged with assisting children. Such agencies often require that an audiologist not only evaluate the needs of the child, but that he also make specific recommendations concerning the purchase of hearing aids.

There is also a growing recognition of the special needs of the aged. The panel agreed that this segment of the population presents unique audiological problems that require the advice and counsel of professional audiologists (see Chapter 5). Special training is needed to understand and deal with the auditory, psychological, sociological, and economic problems presented by the senior citizen with impaired hearing.

Many hearing-impaired individuals not in either of these two age groups also present complex vocational, psychological, and sociological problems that are interrelated with their auditory problems. If proper solutions are to be found for the specific needs of these individuals, time and effort must be expended by those who are professionally trained and competent in the management of such complex problems.

Panel VI emphasized the view that the selection of a hearing aid and its subsequent purchase is only a part, although a significant one, of the total program of medical and audiologic care of the patient. This program involves the assessment by the audiologist of the degree and characteristics of the deficit in auditory function. Following evaluation and pertinent medical treatment, the aural rehabilitation program is patterned on the special needs of the individual patient. This may include auditory training, vocational guidance, and psychological counseling. In most cases, a variety of services is involved in such a program. The professional supervision of the aural rehabilitation program should be by an audiologist if the highest quality of patient care is to be provided.

PROBLEMS WITH PRESENT SYSTEM

At present, the dispensing of hearing aids is separated from the remainder of the audiologist's services. As a result, the audiologist's responsibility to provide thorough aural rehabilitation often is significantly hampered.

While the otologist may prefer to work with another professional person in the care of his patient, he is often reluctant to involve the patient in a situation

that requires him to go to a variety of places to satisfy his needs. When an otologist refers his patients directly to hearing aid dealers, it may be because the dealers advertise a total service (testing hearing, selecting and dispensing the hearing aid, and follow-up).

An additional problem is that research on the usefulness of hearing aids has not kept pace with advances that have been made in all other aspects of aural rehabilitation services. Medical management of the conditions responsible for auditory impairment has been improved greatly through the work of many dedicated physicians, and diagnosis of the site of lesion has rapidly become more precise because of combined efforts of physicians and audiologists. Parallel strides have yet to occur in the area of amplification aside from the miniaturization of the hearing aid itself. It seems reasonable to assume that if the audiologist had been more responsible for the dispensing of hearing aids over the years; if he had, at the same time, applied rigorous physical measurements to the hearing aids dispensed; and if he had also observed closely on a continuing and large-scale basis the interaction of various physical parameters with many hearing-impaired individuals; then, greater progress might have been made in improving the design of hearing aids.

A third problem is that legislation concerning the regulation of the sale of hearing aids has been increasing in recent years. Certain elements in that legislation are of potential harm to aural rehabilitation. The desirable elements in that legislation include those provisions which restrict the activities of the "traveling" sales operation which functions in an area for a short period of time and moves on when sales decrease or complaints increase. They include also provisions for the control of bait advertising and other business practices that take advantage of the public. The major negative element in that legislation is the possibility of creating the misleading impression that hearing aid dealers are professionally qualified. If conferring a quasi-professional status on the hearing aid dealer reduces the audiologist's contact with the hearing-impaired, the concept of a total rehabilitation program by audiologists is subverted.

THE ALTERNATIVES

As the discussions developed, an underlying question became impossible to ignore: Are changes in the methods of dispensing hearing aids desirable at this time? In considering this question, the panel was united in its conviction that the answer must satisfy one requirement—any change must improve service to the hearing-impaired population.

In framing the answer to its own question, Panel VI viewed two immediate choices. First, that the system for hearing aid evaluations by audiologists as it presently exists is as good as any other that could be devised. Second, that some system might be devised to improve services available to the patient with a hearing impairment. It was apparent that to accept the first alternative would be to assume the stance of the ostrich with its head buried in the sand. Changes which might be desirable were considered.

RECOMMENDATIONS

The panel offered a number of recommendations reflecting what they believed to be the best possible method for improving the present system for hearing aid evaluations. The first and most basic change recommended by Panel VI was that audiologists become directly involved in the dispensing of hearing aids, under certain prescribed conditions. (*Editor's note: The recommendation that audiologists become directly involved in the dispensing of hearing aids was discussed and evaluated by the Committee on Ethical Practice. The Committee reaffirmed the validity of the present ASHA Code of Ethics concerning this issue and concluded that no change in the Code of Ethics was indicated.*)

Such a recommendation, to be carried through effectively, would dictate that a number of other recommendations be implemented as well.

Change in Code of Ethics

It was recommended by Panel VI that paragraphs (a) and (c) of Section C. 1. of the Code of Ethics of the American Speech and Hearing Association be deleted and that in their place guiding principles be inserted to define the ethics involved for the dispensing of commercial products by qualified ASHA Members (*ASHA Directory, 1966*).

The following points concerning this recommendation are of major importance:

1. The recommendation for audiologists to dispense hearing aids under certain prescribed conditions is permissive in nature and is not a requirement that an audiologist do so.
2. The dispensing of hearing aids by audiologists should not be viewed as replacing or discouraging the activities of competent hearing aid dealers. For most hearing-impaired individuals whose problems do not require an extensive aural rehabilitation program, the hearing aid dealer would continue to be the appropriate source.
3. Standards and qualifications for audiologists engaged in the dispensing of hearing aids must be established and must be controlled by a governing body of the profession.
4. When legislation is enacted at the state level, it should be designed to differentiate between the professional and the business aspects of the dispensing of hearing aids.
5. The present restriction preventing all audiologists from dispensing hearing aids was established solely by ASHA. It is possible, therefore, for ASHA to eliminate these restrictions at any time.
6. The guiding principles must include the basic concept that the audiologist at all times represents the patient and must not be identified as the commercial representative of a manufacturer. In practice, the manufacturers of hearing aids would have their product represented in a clinic or practice of an audiologist, but the audiologist would not be their representative.

7. The audiologist must not advertise except in the ways presently specified by the Code.
8. The audiologist who is professionally qualified and who wishes to dispense hearing aids may only do so as a part of a professional program of aural rehabilitation.
9. The fiscal matters related to dispensing of hearing aids will need to be given careful attention in the Code.

The panel was aware that the fact that monetary transactions would be involved might lead some individuals to question whether the audiologist would be able to render an unbiased professional decision. There was general agreement, however, that a system can be established to ensure that the audiologist will be acting in a professionally ethical manner when he is engaged in this type of activity. Although it did not have sufficient time to consider in detail specific standards for such a system, its discussion of the principles for such systems convinced Panel VI that careful study of the problem would lead to the guidelines necessary to ensure continuation of acceptable ethical conduct.

Training

A process of continuing self-evaluation by those in charge of training programs is a desirable venture. Increased emphasis on the subject of hearing aids should be considered in many existing programs. It was recommended by Panel VI that, as a minimum, the audiologist who is to work with hearing aids in a clinical setting: (1) must be prepared to provide or make provisions for all services included in the nonmedical phases of clinical aural rehabilitation; (2) must understand the relationships of these services to the medical consultation available to the hearing impaired; (3) must recognize the differences in management that are associated with different age groups and degrees of loss; (4) must be aware of the emotional problems encountered by the hearing impaired and their families; (5) must be able to make physical measurements of a hearing aid as a special purpose amplifier; (6) must be aware of the effects of coupling an amplifier (hearing aid) to an impaired auditory system; and (7) must have had experience under competent supervision in all of these areas.

While all of these factors are important in the education of clinical audiologists, well supervised clinical practice in the selection of hearing aids is of critical importance. This experience must include a wide variety of problems and also work with various age groups.

There are many possible vocational subdivisions within audiology and a number of special professional activities for each subdivision. Since it is doubtful that all universities would wish to offer preparation in depth for all of the subareas, it is neither appropriate nor realistic to recommend specific changes to academic programs. The individual university should decide for itself the degree to which it will stress a given area and the measures needed to accomplish this concentration.

Certification

Present clinical standards have the effect of establishing a base or minimum for professional work. When the individual wishes to engage in activities that require special training, such as the dispensing of hearing aids, additional certification procedures may be needed.

It was recommended by Panel VI that, as an important adjunct to the proposed change in ASHA's Code of Ethics relative to the dispensing of hearing aids, a policy of endorsements be established for specialization, when necessary, without continued modification of the general certificate requirements.

The most obvious parallels are the Board examinations used by most medical specialists. The endorsement could be based on a series of specific course and practicum requirements, while such specificity might not be appropriate for the general certification program.

Standards

The dispensing of hearing aids by audiologists would require careful attention to standards in several areas. First, the current statement published by ASHA concerning "Minimum Requirements for Hearing Programs Offering Guidance in Selection of Hearing Aids" (See Appendix A) is inadequate. Standards relating to personnel requirements, to physical facilities, to fiscal policy, and to other aspects of professional activities need to be developed. These various standards would provide the Professional Services Board with guidelines by which the professional programs engaged in dispensing hearing aids could be evaluated.

It was noted by Panel VI that, as new standards are written, the statements will provide a goal of excellence in all areas. Through high standards the ultimate aim of excellence in service can be achieved.

Legislation

Legislation concerning hearing aids is likely to be enacted in several states within the next several years. Yet, a review of the past history of proposed legislation in this area, and of that already enacted in Oregon, indicates the singular lack of any positive policy by ASHA as an organization.

There are great dangers inherent in this lack of action. All of the legislation known to the panelists has dealt with the regulation of the activities of hearing aid dealers. However, such legislation can have direct implications for audiologists. In one proposed bill (Illinois House Bill No. 1403), for example, the definition of the term "hearing aid dealer" included one ". . . who by means of auditory equipment and instruments detects the hearing abilities of individuals." Such a definition clearly could be interpreted to include audiologists. Thus, the audiologist might find himself in the position of needing a license to practice his own profession, and of having that document identify him not as an audiologist but as a hearing aid dealer.

Currently an individual who does not wish to subscribe to the Association's Code of Ethics may resign his membership and continue to work

professionally. If the activities he then engages in are not in the best interests of the public from a professional point of view, no course of action is available to stop him. Clearly the code of ethics of any professional association can apply only to its members, and membership in such an association is not a prerequisite to professional practice. For this reason, as well as others, the professional licensing of audiologists may be desirable.

Because of the proposed legislation for hearing aid dealers and the need for a firm legal base for regulating professional activity, it was recommended by Panel VI that immediate action by ASHA be taken in the field of legislation as follows:

1. If benefit to the public could be expected from a bill concerning licensing hearing aid dealers without its adversely affecting activities in the professional area, such a bill should be supported. If, however, a given bill might work to the detriment of a total aural rehabilitation program, it should be vigorously opposed. Legislation designed by the Federal Trade Commission (1965) should be supported.
2. ASHA should investigate the desirability of professional licensing of audiologists and develop specific guidelines to be set down in model legislation. While all particulars for such a sample bill are not clear, certain principles can be suggested. These include provision for examination or otherwise evaluating applicants, statements of professional responsibilities and limitations, and statements of and for enforcing standards.

IMPLICATIONS

There are many implications for the profession if the American Speech and Hearing Association adopts the policy that it is proper and desirable for audiologists to be directly involved in dispensing hearing aids.

Medical - Audiological Coordination

Since the clinical audiologist is a professionally trained individual whose primary responsibility often is aural rehabilitation, such an action would materially strengthen the total aural rehabilitation service available to the patient. A closer relationship between the physician and the audiologist could be anticipated through the proposed change. Working at all times with a professional person would allow the physician to maintain better contact with his patient and to be more confident that the best available service was being offered in conjunction with and following his medical management. The audiologist, through his education in many areas, is the best equipped individual to direct the nonmedical aspects of clinical aural rehabilitation. If all the facets of such a program were placed under the leadership of a single, professionally trained individual, service to the patient would be improved.

The same point can be expressed in another way. The audiologist, as a result of his knowledge of hearing impairment and its relationship

to the general health and medical problems of the patient, is well aware of the vital nature of complete medical attention in any case of auditory dysfunction. Since many hearing problems are manifestations of pathology that is potentially a threat to the patient, the audiologist has long insisted on proper medical clearance of the patients he sees. Yet, according to a survey of hearing aid dealers (1964), 82.4% of the dealers who responded indicated that a medical examination was not necessary for all persons who wished to purchase a hearing aid.

Follow-up

A second implication the panel saw in the proposed change was an improvement in the services received by the patient after the purchase of a hearing aid. The audiologist would be able to offer all of the elements of a total aural rehabilitation program, including the dispensing of hearing aids. The experience of the panelists indicates that at the present time the typical dissatisfied hearing aid user does not return to the professional individuals who recommended an instrument, but more usually to the hearing aid dealer from whom it was purchased. It may be that the difficulties may be traced to an original recommendation. Moreover, the ability of the professional audiologist to improve the accuracy of his recommendation can best result from the knowledge he gains from proper follow-up of his past recommendations. The audiologist has been placed in an unusual position in this regard. This is somewhat like a physician who is allowed to make the decision that surgery is to be done, but who is only sometimes informed of the results of the surgery or the adequacy with which someone else carried out his decision. Such a situation is obviously intolerable in medicine. It is equally intolerable in aural rehabilitation if improvements in service, both before and after the selection of a hearing aid, are to be made by the audiologist.

Research

A third implication seen by the panel is in the area of research and development concerning all aspects of hearing aid usage. One can develop the thesis that increased involvement by professionally trained individuals will lead to increased amounts of research data concerning the physical characteristics of hearing aids and the criteria by which a given ear is matched to a given instrument as well as to new ways of using conventional hearing aids. If improvement in these areas occurs, it is reasonable to predict that a greater number of hearing-impaired individuals who presently are not wearing hearing aids can receive the benefits of amplification.

Health Legislation

The recent history of state and Federal health legislation and of developments in private insurance programs led the panel to conclude that the actions it recommended would be of great importance to segments of the

population not presently receiving needed aural rehabilitation. One major reason for the fact that hearing aids are not included in such health programs may be the absence of a professional body directly engaged in dispensing the instruments. If all of the above recommendations were enacted, it might be possible for agencies concerned with the elderly, for example, to write guidelines so that hearing aids could become available as a part of private or Federal health care plans. Since the current price of hearing aids often makes it impossible for many retired individuals to experience the benefits of amplification, establishing a situation in which hearing aids, as well as other aural rehabilitation services, can come under the individual's health insurance plan is of great importance.

Education and Training

The recommended actions may well necessitate major modifications of the educational patterns presently followed by those preparing for careers in this professional area. Many persons have recognized for a long time that differences exist in the educational needs of various segments of the audiology profession. It has been proposed before that some type of professional degree is needed to satisfy the educational needs of those who are preparing for clinical careers. The future definition of a clinical specialty such as that implied by the involvement of audiologists in the dispensing of hearing aids, may further such a point of view. In many ways this seems to be a logical step and would provide a clearer identification of the specific educational requirements for various areas within the total field. Such a separation in terms of advanced degrees does not, in any sense, imply a separation between parts of the field or among individuals interested in different aspects of the same problems.

CONCLUSIONS

Action to allow audiologists to dispense hearing aids under prescribed conditions is recommended by members of Panel VI*.

While all of the participants in the discussion recognized the controversial nature of the recommendation and its many implications, none supported it on the basis of its dramatic nature. Support came, rather, from the firm conviction that the course proposed is in the best interests of both the hearing impaired and the professions of audiology and medicine.

Many factors that will need to be considered in the implementation of this recommended action have been discussed in this report; many others undoubtedly exist. While it was not possible to discuss all of these known and unknown factors, it was possible to bring some of them into focus.

For the most part, the panelists were in agreement concerning the nature of the recommendations made as a result of the discussions held. Some panelists

* It is important that the reader be reminded that this recommendation came from a panel of ten persons. It was not a recommendation of the conference as a whole, nor has it been accepted by the American Speech and Hearing Association (Editor's note).

viewed the recommendations as final and wished to see immediate action. Others viewed the same recommendations as instruments through which meaningful dialogue could be initiated on problems of great importance. The individual panelists may argue for or against any specific point in the future as the weight of additional deliberation either strengthens or changes the position reflected herein.

The profession of speech pathology and audiology must face these issues with vigorous discussion and with equally vigorous action.

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CHAPTER 8

A SUMMARY RECOMMENDATION

The Subcommittee

Each of Chapters 2 through 7 reviews the primary deliberations of one of the six panel groups that served the conference. The six separate deliberations could not help but entail some overlap. However, in the development of the total report every effort has been made to eliminate unnecessary redundancy across chapters without destroying the uniqueness of any given chapter.

Chapters 2 through 7 show that many unmet needs persist regarding the role of audiologists in hearing aid evaluation procedures. This fact finds expression in the several statements regarding research needs found in Chapters 2 through 6. It also finds expression, for example, in the dissatisfaction with existing test procedures declared by Panel I (see Chapter 2); in the disagreement within Panel II about whether audiologists should do hearing aid evaluations (see Chapter 3); in the relatively undeveloped and laborious procedures described by Panel III for use with children (see Chapter 4); in the special difficulties encountered when dealing with the geriatric population, as recited by Panel IV (see Chapter 5); in the relative infrequency and inadequacy of follow-up procedures alluded to by Panel V (see Chapter 6); and in the multitude of frustrations described by Panel VI as to what audiologists must face because they are not, as a rule, involved in the dispensing of hearing aids (see Chapter 7).

On the other hand, the several panel groups were not pessimistic regarding the unmet needs. Each group offered its own kinds of solutions to problems. To exemplify, Panel I advocated development of new procedures and rigorous standardization of all procedures used by audiologists; Panel II advocates useful guidelines for the procurement of hearing aids and more careful and more detailed description of the characteristics of all aids; and Panel III, while admitting that the threshold for audiologic management of children has barely been crossed, laid out some rich detail on what might well be considered today's optimal methodologies with children.

As a first order satisfaction to some of the needs, the Subcommittee worked out a revision of the existing document entitled *Minimum Requirements for Hearing Programs Offering Guidance in Selection of Hearing Aids* (see Ap-

pendix A). Their revision was worked out primarily by using the discussions scheduled for two panel sessions of all six groups on the topic "Minimum Standards"; but reference was made as well to the other deliberations of the conference. This revision not only serves as the Subcommittee's recommendation to ASHA for replacing the existing document; in its own way, it also serves to summarize the deliberations of the conference as a whole. The suggested revision is as follows:

GUIDELINES FOR AUDIOLOGIC PROGRAMS OFFERING HEARING AID EVALUATION SERVICES

The American Speech and Hearing Association recognizes that the activities of audiologic service are diverse. No single definition can cover all the legitimate activities that such programs incorporate. The assessment of hearing to evaluate the potentialities which individuals have for use of hearing aids is frequently an important phase of a program's activities.

The American Speech and Hearing Association is committed to the philosophy that every activity worthy of designation as an audiology program should satisfy realistic standards insuring its competence. Generally speaking, there is a widely recognized frame of reference for such standards. The qualifications which a clinic's personnel may be expected to satisfy are implicit in: (1) the degree requirements of institutions offering training in audiology, and (2) the Association's own requirements for clinical competence in the field of audiology. In turn, competent personnel will make demands upon administrative superiors which will encourage adequate physical facilities and equipment for the clinic. Thus, there does not at the moment seem to be need to formulate requirements covering all phases of an audiology program's activities. The principles established by current practices appear to be ample safeguards.

The situation is somewhat different when one of the services offered is hearing aid evaluations. This consideration leads to the following statement of guidelines which the American Speech and Hearing Association deems important if a clinic engages in the evaluation and recommendation of hearing aids:

- I. The clinic shall follow a sound policy of obtaining pertinent medical diagnosis and adhering to medical recommendations.
- II. The individual supervising the program of hearing aid selection and conduct of the tests and other routine activities of the program for hearing aid selection shall possess the Certificate of Clinical Competence in Audiology.
- III. Special testing rooms and electroacoustic and other equipment meeting the current ASA standards and appropriate for testing the population served by the clinic shall be available. The equipment shall be used in such manner as to maintain the validity of the test employed. This requirement includes arrangements to keep the equipment properly calibrated and in good working condition.

Current practice indicates that ordinarily the minimum equipment is that which allows the exploration of threshold for pure tone as well as both threshold and suprathreshold hearing for speech.

- IV. A hearing aid evaluation must include testing with wearable hearing aids.

The hearing program shall have ample and satisfactory provisions for the educational and rehabilitation management of the persons examined and the assessment of the effects of such management. Either the clinic must offer these facilities itself, or a sound plan of referring patients for these services must be in effect.

Any stock of commercial aids with which clients are tested shall represent a reasonable sample of the desirable hearing aid characteristics that are currently available in the client's community. Provisions shall be made to keep these hearing aids in proper working condition. Information regarding the electroacoustical characteristics of the hearing aids in stock should be available.

The clinic shall adhere to a policy of referring patients about to purchase hearing aids only to organizations and individuals who have demonstrated their competence in dealing with hard-of-hearing persons, and the adequacy of both their facilities and service.

APPENDIX A

MINIMUM REQUIREMENTS FOR HEARING PROGRAMS OFFERING GUIDANCE IN SELECTION OF HEARING AIDS

The American Speech and Hearing Association recognizes that the activities of a hearing service are diverse. No single definition can cover all of the legitimate activities that such programs incorporate. In general, such programs offer education and rehabilitational services but do not engage in the sale or maintenance of hearing aids. However, the assessment of hearing to evaluate the potentialities which individuals have for use of hearing aids is frequently an important phase of a program's activity.

A hearing center may be associated with an education institution, a hospital, or a service agency. There is no inherent reason why such a center could not be a private venture provided its practices and ethics conform to recognized professional standards. The center may offer medical services if appropriately affiliated and staffed. In any event, the services of the center are distinguished from the general practice of otolaryngology because of their emphasis on non-medical rehabilitation. Conversely, its services are distinguished from schools whose purpose is the long term academic training of pupils with auditory impairments.

The American Speech and Hearing Association is committed to the philosophy that every activity worthy of designation as a hearing program should satisfy realistic standards insuring its competence. Generally speaking, there is a widely recognized frame of reference for such standards. The qualifications which a center's personnel may be expected to satisfy are implicit in (1) the degree requirements of institutions offering training in audiology, (2) the requirements of the several states for certification of teachers, and (3) the Association's own requirements for clinical competence in the field of hearing. In turn, competent personnel will make demands on administrative superiors which will encourage adequate physical facilities and equipment for the cen-

These requirements were recommended by the Committee on Minimum Requirements for Hearing Clinics (Jack L. Bangs, George A. Falconer, Wallace A. Goates, John W. Keys, Donald M. Markle, S. Richard Silverman, Jesse J. Villarreal, Raymond T. Carhart, Chairman) and approved by the Executive Council at the 1952 Annual Convention. Revised November 1964.

ter. Thus, there does not at the moment seem to be need to formulate requirements covering all phases of a hearing program's activities. The principles already established by current practices and a general program of assuring recognition of competent professional workers appear ample safeguards.

The situation is somewhat different when one of the services offered is guidance in selection of hearing aids. This consideration leads to the following statement of requirements which the American Speech and Hearing Association deems minimal if a center engages in this activity.

Minimum Requirements

A hearing program shall be considered as equipped to engage adequately in the task of guidance in the selection of hearing aids only if it satisfies all the criteria listed below.

I.A. The center shall follow a sound plan for obtaining otological guidance and advice regarding its policies and practices.

B. The center shall follow a sound policy of obtaining otological diagnoses and adhering to medical recommendations.

C. Except where there is medical approval to the contrary, final recommendations regarding hearing aids will be withheld until medical or surgical regimes advised by the otolaryngologist shall be completed.

D. If appropriate medical clearance is obtained, the center may make ear impressions and may arrange for the manufacture of earpieces as an adjunct to proper testing.

II.A. The individual supervising the program of hearing aid selection and the persons conducting the tests and other routine activities of the program for hearing aid selection should satisfy the qualifications for the Certificate of Clinical Competence in Audiology.

B. A person who does not satisfy the above criteria may be used only if three conditions are met.¹

1. His activities shall be directly supervised by a certified member of the center's staff.

2. The evaluation of findings and the clinical decisions arising therefrom shall remain the responsibility of the staff member.

3. He shall have had sufficient instruction, both theoretical and practical, to qualify him for participation in the program before undertaking the above duties.

III.A. Special testing rooms shall be so constructed and located as to supply a physical environment which is acceptable for the use to which they are put. The basic requirement is that all special facilities must make possible the validity of the tests or other techniques conducted therein.

B. The electro-acoustic and other equipment employed in testing patients

¹ It is the sense of this requirement that students-in-training shall not be substituted for qualified personnel. Students-in-training are here defined as individuals engaged in mastering the techniques involved in hearing aid selection.

shall satisfy the conventional standards for adequacy. The equipment shall be used in such manner as to maintain the validity of the tests employed. This requirement includes arrangements to keep the equipment properly calibrated and in good working condition.

Current practice indicates that ordinarily the minimum equipment is that which allows the exploration of threshold for pure tones as well as both threshold and supra-threshold hearing for speech. Procedures may change as a result of advancing knowledge, and it is explicitly intended that the equipment shall be consistent with contemporary clinical standards.

IV. The hearing program shall have ample and satisfactory provisions for the educational and rehabilitational management of the persons examined. Either the center must offer these facilities itself, or a sound plan of referring cases for these services must be in effect.

V. Any stock of commercial hearing aids with which cases are tested shall represent a reasonable sample of the hearing aid characteristics which are currently available. Furthermore, provisions shall be made to keep these hearing aids in proper working condition.

VII. The center shall adhere to sound ethical practices.

A. The Code of Ethics of the American Speech and Hearing Association shall be observed.

B. The center shall maintain a positive policy of offering access to its philosophy and method of operation.

C. The center shall not release advance information on its recommendations to a commercial organization or an individual engaged in the sale of hearing aids.

VIII. The center shall adhere to a policy of referring patients about to purchase hearing aids only to commercial organizations and individuals who have demonstrated their integrity, their competence in dealing with hard-of-hearing persons, and the adequacy of both their facilities and service.