NATIONAL CENTER For HEALTH STATISTICS | Series 2 Number 37

VITAL and HEALTH STATISTICS
DATA EVALUATION AND METHODS RESEARCH

# Development and Evaluation of an Expanded Hearing Loss Scale Questionnaire

The development and evaluation of a series of scale questions for measuring the degree of hearing impairment.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration

Rockville, Md. April 1970


Public Health Service Publication No. 1000-Series 2-No. 37

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402 - Price 50 cents

# NATIONAL CENTER FOR HEALTH STATISTICS


THEODORE D. WOOLSEY, *Director*

PHILIP S. LAWRENCE, Sc.D., *Associate Director*

OSWALD K. SAGEN, PH.D., *Assistant Director for Health Statistics Development*

WALT R. SIMMONS, M.A., *Assistant Director for Research and Scientific Development*

*Medical Consultant*

JAMES E. KELLY, D.D.S., *Dental Advisor*

EDWARD E. MINTY, *Executive Officer*

MARGERY R. CUNNINGHAM, *Information Officer*


## DIVISION OF HEALTH INTERVIEW STATISTICS


ELIJAH L. WHITE, *Director*

ROBERT R. FUCHSBERG, *Deputy Director*

GERALDINE A. GLEESON, *Special Assistant to Director*

RONALD W. WILSON, *Chief, Analysis and Reports Branch*

ABIGAIL MOSS, *Chief, Developmental Operations Section*

CLINTON BURNHAM, *Chief, Survey Operations Section*


### COOPERATION OF THE BUREAU OF THE CENSUS

Under the legislation establishing the National Health Survey, the Public Health Service is authorized to use, insofar as possible, the services or facilities of other Federal, State, or private agencies.

In accordance with specifications established by the National Health Survey, the Bureau of the Census, under a contractual arrangement, participates in most aspects of survey planning, selects the sample, collects the data, and carries out certain parts of the statistical processing.


**Public Health Service Publication No. 1000-Series 2-No. 37**

*Library of Congress Catalog Card No. 73-603012*

# PREFACE

This study represents another step toward the development of a functional scale of hearing loss by which household respondents can describe the severity of their hearing impairment. The ultimate objective of this series of studies, initiated in 1962, is to devise a severity scale, couched in functional terms, that can be correlated to standard clinical measures or tests.

Gallaudet College, a federally sponsored institution and the only institution in the world that provides higher education exclusively for persons with severely impaired hearing, has completed two studies through contractual arrangements with the Division of Health Interview Statistics. The findings of the first study, which were presented in *Vital and Health Statistics,* PHS Pub. 1000, Series 2, No. 12, indicated that persons with severe hearing loss were identified by the functional scale. However, it was obvious that additional work was needed to develop a scale which would increase the differentiation of lesser degrees of hearing loss. The present study describes the general revision of the original scale, the evaluation of the scale in a number of hearing and speech clinics, and the effectiveness of the scale for use in a general health interview population.

To each of the following clinics and to their professional and clerical staff, grateful acknowledgment is hereby given of their indispensable contribution to this project: Bill Wilkerson Hearing and Speech Center, Nashville, Tennessee; Cleveland Hearing and Speech Center, Eye and Ear Hospital, Pittsburgh, Pennsylvania; Gallaudet College, Washington, D.C.; Henry Ford Hospital, Detroit, Michigan; Houston Hearing and Speech Center; Jackson Memorial Hospital, Miami, Florida; Jewish Hospital of St. Louis; Northwestern University; Otologic Medical Group, Los Angeles, California; Temple University; University of Oklahoma Medical Center, Oklahoma City, Oklahoma; University of California at San Francisco Medical Center; and Washington Hospital Center, Washington, D.C.

Deep appreciation for their cooperation is also due to Dr. Philip Rosenberg, Dr. Jean Lovrinic, and the other professional and clerical staff of the Audiology Section, Temple University.

# CONTENTS

**SYMBOLS**

| | |
|---|---|
| Data not available---------- | --- |
| Category not applicable---------- | ... |
| Quantity zero---------- | - |
| Quantity more than 0 but less than 0.05---- | 0.0 |
| Figure does not meet standards of reliability or precision---------- | * |

*IN THIS REPORT findings are presented on the development and evaluation of a series of scale questions designed to measure degree of hearing loss. Since a scale developed during an earlier study lacked specificity in differentiating between persons with relatively small hearing losses and those with normal hearing, the primary objective of the present study was the refinement of the scale in this area.*

*The evaluation phases of the study consisted of validating the revised scale audiometrically with persons having minor to severe hearing losses and also with persons having normal hearing. The scale was first administered to persons attending hearing and speech clinics, validating their responses to the scale by comparison with audiometric measurements. The scale was then administered in household interviews of a representative sample of persons living in the Philadelphia Standard Metropolitan Statistical Area. Respondents in the interview survey who reported some impairment of hearing were scheduled for audiometric examination. A subsample of persons who reported no hearing loss were also scheduled for audiometric testing.*

*In addition to the hearing scale, another method of determining the extent of hearing loss was introduced into the study. This measure was a four-step self-rating of hearing ability in each ear (good, a little trouble hearing, a lot of trouble hearing, deaf). This method was found useful in earlier studies in the detection of cases in which a person with a unilateral hearing loss responded to the scale in terms of his ability to hear with his worse ear rather than with both ears.*

*The inclusion of the self-rating measure was found to be a wise decision because it, as well as the hearing scale, correlates satisfactorily with audiometric test results, when age and use of hearing aids are considered in the interpretation of results. Moreover, the self-rating is probably more useful than the more complicated hearing scale in an interview situation because it is simpler to administer, is easier to comprehend, and yields a more reliable estimate of hearing ability in the worse ear when the better ear is normal or near-normal.*

# DEVELOPMENT AND EVALUATION OF AN EXPANDED HEARING LOSS SCALE QUESTIONNAIRE

Jerome D. Schein, *Dean, College of Education, University of Cincinnati*
Augustine Gentile, *Director, Office of Demographic Studies, Gallaudet College*
Kenneth W. Haase, *Former Assistant to the Director, Division of Health Interview Statistics*

## INTRODUCTION

The National Center for Health Statistics utilizes a variety of approaches for obtaining data on the health of the U.S. population. One of its major approaches is to obtain data on health and related topics by means of household interviews. In addition to its efforts to meet the needs for factual information, the Center also devotes a substantial part of its resources to finding new or improving existing techniques for gathering information. In many instances the Center, under contractual arrangements, seeks the assistance of outside organizations. The study discussed in this report is the result of such an arrangement in which Gallaudet College was asked to collaborate in a project to improve techniques for gathering information on the population with impaired hearing.

The present study extends earlier efforts to improve the collection of data on hearing impairment by interviews. In preparation for a special survey on hearing ability to be conducted during the period July 1962-June 1963, a set of statements to measure extent of hearing impairment was designed for the National Center for Health Statistics.[1] An attempt was made at that time to develop a group of statements that would form a scale utilizing the methodology originally developed by Louis Guttman.[2]

In a perfect Guttman scale, the items are so arranged that an individual's responses up to a point will all be in one direction (positive or negative) and beyond that point all in the opposite direction. For example, if a series of questions about weight were asked—Are you heavier than 100 pounds? Are you heavier than 110 pounds? etc.—a person would respond "yes" until his weight was reached or exceeded and "no" to all subsequent questions in the series. The estimate of his weight would then lie between the value of the item at which the response shift occurs and the preceding one.

For the July 1962-June 1963 survey on hearing impairments, five items were found to approximate this type of scale. The scale was tested under several conditions of administration and with several groups of hearing-impaired persons before being used in the field with a probability sample of the U.S. population. While the evidence thus obtained supported its use, the scale appeared to have two basic shortcomings.

First and most important was its lack of range. For persons obtaining the highest (best hearing) score, little more could be said from the

[1]National Center for Health Statistics: Methodological aspects of a hearing ability interview survey. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 2-No. 12. Public Health Service. Washington. U.S. Government Printing Office, Oct. 1965.

[2]Guttman, L.: The Cornell technique for scale and intensity analysis. *Educ. Psychol. Measmt.* 7:247-279, 1957.

audiological findings than that they had a probable loss of hearing of less than 65 decibels.[3] Since a large proportion of the hearing-impaired population, with varying degrees of hearing loss, had to be categorized in this broad group, this lack of definitiveness was a crucial defect.

Secondly, the validation groups for the earlier scale did not contain a sample of normal-hearing persons. Therefore, it could not be predicted with any assurance how the scale would operate with persons who did not have impaired hearing.

## OBJECTIVES OF THE PRESENT STUDY

With an ever-increasing need for reliable national health statistics—many of which can most appropriately be obtained by household interviews—the National Center for Health Statistics has established as one of its primary objectives, the development of interview procedures designed to improve the accuracy of the information reported. As part of this policy, a project to develop an improved scale was undertaken. The principal objectives of this study were:

To develop a revised scale that would differentiate between persons with relatively small hearing losses and also differentiate between persons with small losses and normal-hearing persons.

To validate the revised scale audiometrically with persons having minor to severe hearing losses and also with persons having normal hearing.

## DESCRIPTION OF THE STUDY PLAN

In order to attain the above objectives, the study was divided into three phases:

Phase I. This phase consisted of developing and pretesting various questions that could be used as a scale to measure hearing ability for a wider range of hearing loss than could be measured by the earlier scale.

Phase II. This phase consisted of administering the final set of questions developed during Phase I to persons attending hearing clinics and then validating their responses to the scale by comparison with audiometric measurements.

Phase III. During the final phase, the revised scale was administered in household interviews of a representative sample of persons living in the Philadelphia Standard Metropolitan Statistical Area. The interviews were conducted using methods somewhat similar to those adopted by the Division of Health Interview Statistics of the National Center for Health Statistics.

All respondents in the interview survey were asked the scale questions. All those who indicated some impairment of hearing were scheduled for audiometric examinations. In addition, a subsample of persons for whom no impairment of hearing was reported was also scheduled for audiometric examinations.

## PHASE I: DEVELOPMENT OF A SCALE

The major problem in developing the new scale was to find statements which would differentiate between persons with small hearing losses and those with normal hearing. Finding items that distinguish those with severe losses from those with smaller ones was accomplished by the earlier scale.

It was decided to confine the initial questions of the scale to aspects of speech perception. In considering the wording of the scale statements, a number of qualifications were desired, e.g., the surrounding noise level ("quiet room"), distance from speaker ("across a quiet room," "in your better ear"), and loudness of stimulus ("whisper," "shout"). Other qualifications not included might have assisted some respondents to reply more satisfactorily, e.g., whether a man or woman was speaking. However, the questions had to be of a length suitable to oral administration; therefore they could not be too complex or too lengthy.

Items worded in various ways were presented to small numbers of hearing-impaired people. An inquiry was conducted after each administration in an attempt to discover why persons responded as they had. When they expressed difficulty answering a question because they could not choose between the dichotomous responses or could not clearly comprehend the question, alternative wordings were sought. In this way, the statements

---

[3] Davis, H., and Kranz, F.: International audiometric zero. *J. Acoust. Soc. Amer.* 36:1450-1454, 1964.

Please answer the next questions the way you **usually** hear with both ears. If you use a hearing aid, please answer the way you hear **without** a hearing aid.

| | YES | NO |
|---|---|---|
| 1. Can you usually **hear** and **understand** what a person says without seeing his face if he whispers to you from across a quiet room? | | |
| 2. Can you usually **hear** and **understand** what a person says without seeing his face if he talks in a normal voice to you from across a quiet room? | | |
| 3. Can you usually **hear** and **understand** what a person says without seeing his face if he shouts to you from across a quiet room? | | |
| 4. Can you usually **hear** and **understand** a person if he speaks loudly into your better ear? | | |
| 5. Can you usually tell the sound of speech from other sounds and noises? | | |
| 6. Can you usually tell one kind of noise from another? | | |
| 7. Can you hear loud noises? | | |

Figure 1. The seven questions in the new Hearing Ability Scale.

(These seven statements are identical to those administered during Phase II of this study. During Phase III, in which the household interview technique was used, these statements were modified only to the extent that they became applicable to an interview situation. See appendix III.)

were continually modified until it was felt that a workable set had been obtained.

The final scale consisted of the seven questions reproduced in figure 1. They are arranged in anticipated order of hearing impairment, from least to greatest loss. The earlier hearing scale[1] had the opposite order. This procedural change makes the scale more efficient in interviews of the general population. Since the concept of scaling involves finding the point of response disjuncture—the question before which all answers are in one direction and after which they are all in the opposite direction—no more useful information will theoretically be gained by asking further questions once that point is reached, i.e., the person who says he can hear and understand whispered speech will also be expected to say he is able to hear and understand shouted speech. Since most persons in the general population do not have a hearing problem, only the first question need be asked of the vast majority of respondents. In a household survey, this procedure would mean a substantial saving of time.

In addition to the hearing scale just discussed, it was decided to include in this study another method of determining the extent of hearing loss. Results of the earlier survey[1] and other studies had indicated that a four-step, self-rating scale provided valuable information, especially useful in detecting those instances in which a person with a unilateral hearing loss responds to the scale in terms of how he hears with his worse ear rather than with both ears. As will be seen, the decision to continue to use the self-rating of each ear proved most worthwhile. The self-rating scale is reproduced in figure 2.

(Mark one box for each ear)

| Left | | Right |
|---|---|---|
| ☐ | Hearing is good. | ☐ |
| ☐ | Little trouble hearing. | ☐ |
| ☐ | Lot of trouble hearing. | ☐ |
| ☐ | Deaf. | ☐ |

Figure 2. Rating scale for each ear.

## PHASE II: CLINICAL VALIDATION

Having decided on the scale, the next step became its validation. Two questions were raised: Do the items tend to approximate scalar form? How well do the scale positions correspond to audiological measures of hearing ability?

To answer the second question, in particular, many hearing-impaired persons with varying degrees and types of losses were needed. A sample of the general population could be expected to yield a very low proportion of such persons[4] and would not have been economically feasible—especially prior to the development of new scales. The alternative was to select persons attending audiological clinics, because a suitably high proportion of these patients have the characteristics sought.

Fourteen clinics widely spread across the United States agreed to cooperate in the study. These clinics had sizable caseloads of adults and had earned reputations for the excellence of their activities in the field of audiology. Each clinic was assigned a quota of patients who were to constitute an ongoing sample of their cases over the time specified. The clinics began testing on a staggered schedule so that a member of the study staff could be present at the onset of data gathering, in order to assist in making the process as uniform as possible among clinics. For the same reason, printed directions and standard report forms were given to clinic personnel (Washington Hearing Survey, appendixes I and II).

The Hearing Ability Scale was self-administered. The clinic staffs were instructed not to assist respondents, except to answer any questions in a nondirective fashion. At the same time, the clinics were asked to encourage each patient to complete the questionnaires. In this, they seemed quite successful; refusals to complete the questionnaire were less than 5 percent in any clinic, with most showing no refusals.

Data came from ongoing samples of persons 18 years and over, patients being eliminated only if they were unable to complete the questionnaire without substantial assistance. On this basis, blind persons, severely deteriorated senile patients, illiterate persons, and similarly disabled individuals were not included in the sample.

No instructions on the conduct of the audiological examinations were given, only specific directions on recording the results. The clinics themselves were the sole judges of the accuracy of their audiological measurements. Whenever they felt that the results of an audiological examination were unreliable, they were asked to indicate the unreliability so that such records could be subsequently discarded from the analysis.

The clinics also noted on the records diagnostic information about any patient whose hearing problem was so unusual as to cause his responses from the scale to be suspect. Such cases included nonorganic losses, intermittent losses (e.g., Meniere's syndrome), and postsurgical restoration of hearing. This information proved to be very useful in the analysis of response patterns to the scale questions.

The questionnaires were submitted to the study directors as soon after completion as possible. They were coded as received, so that errors and omissions could be detected while the clinic staff might still recall the patient and be able to make corrections. This procedure was intended primarily to correct errors made in information supplied by the clinic relating to the audiometric measurements. A number of questionnaires were received on which responses to some of the scale statements were omitted. No steps to correct these oversights could be taken. However, continually advising the clinics of these errors probably reduced their rate of occurrence.

## Analysis of Scalability

Responses to the seven items on the revised hearing scale are said to be "scaled" if, once a "yes" response is given, all subsequent responses are "yes." If a person answers "yes" to the first question, he must answer "yes" to the remaining six questions, in order for his responses to be scaled. Similarly, a person may respond "no" to the first two items and "yes" to the third; to be scaled, his next four answers must be "yes." In addition, scaled responses must comply with two mechanical rules: (a) only one response to a question and (b) no responses omitted. Multiple responses to a question and omission of responses are considered to be indications of scale weakness, based on the reasoning that an equivocal or missing response may be due to poor wording or incorrect placement of the item on the scale. How-

[4]National Center for Health Statistics: Characteristics of persons with impaired hearing. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 10-No. 35. Public Health Service. Washington. U. S. Government Printing Office, Apr. 1967.

ever, because the indications of the problem are different, they have been treated separately in analyzing the scale.

Scalability in these terms, then, is taken as synonymous with unidimensionality. The first analyses of the responses to the seven statements dealt with their tendency to scale and with factors associated with scaling. The object of the analyses was to establish the extent to which the statements could be accepted as approximating scale (unidimensional) form.

As shown in table 1, of the 1,815 respondents in the clinic sample, 1,345 (74.1 percent) gave responses which scaled and were free of response error. Approximately 7 percent of the respondents failed to respond to all or some of the statements or provided multiple answers to the same statement. While this group does not contribute pertinent data to the analysis of scalability, they do indicate the need to either clarify instruction or develop a followback editing procedure designed to decrease the magnitude of this group. However, even when these responses—including the omissions or multiple answers—are eliminated, the proportion scaling is only 79.7 percent, which is considerably lower than that for the earlier hearing scale (88.9 percent).[1] The following discussion will examine the possible reasons why the 343 respondents gave inconsistent answers to this scale.

## Diagnosis

Table 1 shows scaling of the 1,815 cases in the clinic sample by characteristics of their hearing loss and hearing examination. In addition to audiometric data, clinics were asked to note any characteristics which would make the results of the examination suspect.

In four out of five cases, no diagnosis was given or, if some diagnostic information was entered, it was of a routine nature. (A routine diagnosis included otitis media, presbycusis, and otosclerosis.)

Intermittent losses (including Meniere's syndrome) were reported for 4.5 percent (81) of the clinic patients. Nearly 12 percent (216) of the patients were seen following surgery, usually stapedectomy. A little more than 3 percent of the cases were suspected of having a nonorganic loss

Table 1. Number and percent of persons giving scaled and nonscaled responses according to type of error, by diagnostic classification of their hearing impairment: clinic sample

| Diagnostic classification of hearing impairment | Total number of persons | Scaled responses | | Nonscaled responses | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Inconsistent | | Omissions | | Other[1] | |
| | | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Total--------- | 1,815 | 1,345 | 74.1 | 343 | 18.9 | 88 | 4.8 | 39 | 2.1 |
| Routine or no diagnosis---------- | 1,460 | 1,074 | 73.6 | 281 | 19.2 | 73 | 5.0 | 32 | 2.2 |
| Intermittent loss--- | 81 | 64 | 79.0 | 12 | 14.8 | 4 | 4.9 | 1 | 1.2 |
| Postsurgery--------- | 216 | 171 | 79.2 | 35 | 16.2 | 7 | 3.2 | 3 | 1.4 |
| Nonorganic---------- | 35 | 22 | 62.9 | 10 | 28.6 | 2 | 5.7 | 1 | 2.9 |
| Unreliable examination---------- | 23 | 14 | 60.9 | 5 | 21.7 | 2 | 8.7 | 2 | 8.7 |

[1]Other errors include checking both yes and no to the same statement or a combination of two or more types of errors for a given respondent.

(malingering, psychogenic, etc.) or of giving unreliable audiological results for other reasons. The records of these latter 58 cases are not included in the remaining analyses.

Except for these cases omitted, there appears to be little difference in scalability for these broad diagnostic groupings. However, the "routine/no diagnosis" category is so large that it may be obscuring additional information about type of hearing loss in relation to scalability. The differences in scalability between those with unreliable audiological results or nonorganic losses and those with intermittent losses or postsurgical evaluation is to be expected, because persons who are unreliable in one respect are apt to be so in another and because persons seeking relief from severe impairments are more likely to be aware of their impairment.

As indicated below when the 58 cases noted above, along with the scale responses which included omissions or multiple answers, are eliminated, the proportion of persons who gave scaled responses rises to 80.0 percent.

| | *Number* | *Percent* |
|---|---|---|
| All persons------- | 1,637 | 100.0 |
| Scaled responses----- | 1,309 | 80.0 |
| Unscaled responses (inconsistent)------- | 328 | 20.0 |

Since this proportion is still much lower than the proportion of persons who scaled (88.9 percent) in the earlier national survey, a further discussion of this difference is taken up in the next section.

### Patterns of Response

Even though the discrimination being sought in the newer scale was far greater than that in the earlier version, the large difference between the proportion of respondents who scaled in the July 1962-June 1963 survey and the proportion of scaled responses in the clinic group led the authors to examine the patterns of responses given by the clinic group. As shown in table 2, the nonscaled response noted most often (57 times) was the pattern "N, N, Y, Y, Y, N, Y." This response pattern would imply that although the person can usually hear and understand shouted speech, he is unable to distinguish one kind of noise from another. The next most common nonscaling response pattern was "N, N, Y, Y, N, Y, Y," which occurred 40 times. This response pattern would imply that although the person can hear and understand shouted speech, he cannot distinguish speech from other sounds and noises. On face validity, both of the above responses appear illogical and because of any evidence to the contrary, it is necessary to assume that questions 5 and 6 are being misinterpreted by some proportion of the respondents. On further inspection of these response patterns, it was found that question 6 alone accounts for 108 of the 329 inconsistent responses, question 5 alone accounts for 79 failures, and questions 5 and 6 jointly account for 50 failures. Taken together, a total of 237 inconsistent responses of the 329 such errors could be eliminated by ignoring the responses to questions 5 and 6.

If questions 5 and 6 are ignored, then 1,546 of the 1,758 (87.9 percent) of the entire clinic group would have scaled responses. Further, by eliminating from the analysis those respondents who failed to answer each statement and those who gave multiple answers to the same statement, the proportion of respondents that scale rises to 94.4 percent.

This analysis suggests the deletion of these two scale statements "can usually tell the sound of speech from other sounds and noises" and "can usually tell one kind of noise from another." The purpose of these statements was intended to provide a more detailed discrimination among those who were unable to hear or understand even loud speech but were able to hear loud noise. However, it appears that these statements created some confusion in the respondent's mind. Since the group for whom the questions were intended to provide more discrimination comprises a very small fraction of the hearing impaired population,[4] a more detailed classification within it would have very limited statistical reliability for the purposes of the Health Interview Survey. Therefore, the deletion of these two statements would not greatly affect the overall usefulness of this scale.

It should be noted that statements similar to questions 5 and 6 appeared on the Hearing Ability Scale used in the July 1962-June 1963 survey. However, the impact that they had on scalability

Table 2. Frequency of responses to hearing scale statements in clinic sample

| Response | Frequency | Pattern statement number | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| All responses[1] | 1,758 | | | | | | | |
| Scaled responses | 1,309 | | | | | | | |
| | 378 | [2]Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | 476 | No | Yes | Yes | Yes | Yes | Yes | Yes |
| | 382 | No | No | Yes | Yes | Yes | Yes | Yes |
| | 30 | No | No | No | Yes | Yes | Yes | Yes |
| | 8 | No | No | No | No | Yes | Yes | Yes |
| | 3 | No | No | No | No | No | Yes | Yes |
| | 15 | No | No | No | No | No | No | Yes |
| | 17 | No | No | No | No | No | No | No |
| | | (The underlined response indicates those that are out of order) | | | | | | |
| All inconsistent responses | 329 | | | | | | | |
| | 57 | No | No | Yes | Yes | Yes | <u>No</u> | Yes |
| | 40 | No | No | Yes | Yes | <u>No</u> | Yes | Yes |
| | 31 | No | Yes | Yes | Yes | Yes | <u>No</u> | Yes |
| | 25 | No | Yes | Yes | Yes | <u>No</u> | Yes | Yes |
| | 23 | No | No | Yes | Yes | <u>No</u> | <u>No</u> | Yes |
| | 14 | No | No | No | Yes | <u>No</u> | <u>No</u> | Yes |
| | 13 | No | Yes | Yes | <u>No</u> | Yes | Yes | Yes |
| | 13 | No | No | No | Yes | Yes | <u>No</u> | Yes |
| | 11 | No | No | Yes | <u>No</u> | Yes | Yes | Yes |
| | 10 | No | Yes | Yes | Yes | <u>No</u> | <u>No</u> | Yes |
| | 24 | Response patterns in which only statement 5 and/or 6 are inconsistent | | | | | | |
| Other inconsistent patterns having a frequency of less than 10 | 68 | Other inconsistent responses | | | | | | |
| All other response errors | 120 | | | | | | | |
| Response omitted[3] | 84 | 11 | 16 | 6 | 25 | 17 | 19 | 3 |
| Other response errors | 36 | | | | | | | |

[1]Responses of those classified as nonorganic(N=35) and unreliable examination(N=23) are not included. See text for summary of their responses.

[2]See figure 1 for definition of statement number.

[3]Figures beneath each statement number indicate frequency of occurrence of error. Total of individual frequencies exceeds 84 because some respondents omitted more than one response.

was not as obvious, probably because of the nature of the sample population involved. A major analytical problem inherent in analyzing a scale of this type is determining the appropriate denominator. Since this scale is designed to discriminate among various degrees of hearing loss, those persons at either extreme of the scale, such as those with no significant hearing loss and those with complete loss, can be expected to have no problem answering the questions. These persons can either hear everything or nothing. However, for those persons who fall between the extremes, the ability to discriminate becomes more difficult.

Since the July 1962-June 1963 survey was based on the representative sample of the United States in which only a small proportion of the population is expected to have a hearing impairment, a smaller number of persons could be expected to have a problem of confusion with questions 5 and 6 in comparison to the clinic samples used in this study.

It could be argued that in this study, the denominator for the fraction indicating scalability should either include only those persons who were reported to have some hearing impairment or should be weighted to reflect greater or lesser degree of risk of error. However, since the purpose of the scale is to classify all persons—those with and without hearing loss—the total sample population has been used as the denominator in this analysis.

## Factors Affecting Scaling

Except for the lower level of scaled responses due to the choice of the total sample population as a base for the computation of percentages, the relationships between sex, age, hearing aid use, and scalability are similar to those found in the earlier study.[4]

As shown in table 3, the proportion of males providing scaled responses was 81.9 percent; this is slightly higher than the 78.2 percent of scaled responses for females. These differences are nonsignificant, using a 5-percent level of significance. The chi square for this distribution was 3.45, with 1 degree of freedom. The interpretation of this result in terms of associated probability would be that this observed sex difference could be expected to occur from mere chance from 5 to 10 times if this study was repeated 100 times. Even if this difference were statistically significant, its practical implication would be limited.

## Age of Respondent

As shown in table 4, respondents who were 60 years of age and over gave scaled responses less frequently (77.1 percent) than those from 40-59 years (82.4 percent) and than those under 40 years (80.5 percent). The chi square for this distribution was 5.7, which is not significant at a 5-percent level of confidence, with 2 degrees of freedom. However, age does seem to be a significant factor if the scaled responses for the 60 years and over group (77.1 percent) are compared with those for persons under 60 years of age (81.8 percent). The chi square for this distribution is 5.26 with 1 degree of freedom which is significant at the 5-percent level of confidence but not at the 1-percent level. This means that these differences would occur due to chance alone less than five times if this study was repeated 100 times.

## Use of Hearing Aids

Persons presently using hearing aids gave scaled responses significantly less frequently (61.7 percent) than those who had never used an aid (83.8 percent) or those who had used one in the past (79.3 percent). The difference in these percentages is significant beyond the 0.1-percent level (chi square equals 61.0, with 2 degrees of freedom).

Hearing aid use, however, varies with age. For patients aged 60 years and over, 21.0 percent were presently using a hearing aid and 12.3 percent formerly used one (from figures in table 4). These proportions are higher than those reported for the population aged 40-59 years (11.1 percent now use an aid; 12.0 percent used an aid in the past) and the under 40-year-old group (10.3 percent now use an aid and 10.6 percent used an aid in the past).

Because of these differences in the use of hearing aids among the different age groups, it is necessary to question whether the large differences in scalability among the use of hearing aid groups are a function of age or the observed dif-

Table 3. Number and percent distribution of persons, by scaled and inconsistent responses to the hearing ability scale according to sex and hearing aid use: clinic sample

| Sex and hearing aid use[1] | Total | Scaled | Non-scaled inconsistent | Total | Scaled | Non-scaled inconsistent |
|---|---|---|---|---|---|---|
| Both sexes | Number of persons | | | Percent distribution | | |
| All persons | [2]1,634 | 1,307 | 327 | 100.0 | 80.0 | 20.0 |
| Never used aid | 1,201 | 1,006 | 195 | 100.0 | 83.8 | 16.2 |
| Now uses aid | 240 | 148 | 92 | 100.0 | 61.7 | 38.3 |
| Formerly used aid | 193 | 153 | 40 | 100.0 | 79.3 | 20.7 |
| Male | | | | | | |
| All persons | 800 | 655 | 145 | 100.0 | 81.9 | 18.1 |
| Never used aid | 591 | 502 | 89 | 100.0 | 84.9 | 15.1 |
| Now uses aid | 107 | 72 | 35 | 100.0 | 67.3 | 32.7 |
| Formerly used aid | 102 | 81 | 21 | 100.0 | 79.4 | 20.6 |
| Female | | | | | | |
| All persons | 834 | 652 | 182 | 100.0 | 78.2 | 21.8 |
| Never used aid | 610 | 504 | 106 | 100.0 | 82.6 | 17.4 |
| Now uses aid | 133 | 76 | 57 | 100.0 | 57.1 | 42.9 |
| Formerly used aid | 91 | 72 | 19 | 100.0 | 79.1 | 20.9 |

[1]Excludes those respondents who failed to answer each question or provide a multiple or qualified answer to at least one of the questions.

[2]Excludes three patients for whom clinical data were not available.

ferences among age groups are a function of hearing aid usage.

Since the proportion of persons who scaled for each of the hearing-aid-use groups show similar differences within each of the age-specific categories, it is obvious that these differences cannot be solely a function of age. This is borne out by a comparison of the age-adjusted percentages of scalability for the hearing-aid-use categories. This procedure yields rates of 83.6 percent scalability for those who have never used an aid, 60.3 percent for present users, and 79.2 percent for the former users. A test of the significance of the difference in these percentages results in chi square of 65.66 with 2 degrees of freedom. This statistic, which is significant beyond the 0.1 confidence level, indicates that hearing aid status has a marked influence on the scalability of responses regardless of age.

It is, however, possible to standardize for hearing aid use and compare differences among age groups. The proportion of persons scaling within each age group, after adjustment for differences in hearing-aid-use status, results in 79.3 percent for the 18-39 year age group, 81.3 percent for the 40-59 year age group, and 78.0 percent for the 60 year and over age group. These adjusted rates of scalability for the age groups which yield a chi square of 2.16 with 2 degrees of freedom are not significantly different at the 5-

Table 4. Number and percent distribution of persons, by scaled and inconsistent responses to the hearing ability scale according to age and hearing aid use: clinic sample

| Age and hearing aid use[1] | Total | Scaled | Non-scaled inconsistent | Total | Scaled | Non-scaled inconsistent |
|---|---|---|---|---|---|---|
| All ages, 18+ years | Number of persons | | | Percent distribution[2] | | |
| All persons | [3]1,634 | 1,307 | 327 | 100.0 | 80.0 | 20.0 |
| Never used aid | 1,201 | 1,006 | 195 | 100.0 | 83.8 | 16.2 |
| Now uses aid | 240 | 148 | 92 | 100.0 | 61.7 | 38.3 |
| Formerly used aid | 193 | 153 | 40 | 100.0 | 79.3 | 20.7 |
| 18-39 years | | | | | | |
| All persons | 339 | 273 | 66 | 100.0 | 80.5 | 19.5 |
| Never used aid | 268 | 225 | 43 | 100.0 | 84.0 | 16.0 |
| Now uses aid | 35 | 20 | 15 | 100.0 | 57.1 | 42.9 |
| Formerly used aid | 36 | 28 | 8 | 100.0 | 77.8 | 22.2 |
| 40-59 years | | | | | | |
| All persons | 675 | 556 | 119 | 100.0 | 82.4 | 17.6 |
| Never used aid | 519 | 449 | 70 | 100.0 | 86.5 | 13.5 |
| Now uses aid | 75 | 43 | 32 | 100.0 | 57.3 | 42.7 |
| Formerly used aid | 81 | 64 | 17 | 100.0 | 79.0 | 21.0 |
| 60 years and over | | | | | | |
| All persons | 620 | 478 | 142 | 100.0 | 77.1 | 22.9 |
| Never used aid | 414 | 332 | 82 | 100.0 | 80.2 | 19.8 |
| Now uses aid | 130 | 85 | 45 | 100.0 | 65.4 | 34.6 |
| Formerly used aid | 76 | 61 | 15 | 100.0 | 80.3 | 19.7 |

[1]Excludes those respondents who failed to answer each question or provide a multiple or qualified answer to at least one of the questions.

[2]Percentages of scalability have been adjusted to the age distribution and to the "hearing aid status" distribution of the total study population shown in the table.

[3]Excludes three patients for whom clinical data were not available.

percent level of significance. These differences could be expected to occur 30 percent of the time by chance alone.

From the above discussion, it is possible to draw the following conclusions: Hearing-aid-use status is related to the respondent's ability to scale, and those patients who presently use a hearing aid have the most difficulty in providing a scaled response. There is insufficient evidence to indicate that inability to scale is a function of age; however, since there are some observed differences, it should not be eliminated as a possible factor.

The age of the respondent is an important factor as it relates to other types of errors in completing the Hearing Ability Scale. Approximately 10 percent of the respondents who were 60 years and over either failed to answer all of the questions or provided multiple answers to the same question on the scale. The proportion of similar types of errors for the 18-39 and 40-59 year age groups was 5 percent or approximately one-half the proportion occurring for the older age group.

### Audiometric Analysis

The second concern about the clinic data was the relation of the scale scores to the audiological measures. Better-ear averages (the arithmetic average of the air-conduction thresholds at 500, 1000, and 2000 cycles per second for the better-hearing ear) formed the basis for most of the analysis. These measures were related to the scale scores, which were determined by the first "yes" response given by the patient. Thus, if question 1 was answered "yes," then the scale score would be 1, and so on, to a score of 8 for the case in which all answers to the seven questions were "no." It should be noted that in the following analysis the data includes scores for those patients whose responses did not scale, because the plan for the field test (Phase III) was to stop questioning when the first "yes" response was made to a scale item. It should be further noted that the low frequencies of scale scores beyond 4 necessitated combining scores 5 through 8 for purposes of analysis.

As shown in table 5, the mean better-ear average for the total sample increases with increasing scale scores. The mean better-ear average ranged from 13.7 dB loss for persons with a scale score of 1 (able to hear and understand a whisper from across a quiet room) to 81.8 dB loss for persons with a scale score of 5 or better (usually unable to hear and understand even loud speech) with a fairly even progression of corresponding better-ear averages. These mean better-ear averages indicate that the hearing ability scale was quite effective in discriminating among groups of persons with varying degrees of hearing loss. However, the relatively large standard deviation for these mean audiometric measures also indicate that there is considerable variation within each scale group.

As the evidence on scalability suggested, the use of hearing aids apparently influences the way in which persons describe their hearing loss. For the same scale score, persons who are presently using a hearing aid tend to have a more severe average loss than those who never used an aid or those who used one in the past. As shown in table 5, this phenomenon is observed with each of the scale scores. Persons never using an aid recorded the lowest mean better-ear averages. Persons presently using an aid had the highest mean better-ear average. Persons who formerly used an aid fall between these two extremes.

Since age could also be a factor, table 6 presents the mean better-ear averages according to scale score by age within each of the hearing-aid-use categories. Approximately 73 percent of the clinic sample were classified as having never used a hearing aid. Within this group for the same scale score, older persons tend to have more severe average losses than do younger persons. An increasing better-ear average loss with increasing age is observed for each of the first four scale scores. The fact that this pattern is broken in the last scale score group might only be a reflection of the small number of cases within this group. For the other two hearing-aid-use categories, no obvious age patterns are detected.

The interpretation of these findings would indicate that the Hearing Ability Scale, when hearing aid usage and age are controlled, can be an effective instrument for classifying groups of per-

sons according to degrees of audiometric hearing loss. However, as previously discussed, the standard deviation for each of the computed mean better-ear averages is relatively large, indicating substantial variability within these groups.

### Rating for Each Ear

As mentioned earlier, in addition to the scale questions, each respondent was asked to check a statement for each ear indicating his own estimate of his hearing ability in that ear (fig. 2). These ratings also form a logical assessment of the scale qualities of the two ratings, one for each ear.

Table 7 shows better-ear averages of the composite rating (for both ears) by hearing aid use and age. Better-ear averages increase as the ratings for the *worse* ear increase (ratings of 1 indicate best hearing; 4, worst hearing). Thus, while it might be thought that the better-ear averages should be approximately the same for the same better-ear rating, this is not the case. Apparently, there is a tendency to judge the hearing in one ear in relation to the other ear so that when the hearing in one ear is poor, hearing in the better ear may be somewhat overrated.

Similar to the findings for the Hearing Ability Scale, both use of hearing aids and age are factors in determining how a person described his

Table 5. Number of persons, mean better-ear average in decibels, and standard deviation, by scale score according to hearing aid use: clinic sample

| Hearing aid use status | Scale score | | | | | |
|---|---|---|---|---|---|---|
| | Total | 1 | 2 | 3 | 4 | 5-8 |
| Total | | | | | | |
| Number of persons[1] | 1,752 | 425 | 614 | 573 | 83 | 57 |
| Mean better-ear average in decibels | ... | 13.7 | 28.3 | 43.2 | 63.3 | 81.8 |
| Standard deviation | ... | 11.7 | 16.3 | 16.7 | 18.5 | 20.5 |
| Never used aid | | | | | | |
| Number of persons | 1,287 | 383 | 488 | 379 | 26 | 11 |
| Mean better-ear average in decibels | ... | 12.5 | 25.4 | 37.5 | 51.8 | 73.2 |
| Standard deviation | ... | 11.1 | 15.2 | 14.7 | 19.2 | 28.4 |
| Formerly used aid | | | | | | |
| Number of persons | 206 | 38 | 73 | 71 | 13 | 11 |
| Mean better-ear average in decibels | ... | 23.2 | 35.0 | 50.1 | 58.8 | 77.3 |
| Standard deviation | ... | 10.5 | 13.6 | 14.0 | 16.7 | 28.4 |
| Now uses aid | | | | | | |
| Number of persons | 259 | 4 | 53 | 123 | 44 | 35 |
| Mean better-ear average in decibels | ... | 38.5 | 45.9 | 56.7 | 71.4 | 85.9 |
| Standard deviation | ... | 10.0 | 16.2 | 14.6 | 14.4 | 13.0 |

[1]Five records were excluded for which there was no information on hearing aid use.

Table 6. Number of persons, mean better-ear average in decibels, and standard deviation, by scale score according to age and hearing aid use: clinic sample

| Age and hearing aid use | Scale score | | | | | |
|---|---|---|---|---|---|---|
| | Total | 1 | 2 | 3 | 4 | 5-8 |
| Total number of persons in clinic sample[1] | 1,752 | 425 | 614 | 573 | 83 | 57 |
| NEVER USED AID | | | | | | |
| All ages, 18+ years | 1,287 | 383 | 488 | 379 | 26 | 11 |
| 18-39 years | | | | | | |
| Number of persons | 283 | 112 | 110 | 55 | 1 | 5 |
| Mean better-ear average in decibels | ... | 7.5 | 17.7 | 33.2 | 42.0 | 98.6 |
| Standard deviation | ... | 8.1 | 13.8 | 17.7 | 0.0 | 3.7 |
| 40-59 years | | | | | | |
| Number of persons | 548 | 189 | 202 | 147 | 7 | 3 |
| Mean better-ear average in decibels | ... | 12.4 | 22.1 | 36.0 | 45.0 | 48.3 |
| Standard deviation | ... | 10.0 | 13.5 | 16.1 | 24.7 | 15.3 |
| 60 years and over | | | | | | |
| Number of persons | 456 | 82 | 176 | 177 | 18 | 3 |
| Mean better-ear average in decibels | ... | 19.9 | 34.1 | 40.2 | 54.9 | 55.7 |
| Standard deviation | ... | 13.2 | 13.7 | 11.7 | 17.2 | 27.6 |
| NOW USES AID | | | | | | |
| All ages, 18+ years | 259 | 4 | 53 | 123 | 44 | 35 |
| 18-39 years | | | | | | |
| Number of persons | 36 | 0 | 8 | 16 | 6 | 6 |
| Mean better-ear average in decibels | ... | 0.0 | 53.9 | 56.4 | 68.8 | 91.2 |
| Standard deviation | ... | 0.0 | 13.0 | 11.6 | 5.8 | 8.6 |
| 40-59 years | | | | | | |
| Number of persons | 79 | 0 | 18 | 42 | 9 | 10 |
| Mean better-ear average in decibels | ... | 0.0 | 42.8 | 55.9 | 72.6 | 88.2 |
| Standard deviation | ... | 0.0 | 15.7 | 16.4 | 20.0 | 14.5 |
| 60 years and over | | | | | | |
| Number of persons | 144 | 4 | 27 | 65 | 29 | 19 |
| Mean better-ear average in decibels | ... | 38.5 | 45.6 | 57.3 | 71.5 | 83.1 |
| Standard deviation | ... | 10.0 | 17.1 | 14.3 | 14.0 | 13.2 |

See footnote at end of table.

Table 6. Number of persons, mean better-ear average in decibels, and standard deviation, by scale score according to age and hearing aid use: clinic sample—Con.

| Age and hearing aid use | Scale score | | | | | |
|---|---|---|---|---|---|---|
| | Total | 1 | 2 | 3 | 4 | 5-8 |
| FORMERLY USED AID | | | | | | |
| All ages, 18+ years | 206 | 38 | 73 | 71 | 13 | 11 |
| 18-39 years | | | | | | |
| Number of persons | 38 | 4 | 16 | 14 | 2 | 2 |
| Mean better-ear average in decibels | ... | 19.5 | 39.8 | 51.4 | 45.5 | 74.0 |
| Standard deviation | ... | 10.9 | 16.9 | 17.1 | 3.5 | 36.8 |
| 40-59 years | | | | | | |
| Number of persons | 85 | 21 | 28 | 29 | 3 | 4 |
| Mean better-ear average in decibels | ... | 19.1 | 31.6 | 52.3 | 71.0 | 95.5 |
| Standard deviation | ... | 9.4 | 12.2 | 16.0 | 26.2 | 3.7 |
| 60 years and over | | | | | | |
| Number of persons | 83 | 13 | 29 | 28 | 8 | 5 |
| Mean better-ear average in decibels | ... | 31.1 | 35.7 | 47.2 | 57.5 | 64.0 |
| Standard deviation | ... | 7.6 | 12.5 | 9.1 | 12.7 | 33.3 |

[1]Five records were excluded for which there was no information on hearing aid use.

Table 7. Mean better-ear average in decibels and number of persons, by rating for each ear according to age and hearing aid use: clinic sample

| Age and hearing aid use | Total | Respondents' rating for each ear[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-1 | 1-2 | 1-3 | 1-4 | 2-2 | 2-3 | 2-4 | 3-3 | 3-4 | 4-4 |
| ALL PERSONS | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 12.6 | 17.7 | 19.4 | 26.2 | 31.5 | 39.1 | 38.9 | 52.4 | 61.2 | 87.2 |
| Number of persons | [2]1,736 | 200 | 217 | 194 | 36 | 374 | 274 | 50 | 277 | 73 | 41 |
| NEVER USED AID | | | | | | | | | | | |
| All ages, 18+ years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 11.5 | 16.6 | 17.0 | 21.1 | 30.0 | 35.3 | 31.8 | 45.6 | 52.6 | 84.5 |
| Number of persons | 1,275 | 183 | 200 | 154 | 29 | 320 | 198 | 33 | 130 | 21 | 7 |
| 18-39 years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 7.4 | 9.7 | 14.1 | 15.8 | 19.4 | 34.8 | 19.5 | 47.8 | 54.5 | 94.5 |
| Number of persons | 283 | 52 | 62 | 48 | 8 | 55 | 33 | 4 | 15 | 1 | 5 |
| 40-59 years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 10.6 | 14.9 | 15.7 | 21.8 | 28.8 | 34.2 | 31.8 | 44.0 | 43.0 | --- |
| Number of persons | 542 | 97 | 92 | 76 | 15 | 122 | 78 | 11 | 44 | 7 | --- |
| 60 years and over | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 20.4 | 29.2 | 25.1 | 26.2 | 35.0 | 36.5 | 34.5 | 46.1 | 57.6 | 59.5 |
| Number of persons | 450 | 34 | 46 | 30 | 6 | 143 | 87 | 18 | 71 | 13 | 2 |
| FORMERLY USED AID | | | | | | | | | | | |
| All ages, 18+ years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 23.9 | 28.1 | 25.4 | 14.5 | 38.7 | 44.9 | 45.8 | 52.4 | 62.4 | 90.2 |
| Number of persons | 206 | 17 | 14 | 33 | 3 | 36 | 30 | 9 | 43 | 14 | 7 |
| 18-39 years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 24.5 | 14.5 | 24.5 | --- | 47.0 | 44.5 | 47.8 | 53.5 | 44.5 | 89.5 |
| Number of persons | 38 | 3 | 3 | 5 | --- | 8 | 3 | 3 | 10 | 1 | 2 |

See footnotes at end of table.

Table 7. Mean better-ear average in decibels and number of persons, by rating for each ear according to age and hearing aid use: clinic sample—Con.

| Age and hearing aid use | Total | Respondents' rating for each ear[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-1 | 1-2 | 1-3 | 1-4 | 2-2 | 2-3 | 2-4 | 3-3 | 3-4 | 4-4 |
| 40-59 years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 20.5 | 29.5 | 22.1 | 14.5 | 35.3 | 47.0 | 49.5 | 53.0 | 66.5 | 90.5 |
| Number of persons | 85 | 10 | 6 | 17 | 2 | 13 | 12 | 2 | 13 | 5 | 5 |
| 60 years and over | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | 32.0 | 34.5 | 30.9 | 14.5 | 37.2 | 43.2 | 42.5 | 51.5 | 62.0 | --- |
| Number of persons | 83 | 4 | 5 | 11 | 1 | 15 | 15 | 4 | 20 | 8 | --- |
| NOW USES AID | | | | | | | | | | | |
| All ages, 18+ years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | --- | 41.2 | 43.1 | 72.0 | 45.5 | 51.9 | 60.5 | 60.9 | 65.5 | 87.1 |
| Number of persons | 255 | --- | 3 | 7 | 4 | 18 | 46 | 8 | 104 | 38 | 27 |
| 18-39 years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | --- | --- | 54.5 | 94.5 | 54.5 | 55.8 | 84.5 | 59.5 | 58.7 | 90.5 |
| Number of persons | 36 | --- | --- | 2 | 1 | 2 | 8 | 1 | 10 | 7 | 5 |
| 40-59 years | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | --- | --- | 24.5 | 49.5 | 41.1 | 52.8 | 61.3 | 58.4 | 72.2 | 89.5 |
| Number of persons | 78 | --- | --- | 2 | 2 | 9 | 12 | 3 | 33 | 13 | 4 |
| 60 years and over | | | | | | | | | | | |
| Mean better-ear average in decibels | ... | --- | 41.2 | 47.8 | 94.5 | 48.7 | 50.2 | 53.8 | 62.5 | 63.3 | 85.6 |
| Number of persons | 141 | --- | 3 | 3 | 1 | 7 | 26 | 4 | 61 | 18 | 18 |

[1] 1= My hearing is good; 2= I have little trouble hearing; 3= I have a lot of trouble hearing; 4= I am deaf.

[2] 21 records were excluded because the rating for one or both ears was missing and/or no information on hearing aid use.

ability to hear. For the same given rating, persons who reported that they presently use a hearing aid tend to have the most severe hearing losses and those who have never used an aid have the least severe hearing losses. For those persons classified as never having used a hearing aid, the average hearing loss tends to increase with increasing age, within the same rating category. A similar age pattern is not observed for those who used an aid in the past or for those who presently use an aid.

Another aspect of the ratings for each ear is the actual difference in hearing levels in relation to the respondents' estimates. Table 8 shows the mean difference of hearing levels between the ears by the ratings given for each ear. The results come very close to theoretical expectations. When respondents rate each ear the same—1-1, 2-2, 3-3, or 4-4—there is virtually no audiometric difference. When the ratings for each ear differ by one step (1-2, 2-3, 3-4), regardless of the severity of the rating, the average differences range only from 14 to 26 dB's. When the ratings differ by two steps (1-3, 2-4), the corresponding audiometric differences range from 36 to 44 dB's. Finally, when the ratings differ by three steps (1-4), the audiometric differences are largest, being from 64 to 71 dB's. Along with the fact that the average differences are all in the anticipated direction (positive when the left ear has the greater loss, negative when the right ear has the greater loss), these results add considerable support to the validity of these ratings.

Another interesting facet of the analysis of the ratings of each ear can be seen in table 9. Averages were calculated for the hearing levels associated with each rating. The increase in hearing level which results as the rating of hearing loss increases is not surprising, but the regularity of the increase (about 20 dB's between steps) and the similiarity of these findings for both left and right ears is noteworthy. Furthermore, the hearing levels closely resemble the interpretations associated with the rating: a hearing loss of 17 dB's is not considered handicapping, a loss of 35 dB's gives "difficulty only with faint speech," a loss of 55 dB's leads to "frequent difficulty with normal speech," and a loss of 89 dB's or more usually precludes the understanding even of amplified speech.[5] Altogether, the rating of each ear bears out the accuracy with which people on the average assess their hearing in response to questioning.

[5]National Center for Health Statistics: Hearing levels of adults. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 11-No. 11. Public Health Service. Washington. U.S. Government Printing Office, Oct. 1965.

Table 8. Number of persons, mean difference of hearing levels[1] for each ear, and standard deviation, by respondents' rating of hearing ability for each ear: clinic sample

| Respondents' rating for each ear[2] | Number of persons | Mean difference[3] of hearing levels | Standard deviation |
|---|---|---|---|
| All cases[4] | 1,740 | ... | ... |
| 1-1 | 200 | 0.7 | 10.0 |
| 2-2 | 375 | 0.8 | 10.9 |
| 3-3 | 277 | -0.6 | 13.2 |
| 4-4 | 41 | -1.5 | 9.6 |
| 1-2 | 104 | -17.0 | 18.6 |
| 2-1 | 114 | 13.6 | 15.5 |
| 2-3 | 124 | -16.2 | 16.7 |
| 3-2 | 152 | 14.0 | 17.2 |
| 3-4 | 33 | -24.3 | 15.2 |
| 4-3 | 40 | 25.8 | 21.9 |
| 1-3 | 79 | -40.7 | 24.9 |
| 3-1 | 115 | 35.7 | 22.9 |
| 2-4 | 20 | -41.4 | 29.6 |
| 4-2 | 30 | 43.7 | 30.7 |
| 1-4 | 19 | -64.3 | 26.3 |
| 4-1 | 17 | 70.6 | 23.0 |

[1]Arithmetic average of hearing levels (in decibels) at 500, 1000, and 2000 cycles per second.

[2]1=My hearing is good; 2=I have a little trouble hearing; 3=I have a lot of trouble hearing; 4=I am deaf. The first number of each rating pair is for the left ear; the second number is the rating for the right ear (see figure 2).

[3]Hearing for right ear always subtracted from that for left ear; therefore, negative values mean that hearing loss in the right ear is greater and vice versa for positive values.

[4]17 records were not included because rating for one or both ears was missing.

Table 9. Number of persons, mean better-ear average,[1] and standard deviation, by respondents' rating scale of each ear: clinic sample

| Respondents' rating scale | Left ear | | | Right ear | | |
|---|---|---|---|---|---|---|
| | Number of persons | Mean better-ear average in decibels | Standard deviation | Number of persons | Mean better-ear average in decibels | Standard deviation |
| Total | [2]1,746 | ... | ... | [3]1,745 | ... | ... |
| Hearing is good | 402 | 17.2 | 15.4 | 446 | 17.4 | 13.9 |
| Little trouble hearing | 635 | 35.5 | 16.5 | 663 | 36.0 | 17.5 |
| Lot of trouble hearing | 581 | 55.6 | 18.5 | 523 | 57.1 | 18.5 |
| Deaf | 128 | 89.4 | 16.1 | 113 | 87.6 | 16.4 |

[1]Arithmetic average of hearing levels (in decibels) at 500, 1000, and 2000 cycles per second.

[2]Total for left ear excludes 11 cases for which rating was missing.

[3]Total for right ear excludes 12 cases for which rating was missing.

### Relation of Scale Scores to Better-Ear Averages

In the National Health Survey's July 1962-June 1963 Hearing Ability Study, there was some evidence to indicate that persons who had a hearing impairment in only one ear tended to respond to the scale in terms of the impaired ear rather than their overall hearing ability. Therefore, in presenting the findings from that study, persons with impaired hearing in only one ear were treated separately and were not classified according to their scale scores. In addition, it was decided to consider as normal all persons who responded to the rating in each ear by checking "my hearing is good" for both ears. The effect of these decisions could not be tested at that time. It is now possible, in some measure, to estimate the probable result of these decisions. Table 10 shows the better-ear averages of persons by whether hearing loss was reported in neither, one, or both ears.

The findings presented in table 10 indicate that the earlier decisions were correct. Those groups of persons who reported no impairment in one or both ears and who were classified according to a scale score indicating some degree of hearing loss had mean better-ear averages considerably lower than were expected. For the same given scale score, those persons with reported hearing loss in both ears had considerably more severe average losses than did those with impairment in one ear or with no hearing impairment.

When the information from both the scale and the ratings for each ear are available, it might be thought that the precision of classification would be greatly improved. As shown in table 11, however, with the exception of weeding out the persons with one or both ears reported as good, this is not the case. Two factors intervene to affect the result. First, the scale scores and the ratings of each ear are closely related to each other; hence little reduction in error is obtained from their simultaneous use. Secondly, the matrix of scores becomes so diffused (80 possible configurations) that even the substantial sample in this phase does not provide sufficient representation in many of the cells to reduce sampling errors to the point that a trend, if one were present, would show up. To reduce the confusion somewhat, the scale scores from 5-8 were combined to form a single category, leaving 50 possible combinations. Even so, combining the two measures into a single score

Table 10. Number of persons, mean better-ear average in decibels, and standard deviation, by scale score according to degree of impairment: clinic sample

| Degree of impairment | Scale score | | | | | |
|---|---|---|---|---|---|---|
| | Total | 1 | 2 | 3 | 4 | 5-8 |
| Total number of persons in clinic sample | 1,740 | 424 | 607 | 570 | 82 | 57 |
| Both ears good | | | | | | |
| Number of persons | 200 | 148 | 46 | 5 | 1 | - |
| Mean better-ear average in decibels | ... | 10.2 | 17.5 | 24.6 | 3.0 | - |
| Standard deviation | ... | 8.8 | 13.3 | 20.6 | - | - |
| One ear good, one impaired | | | | | | |
| Number of persons | 448 | 198 | 187 | 60 | 2 | 1 |
| Mean better-ear average in decibels | ... | 12.6 | 20.6 | 30.3 | 31.0 | 100.0 |
| Standard deviation | ... | 10.5 | 15.1 | 18.6 | 1.4 | - |
| Both ears impaired | | | | | | |
| Number of persons | 1,092 | 78 | 374 | 505 | 79 | 56 |
| Mean better-ear average in decibels | ... | 23.1 | 33.4 | 45.0 | 65.0 | 81.5 |
| Standard deviation | ... | 14.5 | 14.9 | 15.6 | 16.8 | 20.5 |

does not yield a hierarchy of corresponding audiometric measures similar to those for either of the measures alone.

## Conclusions From Phase II

The clinic data generally tends to support either the use of the hearing scale or the rating of each ear as valid indications of hearing ability suitable for morbidity surveys. In addition, some interesting modifying factors noted in the development of the earlier scale[1] are reconfirmed by the results of this phase—the relations between age, hearing aid use, and self-reports of hearing ability.

When judging their hearing, respondents are likely to use their age peers as the appropriate reference group. The young man compares his hearing to that of other young men; the older man, to that of men at his age level. Since hearing loss becomes more prevalent with age, the older person with a mild impairment may be unaware of any defect; when he responds that his hearing is good, he may be implying the added phrase "*for my age.*" His loss is expected and accepted because of his years. Thus, the hearing level associated with a given scale score tends to increase as age increases.

The hearing aid user may have a problem responding to questions about his hearing ability because his hearing aid tends to distort the auditory pattern he receives (a necessary distortion in most cases). Thus, his auditory environment differs sufficiently from that of a person who does not use an aid; this makes his responses somewhat less similar in reference point. The constant user of a hearing aid, in particular, may find it difficult to answer questions about his hearing *without* an aid, because he stops attending to his auditory surroundings once he removes the aid. In turn, this may account for the fact that he tends to rate his hearing better than a person with a similar better-ear average who does not use an aid. The hearing aid user does not know how much he does not hear without the aid. Hence, the scale scores of hearing aid users tend to differ from the scale scores of persons who do not use an aid.

Table 11. Number of persons, mean better-ear average in decibels, and standard deviation, by scale score and respondents' rating of hearing ability for each ear: clinic sample

| Scale score and respondents' rating for each ear[1] | Number of persons | Mean better-ear average in decibels | Standard deviation |
|---|---|---|---|
| All cases | 1,725 | 33.0 | 22.4 |
| 1 1-1 | 147 | 10.1 | 8.7 |
| 1 1-2 | 112 | 11.0 | 9.6 |
| 1 1-3 | 67 | 14.3 | 10.5 |
| 1 1-4 | 19 | 16.4 | 13.0 |
| 1 2-2 | 51 | 21.1 | 13.5 |
| 1 2-3 | 18 | 26.2 | 15.6 |
| 1 2-4 | 4 | 16.5 | 10.6 |
| 1 3-3 | 3 | 42.3 | 7.3 |
| 1 3-4 | 1 | 26.0 | - |
| 1 4-4 | - | - | - |
| 2 1-1 | 46 | 17.5 | 13.1 |
| 2 1-2 | 84 | 21.3 | 14.3 |
| 2 1-3 | 90 | 18.6 | 13.2 |
| 2 1-4 | 12 | 30.1 | 25.5 |
| 2 2-2 | 194 | 29.5 | 14.7 |
| 2 2-3 | 102 | 36.7 | 13.5 |
| 2 2-4 | 24 | 32.2 | 14.0 |
| 2 3-3 | 42 | 42.0 | 13.3 |
| 2 3-4 | 8 | 45.0 | 11.0 |
| 2 4-4 | - | - | - |
| 3 1-1 | 5 | 24.6 | 18.4 |
| 3 1-2 | 22 | 30.6 | 20.7 |
| 3 1-3 | 34 | 29.6 | 17.7 |
| 3 1-4 | 3 | 31.0 | 8.3 |
| 3 2-2 | 118 | 36.5 | 14.3 |
| 3 2-3 | 147 | 40.9 | 12.1 |
| 3 2-4 | 19 | 47.7 | 19.0 |
| 3 3-3 | 177 | 50.9 | 14.0 |
| 3 3-4 | 32 | 53.1 | 15.0 |
| 3 4-4 | 5 | 81.8 | 16.5 |
| 4 1-1 | 1 | 3.0 | - |
| 4 1-2 | - | - | - |
| 4 1-3 | 1 | 32.0 | - |
| 4 1-4 | 1 | 30.0 | - |
| 4 2-2 | 5 | 52.2 | 8.3 |
| 4 2-3 | 5 | 65.8 | 15.2 |
| 4 2-4 | 2 | 39.5 | 17.5 |
| 4 3-3 | 38 | 62.7 | 14.1 |
| 4 3-4 | 19 | 67.5 | 18.2 |
| 4 4-4 | 10 | 80.0 | 11.8 |
| 5 1-1 | - | - | - |
| 5 1-2 | - | - | - |
| 5 1-3 | - | - | - |
| 5 1-4 | 1 | 100.0 | - |
| 5 2-2 | 3 | 41.7 | 10.1 |
| 5 2-3 | 1 | 65.0 | - |
| 5 2-4 | 1 | 65.0 | - |
| 5 3-3 | 14 | 64.0 | 20.6 |
| 5 3-4 | 11 | 90.0 | 10.8 |
| 5 4-4 | 26 | 93.1 | 8.1 |

[1] The first number is the scale score with 5 representing scale scores of 5-8. The next two numbers are the ratings of each ear. The combined rating was not available for 11 cases.

Another important finding is that the groups ranked by scale scores up to 5 are similarly ranked by their better-ear averages. It must be granted that the better-ear average alone is not sufficient as a measure of auditory impairment. It is, however, a very useful, widely understood summary statistic. Since the purpose of the scale is to determine the prevalence of hearing impairment in general terms and not to make diagnoses, the overlaps between persons with different scale scores and the different better-ear averages of persons with the same scale score are not serious.

The rating of each ear separately likewise appears to have considerable value as an indication of hearing level. Its simplicity of administration belies the amount of information it yields. First of all, it also shows the relationship with age and hearing aid use which was noted previously. Second, combining the the two ratings yields a 10-step scale. A person who says his hearing is good in both ears (1-1) tends to have better hearing than one who says his hearing is good in one ear and that he has a little difficulty hearing with the other (1-2). The corresponding better-ear average hearing levels continue to increase until a rating of 4-4 (deaf in both ears) is reached. Equally interesting is the fact that as reported differences in hearing ability between ears increase, so also do the differences in audiological thresholds. When both ears are reported to be functioning equally well, there is no difference in audiological thresholds; but greater and greater differences appear as the ratings deviate from one to two to three steps apart.

Combining the scale scores and the rating of each ear into a single measure does not seem worthwhile. As discussed above, the two measures are too highly interrelated to contribute much additional valid information when considered jointly.

## PHASE III: THE FIELD TEST

The principal objective during this phase was to test the revised scale questions in the general population following procedures that would be used in an interview-type survey. The results of the clinic study needed to be confirmed under conditions as close as possible to those encountered in the field. Accordingly, a survey resembling that routinely conducted by the Health Interview Survey was performed in the Philadelphia Standard Metropolitan Statistical Area in 1966.

The questionnaire used in this survey was designed to parallel, as far as possible, the changes in format that are currently being used in the Health Interview Survey. After pretesting several versions of a questionnaire and through consultation with members of the Health Interview Survey staff, the final version of the questionnaire used in this study, shown in appendix III, was developed.

Twelve interviewers were selected from 30 applicants who had had from 2 to 10 years experience in household surveys. One prospective interviewer dropped out during the training and one interviewer resigned immediately after the training period ended. One of the remaining 10 interviewers was selected to work in the office, to conduct reinterviews, and to persuade persons to come to the clinic for examinations, leaving nine persons who did the interviewing.

The interviewers were trained by a staff member familiar with the technique used by the Bureau of the Census in training interviewers for the Health Interview Survey. An interviewer's manual similar in style to that used in the Health Interview Survey was developed for this study. The training period included 5 days of classroom training plus 1 day of practice interviews in the field. All of the nine interviewers were observed during the first 3 days of interviewing by members of the Gallaudet College and the Health Interview Statistics staff. After the first 3 days, they returned for group and individual instructions to correct errors noted by the observers.

### The Sample

The sample for this survey was prepared by National Analysts, Inc., of Philadelphia, according to general specifications prepared by the principal investigators. A description of the sampling plan is given in appendix IV. The sample segments were listed by members of the staff.

The sample was designed to yield approximately 1,200 households that would be representative of the Philadelphia Standard Metropolitan Statistical Area. Actually, the sample produced 1,132 households (table 12).

Table 12. Number and percent distribution of households, by eligibility status: Philadelphia Hearing Scale Study, July 1966

| Eligibility status | Number of households | Percent distribution |
|---|---|---|
| Total in sample---- | 1,132 | 100.0 |
| Eligible for interview--- | 1,084 | 95.8 |
| Noneligible for interview---------- | 48 | 4.2 |
| Vacant---------- | 40 | 3.5 |
| Nonhouseholds[1]--------- | 8 | 0.7 |
| Total eligible----- | 1,084 | 100.0 |
| Interviews completed----- | 929 | 85.7 |
| Noninterviews---------- | 155 | 14.3 |
| Refusals---------- | 41 | 3.8 |
| No one at home (repeated calls)--------- | 114 | 10.5 |

[1]Nonhouseholds include demolished units and places not intended as living quarters.

## Interviewing and Response Rates

The interviewing was conducted during the period July 12-August 25, 1966. Each interviewer was assigned complete segments, arranged so that all interviewers worked in all types of urban and suburban economic areas. Interviewers were instructed to make two additional calls when no response was obtained on the first visit. Additional callbacks were permitted when circumstances warranted. Refusals and nonresponses were later grouped and reassigned to interviewers other than those who had made the original contacts at these households. As a result of these followup procedures, interviews were conducted in about 86 percent of the eligible households (table 12).

## Characteristics of the Sample

Table 13 shows the age, sex, and color distribution of persons in interviewed households in the Philadelphia Hearing Scale Study. A comparison of the age and sex distribution of these persons and population estimates derived from the Health Interview Survey is shown in table 14. Inspection of the two distributions leaves the impression that they are quite similar; absolute differences between the proportions in any of the age categories do not exceed 3 percent. The apparent agreement between the sample and the estimated population for age and sex, lends confidence that the sample drawn is sufficiently representative for purposes of this study.

Of the 3,175 persons interviewed, 2,852 were 6 years of age and over. Since this study was designed for persons 6 years of age and over, the remainder of this report will deal only with this population.

## Screening for Hearing Impairment

Of the 2,852 persons 6 years of age and over in the sample, 180 persons were identified as having a hearing impairment, by response to the following two screening questions: question 12a "Does . . . have any trouble hearing with one or both ears?" and question 12b "Can . . . hear well enough to hear a whisper from across a quiet room?" (see appendix III for questionnaire format). The special hearing supplement to the questionnaire, which included the scale questions and the rating of hearing ability, was administered to these 180 persons. When related to the population of the Philadelphia SMSA, the 180 persons represent a rate of 63.1 persons per 1,000 population with impaired hearing in one or both ears. Of the 180 persons, 156 were identified by a positive response to question 12a on the questionnaire. If only these persons are considered, the rate of impaired hearing in the Philadelphia SMSA is reduced to 54.7 per 1,000 population. The latter rate is quite similar to the estimate for the United States of 56.7 per 1,000 persons 6 years and over. This was produced by a similar screening question in the July 1962-June 1963 Hearing Ability Study (unpublished data). The remaining 24 persons with hearing impairment identified by negative responses to question 12b probably would not have been identified as having hearing loss in the July 1962-June 1963 Survey.

Table 13. Number of persons in interviewed households, by age, color, and sex: Philadelphia Hearing Scale Study, July 1966

| Color and sex | Total, all ages | Under 10 years | 10-19 years | 20-29 years | 30-39 years | 40-49 years | 50-59 years | 60-69 years | 70-79 years | 80+ years |
|---|---|---|---|---|---|---|---|---|---|---|
| All persons | Number of persons | | | | | | | | | |
| Total-- | 3,175 | 599 | 639 | 318 | 385 | 443 | 413 | 213 | 119 | 46 |
| Male---------- | 1,468 | 286 | 304 | 140 | 173 | 207 | 196 | 104 | 45 | 13 |
| Female-------- | 1,707 | 313 | 335 | 178 | 212 | 236 | 217 | 109 | 74 | 33 |
| White | | | | | | | | | | |
| Total-- | 2,763 | 516 | 567 | 261 | 336 | 382 | 359 | 195 | 105 | 42 |
| Male---------- | 1,282 | 244 | 271 | 117 | 155 | 177 | 172 | 94 | 41 | 11 |
| Female-------- | 1,481 | 272 | 296 | 144 | 181 | 205 | 187 | 101 | 64 | 31 |
| Nonwhite | | | | | | | | | | |
| Total-- | 412 | 83 | 72 | 57 | 49 | 61 | 54 | 18 | 14 | 4 |
| Male---------- | 186 | 42 | 33 | 23 | 18 | 30 | 24 | 10 | 4 | 2 |
| Female-------- | 226 | 41 | 39 | 34 | 31 | 31 | 30 | 8 | 10 | 2 |

## AUDIOLOGICAL EXAMINATIONS AND SCALE SCORES

### Response Rates for Audiological Examinations

In addition to the 180 hearing-impaired persons identified by responses to questions 12a and 12b, an additional 234 nonimpaired persons were selected for clinical examination according to the following procedure: all persons aged 18-64 years, reported as not having a hearing impairment, were listed consecutively on a schedule as they were interviewed; in a separate column of the schedule, nonimpaired persons 65-79 years of age were listed. Through the use of a table of random numbers, 1 in 10 of the persons aged 18-64 and 1 in 3 of the persons aged 65-79 were selected for the subsample. This sampling procedure produced 234 persons.

Of the 180 persons with impaired hearing, 141 or 78 percent received audiological examinations, and of the 234 nonimpaired persons in the subsample 181 or 77 percent were examined (table 15). While it appears from these data that approximately the same proportion of persons in both groups were given audiological examinations, it should be noted that it was necessary to examine a higher proportion of the persons in the nonimpaired sample at home (see "Field Audiometry"). It should also be noted that the sample of nonimpaired persons contained a smaller proportion of persons 65-79 years of age (25 percent) compared with the impaired group (29 percent) who were tested. Since persons in this age group are generally less willing and less able to participate in this type of survey, more effort was required to obtain participation in the audiological examination, especially from persons who believed that their hearing was good.

### Field Audiometry

Because so many persons who were asked either refused or could not come to the clinic for an audiological examination, an interviewer-audiologist team was sent to them. The audiologist used a portable Zenith audiometer to get the hearing levels of the respondents and a sound-pres-

Table 14. Number and percent distribution of persons in interviewed households and in general population, by age according to sex: Philadelphia Hearing Scale Study and population estimates from the Health Interview Survey, Philadelphia SMSA, July 1966

| Sex and age | Persons in interviewed households[1] | | Population estimates from Health Interview Survey | |
|---|---|---|---|---|
| | Number | Percent distribution | Number in thousands | Percent distribution |
| **Both sexes** | | | | |
| All ages | 3,175 | 100.0 | 4,640 | 100.0 |
| Under 6 years | 323 | 10.2 | 521 | 11.2 |
| 6 years and over | 2,852 | 89.8 | ... | ... |
| 6-16 years | 729 | 23.0 | 985 | 21.2 |
| 17-44 years | 1,152 | 36.3 | 1,689 | 36.4 |
| 45-64 years | 702 | 22.1 | 971 | 20.9 |
| 65 years and over | 269 | 8.5 | 475 | 10.2 |
| **Male** | | | | |
| All ages | 1,468 | 100.0 | 2,231 | 100.0 |
| Under 6 years | 149 | 10.1 | 266 | 11.9 |
| 6 years and over | 1,319 | 89.9 | ... | ... |
| 6-16 years | 349 | 23.8 | 477 | 21.4 |
| 17-44 years | 532 | 36.2 | 846 | 37.9 |
| 45-64 years | 324 | 22.1 | 453 | 20.3 |
| 65 years and over | 114 | 7.8 | 190 | 8.5 |
| **Female** | | | | |
| All ages | 1,707 | 100.0 | 2,408 | 100.0 |
| Under 6 years | 174 | 10.2 | 254 | 10.5 |
| 6 years and over | 1,533 | 89.8 | ... | ... |
| 6-16 years | 380 | 22.3 | 508 | 21.1 |
| 17-44 years | 620 | 36.3 | 843 | 35.0 |
| 45-64 years | 378 | 22.1 | 518 | 21.5 |
| 65 years and over | 155 | 9.1 | 285 | 11.8 |

[1]Philadelphia Hearing Scale Study.

Table 15. Number and percent distribution of persons scheduled for audiological examinations, by examination status according to hearing loss: Philadelphia Hearing Scale Study, July 1966

| Hearing loss and examination status | Number of persons | Percent distribution |
|---|---|---|
| Persons reporting hearing loss in interview | | |
| Total persons scheduled------- | 180 | 100.0 |
| Examined in clinic----- | 108 | 60.0 |
| Examined in home------- | 33 | 18.3 |
| Not examined---------- | 39 | 21.7 |
| Persons not reporting hearing loss in interview | | |
| Total persons scheduled------- | 234 | 100.0 |
| Examined in clinic----- | 118 | 50.4 |
| Examined in home------- | 63 | 26.9 |
| Not examined---------- | 53 | 22.6 |

sure meter to monitor the noise level of the surroundings. Whenever the noise level exceeded an APL of 50 dB's on the "C" scale, testing was suspended. Otherwise, the audiologist used his judgment as to whether environmental conditions would permit a satisfactory measurement of hearing.

Sixty cases who had been tested in the clinic were retested in the field to determine the comparability of measurements under the two conditions. The results, yielded a correlation coefficient of 0.899 between pure-tone, better-ear averages obtained in the clinic and in the field. The high degree of comparability led to the decision to use the better-ear average from the field test in cases where clinical tests were not obtained.

While the justification for this decision seems firmly established by the sizable correlation between measures, it should be pointed out that the field tests yielded a consistently higher better-ear average than the clinic tests—a mean difference of 4.4 decibels. Therefore when using the field test as a criteria for the scale, there is a risk that 60 of the 156 persons screened out by question 12a below the cutting point may be inaccurately classified as having a hearing impairment, whereas the more accurate clinic assessment would have shown their hearing to be within normal limits in agreement with the scale score.

## Validity of Screening Questions

Table 16 gives the audiometric findings for those who were initially identified by responses to either question 12a or 12b as having a hearing impairment. If losses less than 25 dB's in the better ear are considered nonhandicapping,[5] then 60 of the 156 persons screened out by question 12a and 12 of the 24 persons screened by question 12b did not in fact have significant hearing losses. Further examination of these 72 cases revealed that 30 persons had a loss in excess of 25 dB's in the other (worse) ear. Since the screening questions were designed to identify persons with hearing loss in either one or both ears, those 30 cases were properly classified. However, the remaining 42 cases—33.9 percent of 124 cases for which audiological information was available—would be misclassified according to the criterion established. Of the 108 cases which were screened out by question 12a, and for which audiological information was available, 35 cases or 32.4 percent were misclassified, i.e., the average hearing loss was less than the 26 dB's in both ears. Of the 16 cases screened out by question 12b for which audiological information was available, 7 cases or 43.8 percent were misclassified for the same reason.

Of the 124 persons with impaired hearing who were screened out by questions 12a and 12b and who were examined audiologically, 52 cases or 42 percent had a better-ear average loss of 26 dB's or greater (table 16). Since this screening procedure was designed to elicit impairment in one or both ears while the criterion used to define the true positives was the better-ear averages, these findings indicate that those screening questions were relatively efficient.

Table 16. Number of persons with impaired hearing, by scale-score and mean better-ear average in decibels: Philadelphia Hearing Scale Study, July 1966

| Mean better-ear average in decibels | Total persons | Scale score[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Unknown |
| | Number of persons | | | | | | | | | |
| Identified by positive response to question 12a[2] | 156 | 46 | 71 | 28 | 3 | 1 | 1 | - | 4 | 2 |
| Under 25 dB | 60 | 26 | 30 | 3 | - | - | 1 | - | - | - |
| 25-39 dB | 25 | 5 | 15 | 5 | - | - | - | - | - | - |
| 40-99 dB | 23 | 2 | 4 | 12 | 2 | 1 | - | - | 2 | - |
| No audiological examination | 48 | 13 | 22 | 8 | 1 | - | - | - | 2 | 2 |
| Identified by negative response to question 12b[3] | 24 | 4 | 13 | 3 | 1 | - | - | - | - | 3 |
| Under 25 dB | 12 | 3 | 8 | - | 1 | - | - | - | - | - |
| 25-39 dB | 3 | - | 3 | - | - | - | - | - | - | - |
| 40-99 dB | 1 | - | - | 1 | - | - | - | - | - | - |
| No audiological examination | 8 | 1 | 2 | 2 | - | - | - | - | - | 3 |

[1]Numbers under scale scores 1-8 indicate the first "yes" answers to scale items shown in figure 1.

[2]Question 12a. "Does ...have any trouble hearing with one or both ears?"

[3]Question 12b. "Can ...hear well enough to hear a whisper from across a quiet room?"

However, the other question to be considered in the validation of this screening is the magnitude of the false negatives. That is, how many persons with a hearing impairment, as defined by this criteria, were not picked up by these questions. As shown in table 17, of the 151 persons who did not indicate a hearing loss and for whom audiological information was obtained, 16 or 10.5 percent did in fact have a better-ear average loss of 26 or more dB's.

Because of the nonresponse rate in the original interview and the large number of selected persons for whom audiological information was not obtained, only limited inferences can be made to the general population. However, if such inferences are to be made, it is necessary to consider the unequal weighting of the sample selected for audiometric examinations. As shown in table 17, of the 16 persons who were not reported as having a hearing impairment but who had a better-ear average loss of greater than 26 dB's, 13 or 81.3 percent were 65 years of age and over. As previously described, the procedure for selecting the sample for audiological examinations from the persons who were reported to have no hearing loss, was a sampling rate of 1 in 10 for persons under 65 years of age and 1 in 3 for persons 65 years and over. Therefore, the sample has a disproportionately higher number of persons in the older age group. When this sample is adjusted for age, using the estimated 1966 Philadelphia SMSA as the standard population, the resulting expected proportion of false negatives would be 7.2 percent.

Since even this age-adjusted proportion considerably exceeds the proportion of the population that had hearing impairment and reported it in the

Table 17. Number of persons with no hearing loss reported, by mean better-ear average in decibels, type of respondent, and age: Philadelphia Hearing Scale Study, July 1966

| Type of respondent and age | Total[1] | Mean better-ear average | |
|---|---|---|---|
| | | Under 26 decibels | 26 decibels and over |
| | Number of persons | | |
| Both types | | | |
| All ages, 18+ years | 151 | 135 | 16 |
| 18-39 years | 56 | 56 | - |
| 40-54 years | 41 | 38 | 3 |
| 55-64 years | 14 | 14 | - |
| 65 years and over | 40 | 27 | 13 |
| Self-respondents | | | |
| All ages, 18+ years | 85 | 75 | 10 |
| 18-39 years | 27 | 27 | - |
| 40-54 years | 25 | 24 | 1 |
| 55-64 years | 6 | 6 | - |
| 65 years and over | 27 | 18 | 9 |
| Proxy respondents | | | |
| All ages, 18+ years | 66 | 60 | 6 |
| 18-39 years | 29 | 29 | - |
| 40-54 years | 16 | 14 | 2 |
| 55-64 years | 8 | 8 | - |
| 65 years and over | 13 | 9 | 4 |

[1]Excludes 30 cases for whom audiological information was not available.

interview (true positive), it is necessary to question the screening device or the criteria used for validation. As discussed in the clinical phase of this study, age does appear to be a major factor in rating a person's ability to hear. As shown in table 17, of the 111 persons under 65 years of age who were reported in the interview to have no hearing loss, only 2.7 percent did in fact have a better-ear average loss of 26 or more dB's, as compared with 32.5 percent for the group over 65 years of age. These findings again indicate that there is a tendency for elderly persons to underrate their degree of hearing loss in an interview situation. It might be argued that these self-ratings could be a more meaningful measurement of impairment than the audiometric criteria used. The norms for such measures as height, weight, I.Q., and strength would be quite meaningless if the age factor was not considered. Therefore, it may be necessary to develop different screening questions and/or criteria for specific age groups.

It is apparent from table 17 that the self-respondents correctly reported no hearing loss (less than 26 dB's) in 75 out of 85 instances (88 percent), while the proxy-respondents correctly reported no hearing loss 60 out of 66 times (91 percent). Although these different proportions of correct judgments are not statistically significant, it is interesting to note their direction. The person who rates his own hearing is not necessarily a better judge of his hearing ability than the person he communicates with.

## Relation of the Scale Scores to Better-Ear Averages

As demonstrated in the report of Phase II, there is a regular increase in better-ear averages as the scale scores increase. The same thing is found in the household interview data. As shown in table 18, the average hearing level for a scale score of 1 is 13.2 dB's. Beyond a scale of 3, there were only eight cases, too few for drawing valid conclusions.

Age had been noted as a factor in the earlier study, and here again, there is a progression of hearing levels with age as seen in table 18. For

Table 18. Number of persons, mean better-ear average,[1] and standard deviation, by scale score and age group: Philadelphia Hearing Scale Study, July 1966

| Age group | Scale score[2] | | | | | |
|---|---|---|---|---|---|---|
| | Total[3] | 1 | 2 | 3 | 4 | 5-8 |
| All ages, 18+ years | | | | | | |
| Number of persons | 256 | 146 | 80 | 22 | 4 | 4 |
| Mean better-ear average in decibels | ... | 13.2 | 19.5 | 44.4 | 41.3 | 64.5 |
| Standard deviation | ... | 10.1 | 12.2 | 16.6 | 16.7 | 22.7 |
| 18-39 years | | | | | | |
| Number of persons | 73 | 58 | 13 | 1 | - | 1 |
| Mean better-ear average in decibels | ... | 7.7 | 10.0 | 32.0 | - | 37.0 |
| Standard deviation | ... | 5.9 | 6.5 | - | - | - |
| 40-54 years | | | | | | |
| Number of persons | 66 | 36 | 24 | 6 | - | - |
| Mean better-ear average in decibels | ... | 12.7 | 17.8 | 40.2 | - | - |
| Standard deviation | ... | 8.9 | 11.4 | 15.5 | - | - |
| 55-64 years | | | | | | |
| Number of persons | 40 | 19 | 16 | 5 | - | - |
| Mean better-ear average in decibels | ... | 13.6 | 18.9 | 41.0 | - | - |
| Standard deviation | ... | 7.4 | 8.6 | 19.0 | - | - |
| 65-74 years | | | | | | |
| Number of persons | 59 | 26 | 22 | 7 | 3 | 1 |
| Mean better-ear average in decibels | ... | 21.8 | 24.2 | 53.3 | 41.7 | 99.0 |
| Standard deviation | ... | 11.5 | 13.8 | 15.7 | 19.3 | - |
| 75+ years | | | | | | |
| Number of persons | 18 | 7 | 5 | 3 | 1 | 2 |
| Mean better-ear average in decibels | ... | 28.0 | 33.6 | 42.0 | 40.0 | 61.0 |
| Standard deviation | ... | 6.8 | 5.4 | 7.9 | - | - |

[1]Arithmetic average of hearing levels (in decibels) at 500, 1000, and 2000 cycles per second.

[2]Score indicates number of first question to which respondent answered "yes." See figure 1 for questions used in the scale.

[3]All respondents for whom data on the scale score were available.

example, those having a scale score of 1 have a corresponding better-ear average of 7.7 decibels for the 18-39-year age group, 12.7 for 40-54 years, 13.6 for 55-64 years, 21.8 for 65-74 years, and 28.0 for the group 75 years of age and over. As discussed under validation of the screening question, younger persons apparently rate their hearing less generously than do their elders with similar hearing levels. Respondents tend to imply the qualification "for my age" when describing their hearing ability.

### Rating of Each Ear

The combined rating of hearing ability in each ear also provides an excellent indication of hearing ability (table 19). The smaller number of cases in the field test, of course, does not produce the smooth progression of better-ear averages provided by the clinic test in table 7. They are, however, similar in magnitude where sufficient cases are available. The average differences in hearing levels between the two ears, like those shown in table 8, increase as the ratings in the two ears differ; but, again, the smaller sample shown in table 20 does not yield the regularity of the relationship shown in table 20 noted for the clinic sample.

### Relationship of the Scale and the Rating in Each Ear

In the clinical phase of this study, there was evidence to indicate that persons who were rated as having a hearing impairment in only one ear tended to respond to the scale in terms of their impaired ear rather than their overall hearing ability. Table 21 compares the mean better-ear averages for those persons who were rated as having some difficulty with hearing in both ears with the mean better-ear averages for persons who were rated as having no trouble in either one or both ears. The analysis for these findings is again limited because of the magnitude of the numbers involved. The mean better-ear averages according to scale, for those persons reported to have difficulty in hearing for both ears, are lower than those for the similar group in the clinic population (table 10). However, the audiometric measures for this group are higher and closer to those expected for a given scale score than the measures obtained for those persons who were rated as having at least one good ear. Combining the scale scores and actual ratings of each ear seemed no more successful for the Philadelphia sample than for the clinic sample. One major difficulty, as seen in table 22, is that there are too few cases to meaningfully account for the number of possible combinations.

Table 19. Number of persons, mean better-ear average,[1] and standard deviation, by respondents' rating of hearing ability for each ear: Philadelphia Hearing Scale Study, July 1966

| Respondents' rating for each ear[2] | Number of persons[3] | Mean better-ear average in decibels | Standard deviation |
|---|---|---|---|
| 1-1---------- | 123 | 11.4 | 8.6 |
| 1-2---------- | 53 | 17.7 | 10.8 |
| 1-3---------- | 10 | 26.4 | 16.5 |
| 1-4---------- | 4 | 20.3 | 13.1 |
| 2-2---------- | 33 | 23.4 | 12.9 |
| 2-3---------- | 12 | 35.8 | 15.9 |
| 2-4---------- | 1 | - | - |
| 3-3---------- | 6 | 55.3 | 19.4 |
| 3-4---------- | 5 | 58.6 | 11.7 |
| 4-4---------- | 1 | - | - |

[1]Arithmetic average of hearing levels (in decibels) at 500, 1000, and 2000 cycles per second.

[2]1= My hearing is good; 2= I have a little trouble hearing; 3= I have a lot of trouble hearing; 4= I am deaf.

[3]All respondents for whom rating of each ear and audiological information was available.

## RECOMMENDATIONS

For purposes of deriving group statistics on hearing ability by interview, both the revised hearing scale and the rating of each ear appear to be useful. Both measures correlate satisfactorily with audiometric test results, and both measures seem to be relatively efficient in that the

Table 20. Number of persons, mean differences in hearing levels[1] for each ear, and standard deviation, by respondents' rating of hearing ability for each ear: Philadelphia Hearing Scale Study, July 1966

| Respondents' rating for each ear[2] | Number of persons | Mean difference of hearing levels[3] | Standard deviation |
|---|---|---|---|
| All cases-- | 248 | ... | ... |
| 1-1---------- | 123 | 0.1 | 6.1 |
| 2-2---------- | 33 | -1.1 | 7.7 |
| 3-3---------- | 6 | 3.5 | 8.5 |
| 4-4---------- | 1 | 0.5 | 0.5 |
| 1-2---------- | 20 | -4.4 | 10.1 |
| 2-1---------- | 33 | 6.2 | 15.8 |
| 2-3---------- | 4 | -10.5 | 10.5 |
| 3-2---------- | 8 | 0.2 | 3.5 |
| 3-4---------- | 1 | -61.0 | - |
| 4-3---------- | 4 | 28.0 | 2.5 |
| 1-3---------- | 3 | -15.7 | 9.8 |
| 3-1---------- | 7 | 33.6 | 33.5 |
| 2-4---------- | - | - | - |
| 4-2---------- | 1 | 18.0 | - |
| 1-4---------- | 2 | -35.0 | 5.4 |
| 4-1---------- | 2 | 1.5 | 6.5 |

[1]Arithmetic average of hearing levels (in decibels) at 500, 1000, and 2000 cycles per second.

[2]1= My hearing is good; 2=I have a little trouble hearing; 3= I have a lot of trouble hearing; 4= I am deaf. The first number of each rating pair is for the left ear; the second number in the rating is for the right ear.

[3]Hearing for right ear always subtracted from that for left ear; therefore, negative values mean that hearing loss in the right ear is greater and vice versa for positive values.

Table 21. Number of persons and mean better-ear average in decibels, by self-rating and scale score: Philadelphia Hearing Scale Study, July 1966

| Self-rating and scale score | Number of persons | Mean better-ear average in decibels |
|---|---|---|
| HEARING IMPAIRMENT IN BOTH EARS | | |
| Total---------- | 47 | 31.2 |
| Scale score | | |
| 1---------- | 10 | 21.7 |
| 2---------- | 25 | 26.6 |
| 3---------- | 9 | 43.1 |
| 4---------- | - | - |
| 5-8---------- | 3 | 64.7 |
| ONE OR BOTH EARS RATED AS GOOD | | |
| Total---------- | 190 | 15 0 |
| Scale score | | |
| 1---------- | 138 | 12.6 |
| 2---------- | 44 | 18.6 |
| 3---------- | 6 | 37.7 |
| 4---------- | 2 | 29.0 |
| 5-8---------- | - | - |

small amount of time required to administer either returns a substantial amount of valid information. However, both age and hearing aid use should be considered in order to make optimal use of the scale scores.

If forced to choose between the measures, the authors would select the rating of each ear. It has an advantage over the scale in that it yields an estimate of the hearing ability of the worse ear when the better ear is normal or near normal. The rating of each ear also is simpler to administer, easier to comprehend, and possibly offers more "face validity," i.e., a more immediately apparent relationship to what is being assessed. Even taken separately, the ratings for each ear relate fairly well to audiometric measures. It is when they are combined, however, that the ratings for each ear have greater validity in terms of predicting better-ear average thresholds.

While further investigation would be desirable, the study also points out the possibility of validating hearing impairments reported in interviews by the use of portable audiometers in the field.

Table 22. Number of persons, mean better-ear average in decibels, and standard deviation, by scale score and respondents' rating of hearing ability for each ear: Philadelphia Hearing Scale Study, July 1966

| Scale score and respondents' rating for each ear[1] | Number of persons | Mean better-ear average in decibels | Standard deviation |
|---|---|---|---|
| 1 1-1 | 107 | 11.7 | 8.3 |
| 1 1-2 | 24 | 15.3 | 9.7 |
| 1 1-3 | 3 | 15.7 | 14.3 |
| 1 1-4 | 4 | 20.8 | 12.6 |
| 1 2-2 | 9 | 21.0 | 9.3 |
| 1 2-3 | 1 | 28.0 | - |
| 1 2-4 | - | - | - |
| 1 3-3 | - | - | - |
| 1 3-4 | - | - | - |
| 1 4-4 | - | - | - |
| 2 1-1 | 13 | 14.5 | 13.0 |
| 2 1-2 | 26 | 18.7 | 10.5 |
| 2 1-3 | 4 | 31.8 | 23.7 |
| 2 1-4 | 1 | 20.0 | - |
| 2 2-2 | 20 | 24.2 | 14.6 |
| 2 2-3 | 4 | 32.5 | 18.9 |
| 2 2-4 | - | - | - |
| 2 3-3 | 1 | 52.0 | - |
| 2 3-4 | - | - | - |
| 2 4-4 | - | - | - |
| 3 1-1 | - | - | - |
| 3 1-2 | 2 | 36.5 | 13.5 |
| 3 1-3 | 4 | 38.3 | 14.2 |
| 3 1-4 | - | - | - |
| 3 2-2 | 3 | 25.7 | 11.2 |
| 3 2-3 | 1 | 33.0 | - |
| 3 2-4 | 1 | 40.0 | - |
| 3 3-3 | 1 | 80.0 | - |
| 3 3-4 | 3 | 52.7 | 11.8 |
| 3 4-4 | - | - | - |
| 4 1-1 | - | - | - |
| 4 1-2 | 2 | 29.0 | 9.0 |
| 4 1-3 | - | - | - |
| 4 1-4 | - | - | - |
| 4 2-2 | - | - | - |
| 4 2-3 | - | - | - |
| 4 2-4 | - | - | - |
| 4 3-3 | - | - | - |
| 4 3-4 | - | - | - |
| 4 4-4 | 1 | 67.0 | - |
| 5 1-1 | - | - | - |
| 5 1-2 | - | - | - |
| 5 1-3 | - | - | - |
| 5 1-4 | - | - | - |
| 5 2-2 | - | - | - |
| 5 2-3 | 1 | 28.0 | - |
| 5 2-4 | - | - | - |
| 5 3-3 | - | - | - |
| 5 3-4 | 1 | 67.0 | - |
| 5 4-4 | 1 | 99.0 | - |

[1]The first number is the scale score, with 5 representing scale scores of 5-8. The next two numbers are the ratings of each ear.

# APPENDIX I

# WASHINGTON HEARING SURVEY (CLINIC PHASE)

YOUR NAME .....
(PLEASE PRINT)

---

40. Have you ever used a hearing aid for one or more days?

No ☐ Yes, use one now ☐ Yes, but do not use now ☐

---

Please indicate how well you can hear by checking one of the statements below **for each ear.** If you use a hearing aid, please indicate how you hear **without** your hearing aid.

| 41. LEFT EAR *Check one* | | 42. RIGHT EAR *Check one* | |
|---|---|---|---|
| My hearing is good | ☐ | My hearing is good | ☐ |
| I have a little trouble hearing | ☐ | I have a little trouble hearing | ☐ |
| I have a lot of trouble hearing | ☐ | I have a lot of trouble hearing | ☐ |
| I am deaf | ☐ | I am deaf | ☐ |

---

Please answer the next questions the way you **usually** hear with both ears. If you use a hearing aid, please answer the way you hear **without** a hearing aid.

| | YES | NO |
|---|---|---|
| 43. Can you usually **hear** and **understand** what a person says without seeing his face if he whispers to you from across a quiet room? | | |
| 44. Can you usually **hear** and **understand** what a person says without seeing his face if he talks in a normal voice to you from across a quiet room? | | |
| 45. Can you usually **hear** and **understand** what a person says without seeing his face if he shouts to you from across a quiet room? | | |
| 46. Can you usually **hear** and **understand** a person if he speaks loudly into your better ear? | | |
| 47. Can you usually tell the sound of speech from other sounds and noises? | | |
| 48. Can you usually tell one kind of noise from another? | | |
| 49. Can you hear loud noises? | | |

## CLINICAL DATA

Clinic Number ..... Patient number .....

Birthdate ..... Age ..... Sex male ☐ female ☐
MONTH DAY YEAR

## AIR CONDUCTION

| LEFT EAR | | RIGHT EAR | |
|---|---|---|---|
| 500 | ..... | 500 | ..... |
| 1000 | ..... | 1000 | ..... |
| 2000 | ..... | 2000 | ..... |

Better-ear average .....

## SPEECH RECEPTION THRESHOLD

Left Ear ..... Right Ear .....

## DISCRIMINATION SCORE

Left Ear .....% Right Ear .....%

HEARING AID: .....

.....

.....

DIAGNOSIS: .....

.....

.....

COMMENTS: .....

.....

.....

.....

Compiled by .....

# APPENDIX II

## INSTRUCTIONS FOR ADMINISTERING THE WASHINGTON HEARING SCALE

1. The Hearing Scale should be administered to all patients 17 years of age and over who are able to respond for themselves.

2. Since the design for sampling calls for an ongoing sample, it is essential that every patient that meets the above qualifications be administered the Hearing Scale or, if this can not be done, a notation be provided giving the reason why the scale was not administered. Thus, in the cases of simple oversight or the refusal on the part of the patient to cooperate, a brief note describing the circumstances should be provided.

3. The Hearing Scale should be administered prior to audiometric testing.

4. Instructions to the patient should be as follows:

   > Please answer these questions about your hearing by checking the answers which apply. When you have answered all of the questions, please return the form to this desk.

5. In almost all instances the above instructions are sufficient. However, if the patient requests further information as to why he is being asked to answer questions, a statement like the following should be given:

   > These questions are part of a national study in which this clinic is cooperating. Your answers will provide valuable information about hearing impairment.

6. When the patient brings the form back to the desk, see that all questions have been answered. If any have been left blank, ask the patient to complete them. Try to get a response to every question, but without suggesting a specific answer. Should the patient refuse to respond to or indicate inability to complete one or more questions, record the reason given next to each blank question.

7. For each completed questionnaire, provide the clinic information requested.

8. At the end of each day mail the completed forms to:

   Office of Psychological Research
   Gallaudet College
   Washington, D. C. 20002

Notes on Providing the Clinic Information

1. Clinic Number. Your clinic number is _____.

2. Patient Number. Consecutive numbers should be assigned to each patient beginning with number 1. Aside from its being used to identify the patient from the IBM card, the number serves the purpose of alerting the office to missing forms. When questionnaires are received from your clinic, a gap in the numbers will immediately alert us to the possibility that a form has been lost. Thus, if we have received records for patients numbers 1 through 16 and the next mail brings us records for patients 21 to 35, we will undoubtedly call you to find out where the records are for patients 17 through 20.

3. Birthdate. We asked for both the birthdate and age so that an error in one or the other can be detected. In the event your clinic does not routinely obtain birthdates, simply enter the age to the nearest birthday.

4. Sex. Please be sure that either male or female is checked for each patient. The use of names to determine sex is difficult and often misleading.

5. Air Conduction Thresholds. Please enter the threshold for each ear at each of the indicated frequencies. The better-ear average to be used here is the lower average threshold for either ear. Please do not use the better binaural or other average. For any frequency that cannot be tested because the threshold is beyond the limits of the audiometer, substitute a value of 110 dB.

6. Speech Reception Threshold. Please enter the threshold for each ear.

7. Discrimination Score. Please enter the percent correct. In the event that the method used to determine the discrimination score varies from that which you indicated was standard, please note this fact in the margin next to the discrimination score for the right ear.

8. Hearing Aid. The purpose of this section is to provide us with assurance that the patient's response on the opposite page is correct, insofar as you are able to determine. If you leave this space blank, we will understand that the patient's answer is correct to the best of your knowledge. To correct a mistaken response, please write in this space the correct fact: "Patient never used a hearing aid," "Patient did use a hearing aid, but does not use one now," or "Patient now uses a hearing aid."

9. Diagnosis. In the space provided please indicate if there is something about the patient's hearing which is outside the ordinary. For example, any patient suffering endolymphatic hydrops (or Meniere's disease) or other evidence of intermittent hearing loss should be noted. Other examples are cases of inorganic or psychogenic hearing loss or malingering or whatever term you prefer to indicate a hearing loss which has no apparent anatomical or physiological basis. Particularly, patients who are being seen because of their involvement in a law suit should have a notation to that effect in this space.

10. Comments. This section is reserved for your remarks about the reliability of the audiometric examinations. If you have any reason to doubt the reliability of the audiologicals, please state your reservations in this space. Uncooperativeness or other peculiarity on the part of the patient or difficulties with equipment and similar conditions should be reported here.

11. Signature Line. The purpose of requesting that the record be signed by the person completing it is to save time in the event a question about the form arises. It will be far easier for you to resolve such questions if you know who provided the information initially.

In the event that problems occur that are not covered in the above instructions, please call COLLECT to LINCOLN 3-9515, Extension 327. It is important that all cases be handled uniformly so that the data from the various clinics can justifiably be pooled. Your questions about unusual situations will, therefore, be most welcome.

———— O O O ————

# APPENDIX III. QUESTIONNAIRE USED IN PHILADELPHIA HEARING SCALE STUDY

NOTICE—All information which would permit identification of the individual will be held in strict confidence, will be used only by persons engaged in and for the purposes of the survey, and will not be disclosed or released to others for any purposes.

BUDGET BUREAU NO. 68-6522
APPROVAL EXPIRES JUNE 30, 1967

Form—G1

**U.S. PUBLIC HEALTH SERVICE**

**HEALTH SURVEY**

**In cooperation with Gallaudet College**

1. Questionnaire ..... of ..... Questionnaires

2. Address:
Number:..... Apt. No.....
Street:..... Phone.....
City and State:..... Zip Code.....

3. Identification

4. **RECORD OF CALLS AT HOUSEHOLD**

| | CALL NUMBER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | |
| Date: | | | | | | | | |
| Time: | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. |
| Result: | Date: | | Date: | | Date: | | Date: | |
| No Answer—Try On: | Time: | | Time: | | Time: | | Time: | |
| | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. |
| Partial Interview | | | | | | | | |
| Complete Interview | | | | | | | | |
| Non-Interview* | | | | | | | | |

*If Non-Interview, Record Reason Below (Item 5)

Note Space for Callback Information

5. **REASON FOR NON-INTERVIEW**

| Type: A | B | Z |
|---|---|---|
| *Reason* | *Reason* | *Reason* |
| ☐ No One At Home | ☐ Vacant | Interview Not Obtained for Person(s) Number(s) |
| ☐ Temporarily Absent Will Return..... | ☐ Demolished | |
| ☐ Refused (Explain Below) | ☐ Non-Residential Property | |
| ..... | ☐ No Such Street | Because: |
| ..... | ☐ No Such Number | ..... |
| ..... | (Give 2 Closest Nos.) | ..... |
| ..... | ..... | ..... |
| ..... | ..... | ..... |

Space for Additional Non-Interview Information

6. Interviewer Signature

7. Interviewer Code No.

| | | |
|---|---|---|
| 1. Time Interview Started ..... A.M. ..... P.M. Interview Interrupted—Time: .....A.M. .....P.M. Reason:..... | | |
| 2. (a) What is the name of the head of this household:<br>(b) What are the names of all other persons who live here? (List in the following order: spouse of head, their unmarried children in order of birth, married children and their families, other relatives, others.)<br>(c) Is there anyone else who usually lives here, but is temporarily away? | PERSON 01<br>LAST NAME:<br>FIRST NAME: | PERSON 02<br>LAST NAME:<br>FIRST NAME: |
| 3. How is ..... related to .....(head of household)? | RELATIONSHIP<br>Head | RELATIONSHIP |
| 4. How old was ..... on his last birthday? (*Also mark Race and Sex.*) | AGE RACE ☐ White ☐ Negro ☐ Other SEX ☐ M ☐ F | AGE RACE ☐ White ☐ Negro ☐ Other SEX ☐ M ☐ F |
| 5. *If 17 years old or over, ask:*<br>Is ..... now married, widowed, divorced, separated, or never married? (*Mark one box for each person.*)<br>*If persons under 17 are or have been married mark the "Und. 17" box and give marital status in a footnote.* | ☐ Und. 17 ☐ Never married<br>☐ Married ☐ Divorced<br>☐ Widowed ☐ Separated | ☐ Und. 17 ☐ Never married<br>☐ Married ☐ Divorced<br>☐ Widowed ☐ Separated |
| In asking questions 6–13 obtain responses for each question for all related household members before going to next question. | | |
| 6. Last week or the week before, that is the two-week period which ended last night,<br>Did ..... see or talk to a doctor for any reason? | 01<br>☐ Yes<br>☐ No | 02<br>☐ Yes<br>☐ No |
| 7. Last week or the week before, did ..... take any medicine or treatment for any condition? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| 8. (a) Last week or the week before, did ..... have any accidents or injuries? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| (b) Did ..... ever have an (any other) accident or injury that still bothers him in any way? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| 9. Is ..... limited, in any way, in the amount or kind of activities that other persons his (her) (your) age are able to do? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| 10. Is ..... able to get around outside the house, freely, without the help of another person or special aid? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| 11. *If 6 years old or over, ask:* Does ..... have any trouble seeing with one or both eyes even when wearing glasses? | Yes – ☐ one ☐ both<br>☐ No | Yes – ☐ one ☐ both<br>☐ No |
| *If 6 years old or over, ask:*<br>12. (a) Does ..... have any trouble hearing with one or both ears? (If No ask (b)) | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| (b) Can ..... hear well enough to hear a whisper from across a quiet room? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| 13. Does ..... have any missing fingers, toes, arms, or legs? | ☐ Yes<br>☐ No | ☐ Yes<br>☐ No |
| **R** Q. 6-13 — For persons 19 years old or over, show who responded for (or was present during the asking of) Q. 6-13. If persons responded for self, show whether entirely or partly. For persons under 19 show who responded for them. If eligible respondent is "at home" but did not respond for self, enter the reason in a a footnote. | ☐ Responded for self—ENTIRELY<br>☐ Responded for self—PARTLY<br>Person ..... was respondent | ☐ Responded for self—ENTIRELY<br>☐ Responded for self—PARTLY<br>Person ..... was respondent |

## HEARING EXAMINATION PAGE

1. Check one or more boxes. Also enter number of persons in (b) or (c).

   (a) ☐ No person 19 years old or over with hearing problems—No one in special sample (go to item 3)

   (b) ☐ .....Persons with no hearing problems in special sample

   (c) ☐ .....Persons 19 years old or over with hearing problems

   (If (b) or (c) boxes are marked, go to item 2)

2. **As an important part of this survey and in order to obtain reliable estimates of the hearing ability of all people, we are giving hearing tests to a sample of the people that we interview. ..... and ..... etc. in your family are in this sample. The examination will not last very long and if necessary we will arrange for transportation to and from your home and the test center. May I please make an appointment for this test?**

   ☐ YES (Arrange appointment and fill out triplicate appointment slip)

   ☐ NO (Explain)

   .....

   .....

   .....

   .....

   .....

3. Thank you for your cooperation.

INTERVIEW ENDED: ..... A.M. ..... P.M.

Ask for all persons 17 years old or over.

1. (a) What is the highest grade (year) _____ attended in school?

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Elementary | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| High | 1 | 2 | 3 | 4 | | | | |
| College | 1 | 2 | 3 | 4 | 5 | | | |

(Circle One)

(b) Did _____ finish the _____ grade (year)? ☐ YES ☐ NO

If no Hearing Supplement is to be filled out, go to Item 3

2. **HEARING SUPPLEMENT (For Persons 6 Years Old or Older)**

I. (a) Has _____ ever used a hearing aid? ☐ YES, ask (b) ☐ NO, ask Ques. II

(b) Does _____ use a hearing aid now? ☐ YES ☐ NO

*(Show Card A)*

II. Please look at this card. (Pause) Which statement best describes _____'s hearing ability in his left ear (without his hearing aid)?—Now tell me about his right ear (without his hearing aid).

(Mark one box for each ear.)

| *Left* | | *Right* |
|---|---|---|
| ☐ | Hearing is good | ☐ |
| ☐ | Little trouble hearing | ☐ |
| ☐ | Lot of trouble hearing | ☐ |
| ☐ | Deaf | ☐ |

III. Check responses to (a)–(g). STOP asking questions after a "Yes" answer is obtained. If hearing aid ever used, include parenthetical phrase in (a)–(g).

| | YES | NO |
|---|---|---|
| (a) (Without a hearing aid) Can _____ usually hear and understand what a person says without seeing his face if he whispers to _____ from across a quiet room? | | |
| (b) (Without a hearing aid) Can _____ usually hear and understand what a person says without seeing his face if he talks in a normal voice to _____ from across a quiet room? | | |
| (c) (Without a hearing aid) Can _____ usually hear and understand what a person says without seeing his face if he shouts to _____ from across a quiet room? | | |
| (d) (Without a hearing aid) Can _____ usually hear and understand a person if he speaks loudly into _____'s better ear? | | |
| (e) (Without a hearing aid) Can _____ usually tell the sound of speech from other sounds and noises? | | |
| (f) (Without a hearing aid) Can _____ usually tell one kind of noise from another? | | |
| (g) (Without a hearing aid) Can _____ hear loud noises? | | |

3. ☐ Not last related person (go to next person)

☐ Last related person, ask: (Mark one box)

Which of these income groups represents your total combined family income for the past 12 months—that is, yours, your _____'s, etc. (Show Card B) Include income from all sources such as wages, salaries, social security or retirement benefits, help from relatives, rents from property, etc.

☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ H ☐ J ☐ K

If last related person, go to Hearing Examination Page.

## PERSON—CONDITION PAGE

Ident. No. Person No. Age

Fill one page for each person. Check answers to corresponding questions on worksheet before filling in or asking questions on this page. Ask follow-up questions for each question with a check mark.

| | CONDITIONS |
|---|---|
| 1. Question 6— ☐ YES; ask parts (a) and (b)<br>(a) For what condition did ..... see or talk to a doctor last week or the week before?<br>(b) Any other condition? | |
| 2. Question 7— ☐ YES; ask parts (a) and (b)<br>(a) For what condition did ..... take the medicine or treatment last week or the week before?<br>(b) Any other condition? | |
| 3. Question 8(a)— ☐ YES<br>(a) What kind of injury did ..... have, last week or the week before?<br>(b) Anything else?<br>Question 8(b)— ☐ YES<br>(a) In what way does the injury that ..... had bother him? | Type Part of Body<br>Present Effects Part of Body |
| 4. Question 9— ☐ YES<br>(a) What conditions cause ..... to be limited in his activities?<br>(b) Anything else? | |
| 5. Question 10— ☐ NO<br>(a) What conditions cause ..... to require help in getting around outside the house? | |
| *Applies to persons 6 years old or older:*<br>6. Question 11— ☐ YES (Also ask 11(a) if eye trouble or condition reported above.)<br>(a) Can ..... see well enough to read ordinary newspaper print with glasses? | ☐ YES ☐ NO |
| *Applies to persons 6 years old or older:*<br>7. Question 12(a)— ☐ YES 12(b) ☐ NO<br>If either box checked or hearing or ear trouble reported above, complete hearing supplement.<br>Is supplement required? ☐ YES ☐ NO | |
| 8. Question 13— ☐ YES (Describe missing body parts.) | |

———○○○———

# APPENDIX IV

## THE SAMPLING PLAN FOR THE PHILADELPHIA HEARING SCALE STUDY

National Analysts will design a sample which will cover the SMSA area of Philadelphia. The SMSA area, with a total of 1,333,962 housing units, consists of Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania and Burlington, Camden, and Gloucester counties in New Jersey. No national inferences can be drawn from this sample, since it is a sample of the Philadelphia SMSA only.

The sample design proposed is a systematic random sample using area probability sampling procedures. The actual selection of the sample segments will be accomplished by cumulating the total housing units in each Census block or enumeration district (ED) and systematically selecting the sample blocks or ED's. The probability of selection will be proportional to the number of housing units in the block or ED.

Sixty area segments will be selected within the Philadelphia SMSA. Each segment will contain on the average 26 housing units which are designated as sampling units. Fifty of the 60 segments will be designated to be sampled first, and the remaining 10 will be used only if needed to obtain the desired number of interviews. Within the 50 selected segments a total of approximately 1,300 housing units will be identified as sample households. This allows for a 95 percent occupancy rate and an 80 percent completion rate.

Further "chunking" of the selected area may be necessary to get the segment to the desired size. The sampling rate within each segment will be accomplished by dividing the 26 dwelling units to be sampled into the expected size of the segment.

National Analysts will supply 60 sketches of land areas referred to as segments. These segment sketches will show boundaries of the segment positively identified by streets, roads, streams, or other permanent landmarks. A random starting point indicated by a red "x" on the sketch indicates the point at which the interviewer is to begin work in the segment and a red arrow indicates the direction of travel within the segment. A listing sheet to identify the sample households within the segment will be attached to the segment sketch. The distribution of segments is given below.

| *County* | *Number of segments* |
|---|---|
| Total | 60 |
| Bucks County, Pa | 4 |
| Chester County, Pa | 3 |
| Delaware County, Pa | 7 |
| Montgomery County, Pa | 7 |
| Philadelphia, Pa | 29 |
| Burlington County, N.J | 3 |
| Camden County, N.J | 5 |
| Gloucester County, N.J | 2 |

It appears that we will need about 30 enumeration district maps. National Analysts has to have these maps in its possession 1 week before the actual delivery date of the sample, and will not pursue the ordering of these maps for it has been our experience that it takes in excess of 1 month to obtain them.

———— ooo ————



☆ U. S. GOVERNMENT PRINTING OFFICE — 1970 — 396-234 P. O. 25

## OUTLINE OF REPORT SERIES FOR VITAL AND HEALTH STATISTICS

**Public Health Service Publication No. 1000**

*Series 1.* *Programs and collection procedures.*—Reports which describe the general programs of the National Center for Health Statistics and its offices and divisions, data collection methods used, definitions, and other material necessary for understanding the data.

*Series 2.* *Data evaluation and methods research.*—Studies of new statistical methodology including: experimental tests of new survey methods, studies of vital statistics collection methods, new analytical techniques, objective evaluations of reliability of collected data, contributions to statistical theory.

*Series 3.* *Analytical studies.*—Reports presenting analytical or interpretive studies based on vital and health statistics, carrying the analysis further than the expository types of reports in the other series.

*Series 4.* *Documents and committee reports.*—Final reports of major committees concerned with vital and health statistics, and documents such as recommended model vital registration laws and revised birth and death certificates.

*Series 10.* *Data from the Health Interview Survey.*—Statistics on illness, accidental injuries, disability, use of hospital, medical, dental, and other services, and other health-related topics, based on data collected in a continuing national household interview survey.

*Series 11.* *Data from the Health Examination Survey.*—Data from direct examination, testing, and measurement of national samples of the population provide the basis for two types of reports: (1) estimates of the medically defined prevalence of specific diseases in the United States and the distributions of the population with respect to physical, physiological, and psychological characteristics; and (2) analysis of relationships among the various measurements without reference to an explicit finite universe of persons.

*Series 12.* *Data from the Institutional Population Surveys.*—Statistics relating to the health characteristics of persons in institutions, and on medical, nursing, and personal care received, based on national samples of establishments providing these services and samples of the residents or patients.

*Series 13.* *Data from the Hospital Discharge Survey.*—Statistics relating to discharged patients in short-stay hospitals, based on a sample of patient records in a national sample of hospitals.

*Series 14.* *Data on health resources: manpower and facilities.*—Statistics on the numbers, geographic distribution, and characteristics of health resources including physicians, dentists, nurses, other health manpower occupations, hospitals, nursing homes, and outpatient and other inpatient facilities.

*Series 20.* *Data on mortality.*—Various statistics on mortality other than as included in annual or monthly reports—special analyses by cause of death, age, and other demographic variables, also geographic and time series analyses.

*Series 21.* *Data on natality, marriage, and divorce.*—Various statistics on natality, marriage, and divorce other than as included in annual or monthly reports—special analyses by demographic variables, also geographic and time series analyses, studies of fertility.

*Series 22.* *Data from the National Natality and Mortality Surveys.*—Statistics on characteristics of births and deaths not available from the vital records, based on sample surveys stemming from these records, including such topics as mortality by socioeconomic class, medical experience in the last year of life, characteristics of pregnancy, etc.

For a list of titles of reports published in these series, write to:

Office of Information
National Center for Health Statistics
U.S. Public Health Service
Rockville, Md. 20852