Data from the
NATIONAL HEALTH SURVEY

Series 11
Number 11

Hearing Levels of Adults

by Age and Sex

United States, 1960-1962

Distributions of hearing levels of adults by age and sex at frequencies of 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, for right ear, left ear, and better ear.

DHEW Publication No. (PHS) 79-1063

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Office of Health Research, Statistics, and Technology
National Center for Health Statistics
Hyattsville, Maryland

Vital and Health Statistics-Series 11-No. 11
First issued Public Health Service Publication Series No. 1000
October 1965

NATIONAL CENTER FOR HEALTH STATISTICS

DIVISION OF HEALTH EXAMINATION STATISTICS

COOPERATION OF THE BUREAU OF THE CENSUS

In accordance with specifications established by the National Center for Health Statistics, the Bureau of the Census, under a contractual agreement, participated in the design and selection of the sample, and carried out the first stage of the field interviewing and certain parts of the statistical processing.

Library of Congress Catalog Card Number 65-61846

CONTENTS

IN THIS REPORT are presented the hearing levels for adults in the United States as determined in the first cycle of the Health Examination Survey, which was conducted during 1960-62. A probability sample of 7,710 persons was selected to represent the 111 million adults in the U.S. civilian, noninstitutional population aged 18-79 years. Out of these 7,710 persons, 6,672—more than 85 percent—were examined.

Hearing threshold levels for the right and left ear of each examinee were determined individually by air conduction with standard pure-tone audiometers at six frequencies—500, 1000, 2000, 3000, 4000, and 6000 cycles per second. Testing was done under carefully controlled conditions with respect to equipment and acoustical environment by trained technicians in specially constructed test booths on the mobile trailers used for the examination.

The report contains findings by age and sex for the right ear, left ear, and better ear at each of the test frequencies, as well as presenting estimates of hearing levels for speech. These findings are the first to be made available from a nationwide probability sample of adults in the United States.

Comparison of the findings from the present study with those from some of the previous large-scale hearing surveys, such as the 1935-36 National Health Survey and the Wisconsin State Fair Surveys, are included.

Hearing threshold levels are expressed in terms of the 1951 American Standards Association's audiometric zero, but the International Organization for Standardization's 1964 ISO Recommendation for the standard reference zero is also shown.

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	*

HEARING LEVELS OF ADULTS BY AGE AND SEX

Aram Glorig, M.D., Director, *Callier Hearing and Speech Center*, Dallas, Texas
Jean Roberts, *Division of Health Examination Statistics*

INTRODUCTION

Hearing levels obtained for adults by individual air-conduction testing with pure-tone audiometers in the first cycle of the Health Examination Survey are contained in this report.

The Health Examination Survey is one of three programs of the National Health Survey developed to secure statistics on the health status of the population of the United States. It obtains data through medical examinations, tests, and measurements on a scientifically selected random sample of the population. Other methods used by the ongoing National Health Survey are those in which data are secured through household interview and from available hospital and other medical records.

In the first cycle, the Health Examination Survey was limited to civilian adults living outside of institutions. Its purpose was to determine the prevalence of certain chronic diseases, the status of dental health, and the distributions of auditory and visual acuity and of certain anthropometric measurements. During the Survey which extended from October 1959 through December 1962, 6,672 sample persons were examined out of the 7,710 persons 18-79 years of age who were selected in the nationwide probability sample. Medical and other Survey staff performed the standard examination, which lasted about 2 hours, in mobile clinics especially designed for this purpose.

Previous publications describe the general plan and initial program of the Health Examination Survey[1] as well as the sample population, the proportion of the sample responding, and the effect of nonresponse on the findings.[2]

This report presents national estimates by age and sex based on the Health Examination Survey data of monaural hearing levels at each of six test frequencies, the levels for the better ear, and an estimate of the hearing levels for speech by age and sex. These findings are the first available from a nationwide probability sample of adults in the United States.

HEARING EXAMINATION AND MEASUREMENTS

Hearing thresholds for the right and left ear of each examinee were determined individually in this Survey by using air-conduction earphones with a standard pure-tone audiometer at six frequencies—500, 1000, 2000, 3000, 4000, and 6000 cycles per second (cps). In addition the Survey staff physician inspected the ears of each examinee with an otoscope, recording findings of malformation of the external ear, exudate, and perforations and scarring of the drumhead. A history of noise exposure was not obtained.

Hearing threshold level, as used in this report, is the weakest intensity of a pure tone produced in the audiometer earphone that is just audible to the ear of the examinee being tested. The standard audiometers used in the Survey were factory calibrated in accordance with the 1951 American Standards Association specifications.[3] Hence, the zero sound intensity level on the dial of these instruments corresponds to the threshold of hearing as determined in the National Health Survey of 1935-36. At that time the voltages

were measured on earphones that produced sounds which were, in general, barely audible to persons with no history of otological disease or difficulty in hearing.

The "audiometric zero" is expressed in terms of the sound pressure levels in decibels (dB) produced by the earphones in a National Bureau of Standards (NBS) 9-A coupler when the voltages corresponding to this threshold of hearing are applied. This audiometric zero point corresponds to a different sound pressure level for each test frequency. Measurement of hearing level could be made in 5-decibel steps from 100 decibels above to 10 decibels below this audiometric zero point. The reading in decibels re audiometric zero is, then, the logarithm of the ratio of the sound pressure level at the individual's threshold of audibility (sensation level)to the reference level established for audiometers (audiometric zero). Both sound pressures in this ratio are frequently expressed in decibels re 0.0002 dyne per square centimeter. Findings from the Survey are presented in terms of this 1951 American Standard.

For the testing, performed by trained technicians, the examinee was seated in an armchair within the soundproof booth of the mobile examining center. He was positioned with his face in three-quarter profile view to the tester so that he could rest his arms but see neither the dials of the audiometer nor the face of the operator, both of which were outside the booth, as shown in figure 1.

Earphones were placed directly over and covering the examinee's ears (the hair was pushed back) with the center over the external ear canal and with the wires toward his back. The headband was adjusted down firmly on the head so that the earphones were held in proper position over the ears. Glasses, earrings, and hearing aids were removed.

For further accuracy in obtaining a better seal with the earphones, the examinee was presented a low but audible tone at 250 cycles per second first to one ear and then to the other. He was instructed to move each earphone to the position in which he could hear the tone most clearly. The earphones were not touched during the remainder of the test.

The testing sequence of the ears (right and left) was alternated for each successive examinee. The testing sequence for each ear with respect to

Figure 1. Testing hearing in Cycle I of the Health Examination Survey.

frequency started at 1000 cycles per second, proceeded to 2000, 3000, 4000, 6000, returned to 1000 and finally ended at 500, as shown on the recording form in Appendix I.

Testing was started at the 40 decibel level, a level thought sufficient to be heard clearly by most adults. If the response was positive and definite—indicated by a raised hand, as shown in figure 1—the intensity was lowered to 20. If the response was still definite, the level was dropped to 0 decibels, then to -5 decibels. For those persons who gave no response at 40 decibels, the intensity was increased until there was a definite response or until it was determined that none could be obtained through 100 decibels.

The sound was presented arrhythmically. When the response became doubtful, the intensity levels 5 decibels above and below the doubtful level were repeated two or three times. When the response ceased, the examiner went back to the last level at which there was a definite response, then proceeded by 5-decibel steps of diminishing intensity until the examinee no longer responded. The no-response level was tried once more. If a response was obtained on the second try, the intensity level was dropped 5 decibels. The level of

last definite (lowest intensity) response was the hearing threshold level recorded.

ACOUSTICAL ENVIRONMENT

Hearing was tested within a specially constructed test booth in the mobile examining center. The inside dimensions measured 36 by 28 by 70 inches; the outside, 44 by 36 by 80 inches. Walls, door, and ceiling consisted of 4-inch-thick acoustical panels of heavy steel construction. Electrical jacks near the double-paned windows were available to connect the audiometer earphones within the booth to the testing instrument outside. The booth contained incandescent lighting and had continuous but silent ventilation.

Performance of the booths in attenuating external noise was determined by acoustical surveys conducted under normal test conditions toward the beginning and end of the cycle. Sound pressure levels (SPL's) were measured both inside and outside the test area with and without the air-conditioning equipment on and under other conditions of excess noise. When compared with the American Standards Association's maximum allowable sound pressure levels for no masking of the test signals above audiometric zero,[4] the findings (shown in tables A and B) indicate that under normal conditions the booths would have provided sufficient attenuation of ambient noise for testing to audiometric zero throughout the test range and for testing to 10 decibels below that level for frequencies of 2000 to 6000 cycles per second and in most instances at 1000. If the external noise level became excessive, it would tend to obliterate or mask test sounds weaker than those produced for audiometric zero at 500 cycles and occasionally at 1000 cycles. Hence, due to masking produced by extraneous noise, some persons with at least normal hearing at 500 cycles could be expected to test as though they actually had some elevation of hearing level (poorer hearing) at this frequency.

Table A. Acoustical survey of the audiometric test booth used in Caravan I of the Health Examination Survey, 1960-62

October 4, 1960, in Chicago, Illinois

Audiometric test frequency in cycles per second (cps)	125	250	[1]500	[1]1000	[1]2000	[1]4000	[1]6000
Octave bands (cps)	75-150	150-300	300-600	600-1200	1200-2400	2400-4800	4800-10000
Maximum allowable sound pressure levels (SPL) for no masking above audiometric zero (American Standard) in decibels (dB) re 0.0002 dyne per cm^2	40	40	40	40	47	57	62
SPL inside test booth, trailer, heater, and ventilator OFF (dB)	42	28-40	20-26	16-22	15	16	18
SPL outside test booth, air conditioner ON (dB)	69	61	62	56	52	50	50
SPL inside test booth, air conditioner ON (dB)	52	38	39	30	32	36	38
SPL inside test booth, air conditioner ON in this and adjacent trailer (dB)	54	42	34	30	32	35	37

[1]Test frequencies used in this study.

Table B. Acoustical survey of audiometric test booths used in the Health Examination Survey, 1960-62

November 9 and 10, 1961, in Baltimore, Maryland

Audiometric test frequencies (cps)	125	250	[1]500	750	[1]1000	1500	[1]2000	[1]3000	[1]4000	[1]6000	8000
Octave bands (cps)	75-150	150-300	300-600	600-1200	600-1200	1200-2400	1200-2400	2400-4800	2400-4800	4800-10000	4800-10000
Maximum allowable SPL for no masking above audiometric zero in dB re 0.0002 dyne per cm^2	40	40	40	40	40	42	47	52	57	62	67
Caravan I at Montebello State Hospital											
Not testing	36	21	17	12	12	12	12	12	12	15	15
Examinee being tested	40	25	14	13	13	15	15	17	17	22	22
Caravan II at Baltimore City Hospitals											
Heater and ventilating fans ON	58	41	21	21	21	24	24	26	26	31	31
Fans in laboratory van OFF	38	22	11	12	12	15	15	17	17	21	21
Fans in laboratory and heating units OFF	33	21	10	9	9	11	11	12	12	15	15
Measurement of electrical noise in noise measuring equipment	10	9	8	8	8	9	9	10	10	23	23

[1]Test frequencies used in this study.

In addition, it was not always possible to select locations for the examining center that were at all times as quiet as desirable for testing within the acoustical environment available and still meet the other conditions necessary for the rest of the examination.

Analysis of findings in the frequencies below 3000 cycles does show some possible evidence of masking at 500 cycles in 6 of the 42 examination locations, but essentially none is found at 1000 cycles.

AUDIOMETER CALIBRATION AND OTHER ASPECTS OF QUALITY CONTROL

The audiometers used in this Survey to measure hearing acuity were Beltone instruments—standard electroacoustic generators with air-conduction earphones (receivers) of type TDH-39 with MX-41/AR cushions, providing pure tones of selected frequencies and intensities which cover the major portion of the auditory range, and with a manual device for interrupting the tone.

As indicated previously, the audiometers were factory calibrated to furnish readings in terms of hearing level in decibels on the National Bureau of Standards' 9-A calibrating coupler relative to the 1951 American Standards Association's audiometric zero at frequencies of 125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, and 8000 cycles per second. The present audiometric zero (American Standard of 1951) for air-conduction testing is based on the findings from the clinical followup of the 1935-36 National Health Survey for that subgroup of persons considered to have "normal" hearing. This subgroup consisted of 1,242 persons of all ages and both sexes who gave a history of normal hearing for speech and whose hearing levels (determined by air-conduction tests) for both ears did not exceed

a total variation of 15 or 20 decibels on the eight tones from 64 to 8192 cps.[5] [6]

The sound pressure levels produced by an audiometric earphone in the NBS 9-A coupler when voltages corresponding to audiometric zero are applied differ for each frequency. They also differ for each type and configuration of earphone. The levels for the TDH-39 earphones used in this survey examination, together with the corresponding present international reference zero levels for pure-tone audiometers recommended by the International Organization for Standardization (ISO), are shown in Appendix III.

During the cycle each audiometer was returned to the factory for recalibration (and readjustment to specifications if needed) at least every 3 months or more often if field monitoring or biological calibration indicated that the instrument was not functioning adequately. Calibration procedures included the tests to determine whether the instruments were within the following American Standards Association specifications:[3]

1. Frequencies generated by the audiometer within ±5 percent of the corresponding frequency reading on the instrument.
2. The sound pressure produced by the earphones at hearing level intensity readings of +60 decibels at each frequency not differing from the normal values by more than 4 decibels at frequencies of 2000 cycles or less and by not more than 5 decibels at frequencies above 2000 cycles.
3. The 5-decibel intervals between successive hearing level readings being not less than 3.5 decibels or more than 6.5 decibels.
4. The time required for the test tone to rise to a value within ±1 decibel of the required sound pressure being not less than 0.1 second and not more than 0.5 seconds.
5. The sound pressure of the fundamental signal being at least 25 decibels above the sound pressure of any harmonic.

The first two of these procedures were done routinely during the factory recalibration; the next two, at least twice on each instrument; and the last, on two of the instruments. Data from two of the routine reports are shown in table C.

Independent calibrations on two of the instruments were also made at the University of Pittsburgh Acoustical Laboratory and on three of them in the Acoustical Laboratories of the Research Center of the Subcommittee on Noise, Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology at Los Angeles, California.

Several field checks were also carried out routinely to ensure further the quality of the data. At the beginning of each stand the hearing of five or six of the Survey staff with no known history of hearing defects was tested with the audiometer to be used at that stand. These persons were retested again by the same technicians near the end of the stand, as a rough check of the operating consistency of the audiometer. Checks were routinely made of the voltage output to the earphones at the

Table C. Typical audiometer calibration results for Audiometer No. 5949

Frequency in cycles per second	Deviation from American Standard (in dB)			
	Right earphone		Left earphone	
	11/8/62	4/29/60	11/8/62	4/29/60
250	0.0	0.0	-0.2	+0.2
500	-1.1	-0.6	-1.5	0.0
1000	-1.2	-0.3	-0.6	-0.1
2000	+0.3	-0.4	0.0	+0.7
3000	+1.0	+0.6	-0.5	+0.7
4000	-1.4	+0.6	-1.4	+0.8
6000	-0.6	-1.0	-1.2	-1.0

Frequency check

Dial indication (cps)	Measured frequency (cps)	
	11/8/62	4/29/60
125	125	125
250	250	250
500	495	499
750	747	752
1000	991	998
1500	1481	1500
2000	1965	1991
3000	2961	2998
4000	3972	3993
6000	5936	5990
8000	7943	8015

beginning, middle, and end of each stand for the audiometer used at that location. The instrument was turned on 10 minutes before the start of testing each day and left on for the remainder of the day.

As indicated previously, each ear was retested at 1000 cps to provide a measure of the reliability of the test results. Comparison of the first and second thresholds at this frequency for a subsample of several hundred cases showed very good agreement. More than 95 percent were identical or differed by no more than the 5 decibels which would represent the interval between test intensities and also be of the magnitude expected in test-retest of normal subjects.[7]

FINDINGS

Patterns in Hearing Thresholds

More than half of the adults in the civilian, noninstitutional population of the United States have, for at least the better ear, hearing thresholds lower (better) than the 1951 American Standard audiometric zero at frequencies of 500, 1000, and 2000 cycles per second, as determined through findings from the present Health Examination Survey. At the higher tones—3000, 4000, and 6000 cycles per second—hearing threshold level becomes progressively higher (poorer) as the frequency increases (fig. 2 and table 1). For one-

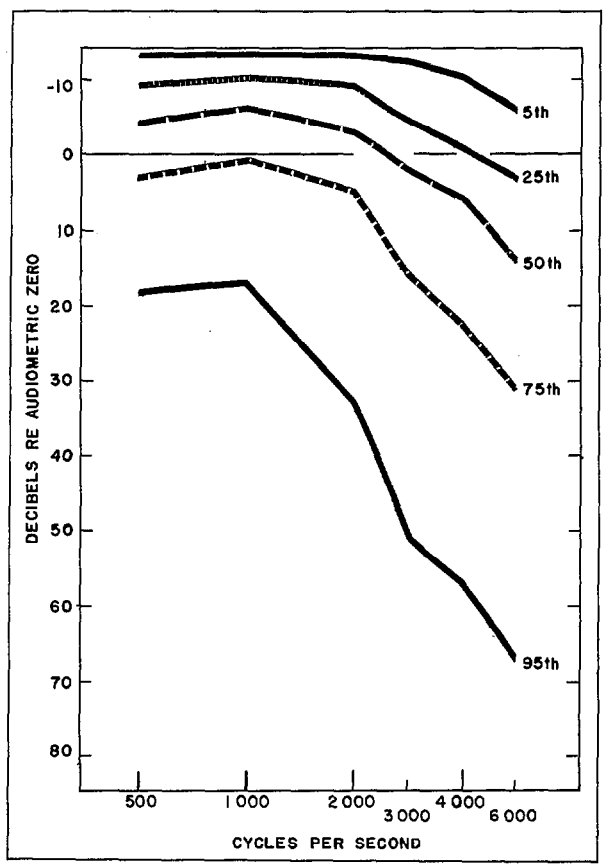

Figure 2. Selected percentiles from the distribution of hearing threshold levels for the better ear of adults at each test frequency, United States.

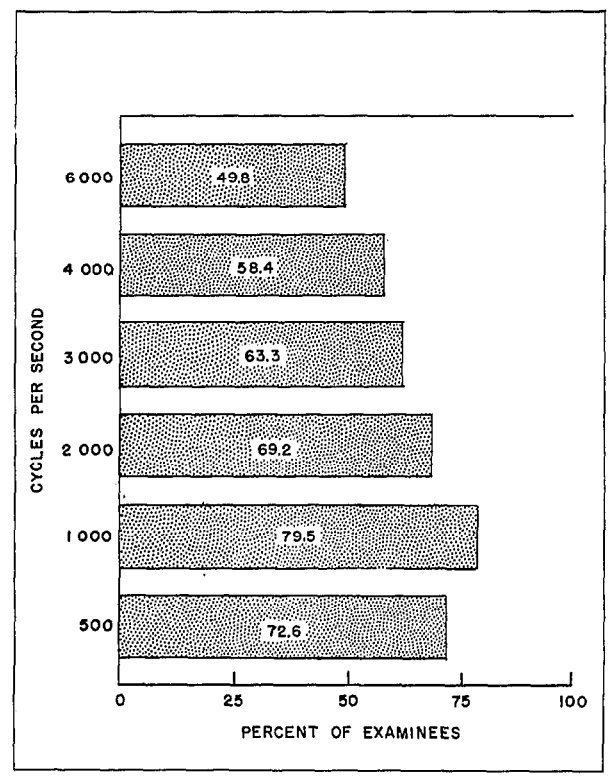

Figure 3. Percent with difference in hearing levels between both ears of 5 decibels or less, Health Examination Survey.

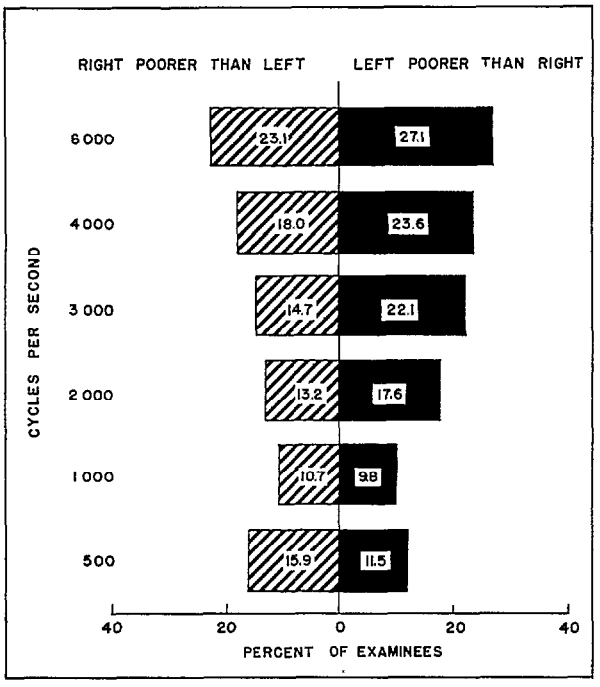

Figure 4. Percent with hearing levels in the two ears differing by more than 5 decibels, Health Examination Survey.

fourth of the population, hearing thresholds remain below this audiometric zero through 4000 cycles.

The general pattern of decreasing sensitivity with the increase in frequency is broken only at 500 cycles, where the median threshold exceeds that at 1000 cycles. (That is, hearing is poorer at 500 cycles than 1000.) This slight elevation in median threshold at 500 cycles probably reflects the masking effect, noted previously, at certain times during the examination when some excessive external noise was apparently not sufficiently attenuated.

Hearing thresholds for the right and left ear of a particular individual tend to be similar for the majority of adults in this country. However, the extent of agreement diminishes with the increase in frequency, from about 80 percent with no more than 5 decibels difference in test results at 1000 cycles per second to around 50 percent at 6000 (fig. 3). The reason for the lower-than-expected level of agreement at 500 cycles per second is not readily apparent but again may reflect some masking.

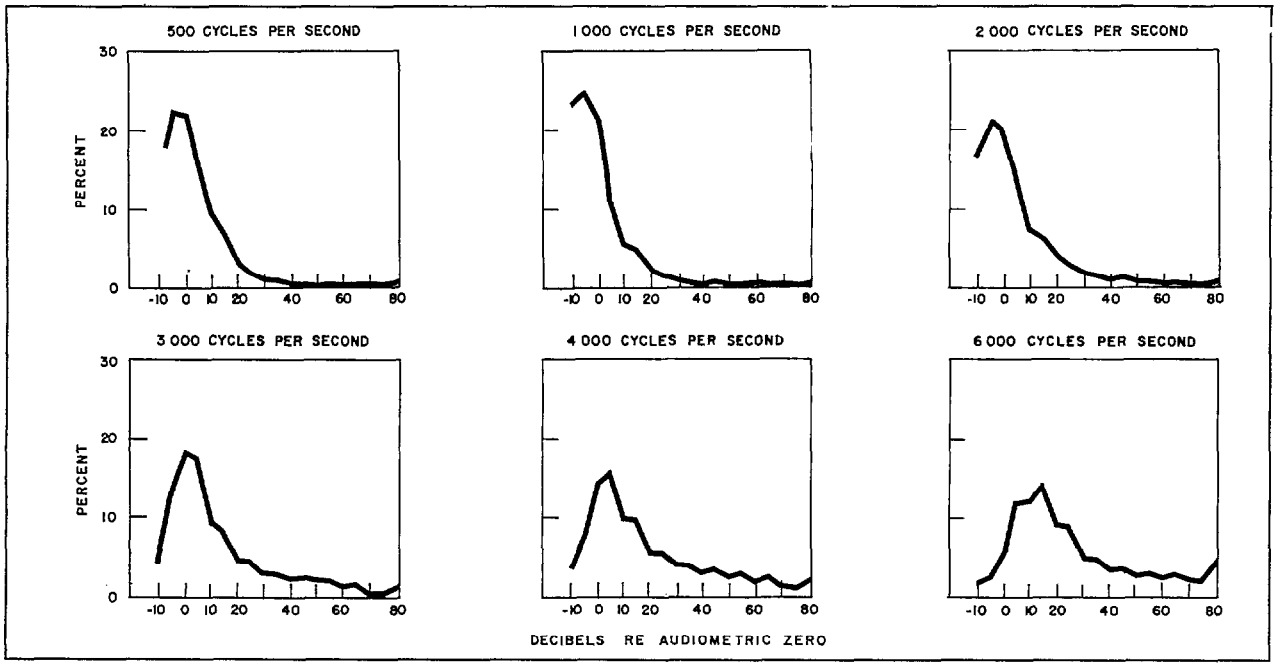

Figure 5. Percent distribution of hearing levels for adults at each test frequency, Health Examination Survey.

When the hearing levels for the two ears do differ by more than 5 decibels, the right ear is found somewhat more often than the left to be more sensitive at all frequencies above 1000 (fig. 4). Here again the reason is not evident, but practice effect during the testing can be rejected since that potential factor was minimized by alternating the sequence for testing ears from one examinee to the next.

The distribution of hearing levels is markedly skewed to the right—more for the lower frequencies (2000 cycles or less) than for the higher ones (3000-6000 cycles). The truncation to the left exists because it was not possible to test hearing levels below -10 decibels re audiometric zero with the equipment available (see fig. 5).

Age and Sex Differences

At frequencies of 500 to 2000 cycles per second, there is little consistent difference in the hearing threshold levels of men and women, as shown in figure 6 and by the distributions in tables 1-4 and 8 and 9. Under the age of 65 years, both groups show median hearing levels in the neighborhood of audiometric zero for these tones. Beginning with age 65 the threshold rises (hearing becomes worse) with each successive age group, increasing more rapidly at 2000 cycles per second than at the lower frequencies.

Above 2000 cycles, sharp sex differences can be seen (fig. 6 and tables 5-7 and 9 and 10). Women have substantially lower hearing levels (better

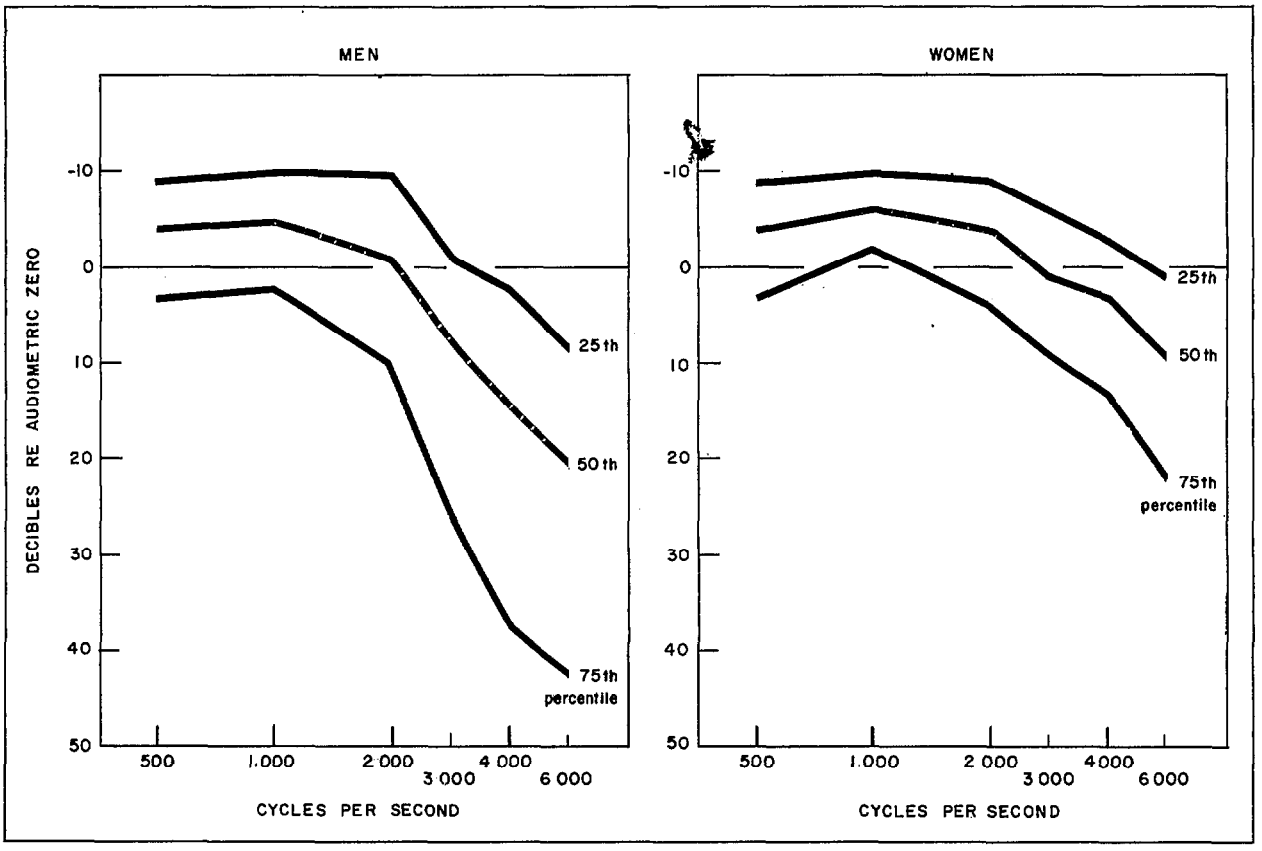

Figure 6. Medians and quartiles (50th, 25th, and 75th percentiles) from the distribution of hearing threshold levels for the better ear of men and women 18-79 years of age at six frequencies, United States.

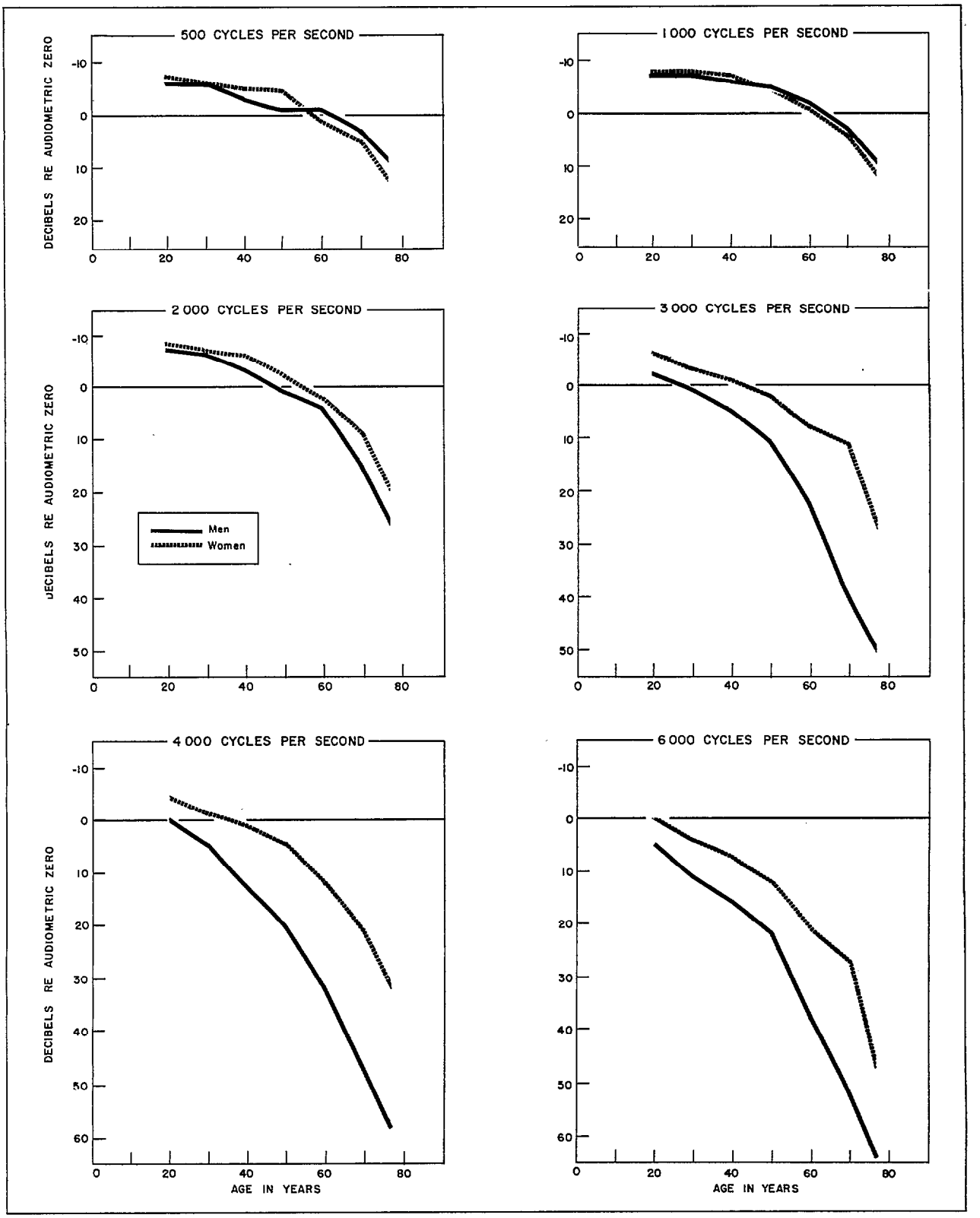

Figure 7. Median hearing levels for the better ear of men and women, by age at each test frequency, United States.

hearing) at these frequencies than do men, with the maximum difference shown at 4000 cycles.

Hearing levels increase steadily (become worse) with age from the youngest to the oldest age group in the Survey for both men and women, the increase being more rapid at the higher frequencies (fig. 7 and tables 1-12).

For men, the increase in median hearing threshold for the better ear per decade of age from the youngest to the oldest group ranges from 2 decibels at 500 cycles to 10 decibels at both 4000 and 6000 cycles. The pattern for women differs but slightly, showing some less variation. Among them, the corresponding increment in the median ranges from 3 decibels at 500 cycles to 8 at 6000 cycles.

Estimated Hearing Levels for Speech

Speech-reception thresholds were not measured in the Survey examination. However, a frequently used estimate of this level and one recommended by the American Medical Association on Medical Rating of Physical Impairment[8] and the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology[9] is obtained by averaging the levels at the three pure-tone frequencies which include the range usually considered most important for understanding speech—500, 1000, and 2000 cycles per second for the better ear. The distribution of these estimates is shown in table 11.

As noted previously for the individual frequencies in this range, the patterns for men and women are similar. A steady increase with age from the youngest to the oldest age group can be noted in the estimated median thresholds for speech shown in figure 8. Only in the age groups 60 years and over does the median threshold exceed audiometric zero (table 12).

Some 8 percent of the adults in this country, or 9.2 million persons, have hearing levels in the better ear of 15 decibels or more above audiometric zero within the critical speech range. This includes persons with varying degrees of hearing handicap—ranging from some difficulty with faint speech to the inability to understand even amplified speech—which impairs their ability to hear everyday speech well enough to understand it.

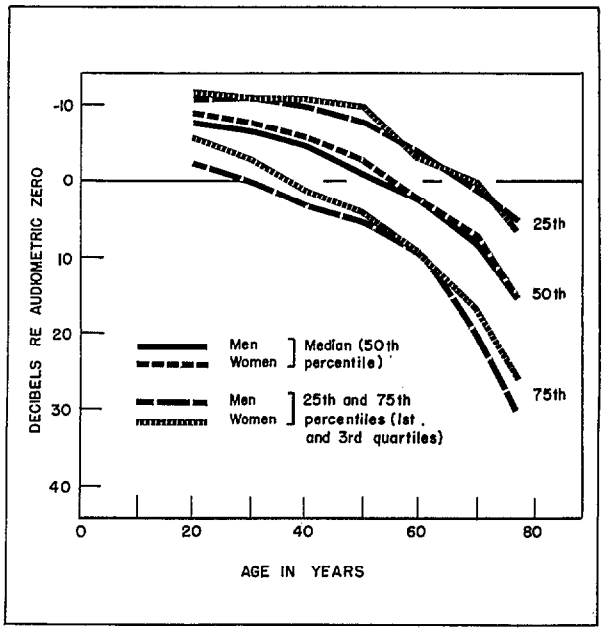

Figure 8. Medians and quartiles from the distribution of the hearing threshold levels for speech (average of pure-tone levels at 500, 1000, and 2000 cycles per second) in the better ear for men and women, United States.

The Committee on Conservation of Hearing proposes a classification of hearing handicap for audiometric survey purposes which contains approximate gradations of impairment that are related solely to pure-tone audiometric measurements but are not related to medical diagnosis and which deliberately disregards the numerous other types of difficulties in understanding speech.[10] (See table D.)

The prevalence of hearing handicap seen in these terms is similar for men and women. The proportion with the more severe hearing handicap—thresholds of 45 dB or more, including those who have difficulty in understanding loud speech, those who understand only amplified speech, and those who cannot even understand amplified speech—is about 1 percent for all persons in this age range. An estimated 1.2 million persons in the adult population of the United States have such a handicap. The 95-percent confidence limit for this estimate, based on the standard

errors of estimates shown in table II, Appendix II, is between 1.0 and 1.4 million persons.

There is a temptation to compare these findings from the Health Examination Survey in 1960-62 with the previously published estimates of the prevalence of hearing impairment from the Health Interview Survey in 1959-61.[11] The basic differences between the two sets of data, however prevent such a comparison. The Examination findings shown in this section are based on pure-tone audiometric measurements of hearing threshold levels for the better ear, within the tonal range usually considered most essential to understanding speech. Speech intelligibility per se is not taken into consideration. The levels obtained are not as precise as would be possible in thorough clinical testing, but where there is a difference, they will in general tend to be higher (worse) than the actual levels. Moreover, the data in this section of the present report concern the hearing in the "better ear" alone, while the Health Interview Survey obtained from the individual himself or from some responsible adult in his household answers to questions regarding "deafness or serious trouble with hearing *in one or both ears.*" Thus, the interview identifies persons with functional hearing difficulty in one or both ears, including ability to understand speech, insofar as the individual (or other household member interviewed regarding him) recognizes or is willing to admit having such a handicap. This may be only unilateral difficulty. However, the ability to recognize the handicap will also depend to some extent on the level of hearing acuity needed by the individual at work or elsewhere.

When prevalence estimates for persons with hearing impairment in both ears are available from the Health Interview Survey, they may be more nearly comparable to the present Examination findings. Similarly, data obtained from the Health Examination Survey can yield information concerning hearing levels of the "poorer ear," but because of the widely accepted basis for estimating hearing levels for speech from pure-tone audiometric data, they have not been used in this section of the present report.

Table D. Estimated percentage of the adult population by gradation of hearing handicap: United States, 1960-62

Average hearing level for 500, 1000, and 2000 cps in the better ear[1]	Ability to understand speech	Both sexes	Men	Women
		Percentage of adults[2]		
Less than 15 dB	No significant difficulty with faint speech	91.6	91.2	92.0
15-29 dB	Difficulty only with faint speech	5.7	5.6	5.8
30-44 dB	Frequent difficulty with normal speech	1.6	1.9	1.3
45-59 dB	Frequent difficulty with loud speech	1.1	1.3	0.9
60-79 dB	Understands only shouted or amplified speech			
80+ dB	Usually cannot understand even amplified speech			

[1] Estimated hearing level for speech re audiometric zero (1951 American Standard).
[2] Standard errors of estimate for these percentages may be obtained from Appendix II, table II.

COMPARISON WITH FINDINGS FROM OTHER STUDIES

Hearing threshold levels for segments of the population of the United States have been measured in several large-scale studies during recent years. Reference is limited here to ones in which the testing methods were somewhat similar to those used in the present study and in which persons from more than one community were included.

The earliest of these was the clinical investigation among some 9,000 persons of all ages selected from 12 of the 84 cities included in the 1935-36 National Health Survey. In this study, threshold levels were determined by air-conduction testing at eight pure tones—64, 128, 256, 512, 1024, 2048, 4096, and 8192 cycles per second—generated by standard audiometers (WE 2-A, earphone type 552). Testing was done in booths constructed to achieve effective insulation. Because of the method used for selecting the study group from these urban communities, the findings cannot be assumed to be representative of the urban population of this country.[5] For comparative purposes it is assumed here that the threshold levels obtained at 512, 1024, 2048, and 4096 cycles were approximately the same as would have been obtained at the 500-, 1000-, 2000-, and 4000-cycle test frequencies used in the present study.

At the 1939 World's Fairs in New York and San Francisco more than 15,000 persons aged 10-49 years were tested in booths by air-conduction with standard audiometers at 5 pure tones—440, 880, 1760, 3520, and 7040 cycles per second.[12,13] Since these frequencies differ substantially from those in the present Survey, no comparison with those findings is included.

In the 1954 Wisconsin State Fair some 3,500 persons aged 10-79 years were tested with standard audiometers (Maico) by air-conduction (PDH-10 earphones) in prefabricated test rooms. Testing was done at 7 tones—500, 1000, 1500, 2000, 3000, 4000, and 6,000 cycles per second.[14] The study group consisted primarily of persons from Milwaukee and surrounding areas who were attending the fair.

Findings from the various studies cited in this section have been converted to the uniform basis of the TDH-39 earphones on the NBS 9-A coupler expressed in decibels re 0.0002 dyne per square centimeter (1951 American Standard). This is a different scale from that used in data presented elsewhere in this report (see Appendix III). Factors which cannot be compensated for are differences in acoustical environment, in testing technique, and in stability of the instruments used. These are confounded with any real differences that may exist among the population themselves.

As shown in figure 9, median hearing threshold levels from the present Survey are consistently and significantly lower (better hearing) at all ages for both men and women at the four roughly comparable frequencies—500, 1000, 2000, and 4000 cycles—than median levels obtained in either the 1954 Wisconsin State Fair or the 1935-36 National Health Survey.

Median levels obtained in the Wisconsin State Fair tended to be similar to or lower than those from the 1935-36 National Health Survey at both 500 and 1000 cycles. In the higher frequencies, some deviations from this trend are evident: The 1935-36 National Health Survey medians dropped below those from the Wisconsin State Fair at 2000 cycles for men over 50 years of age and for women aged 30-45 years and at 4000 cycles for men over 65 years of age.

The pattern of differences in hearing threshold levels for men and women from the present study is not found consistently in the other two studies. At 500 and 1000 cycles, the present study and the Wisconsin State Fair group show no consistent differences in median hearing threshold levels for men and women throughout the age span, while the median hearing levels from the 1935-36 National Health Survey are markedly greater (poorer hearing) for women 50 years of age and over than for men of comparable age.

At 2000 and 4000 cycles, the present study shows lower median levels for women than for men throughout the age range, the differences being greater at 4000 cycles than at 2000. Both of the earlier studies showed consistently lower levels at 4000 cycles for women than for men, while at 2000 cycles substantial differences were not evident until 55 or 60 years of age.

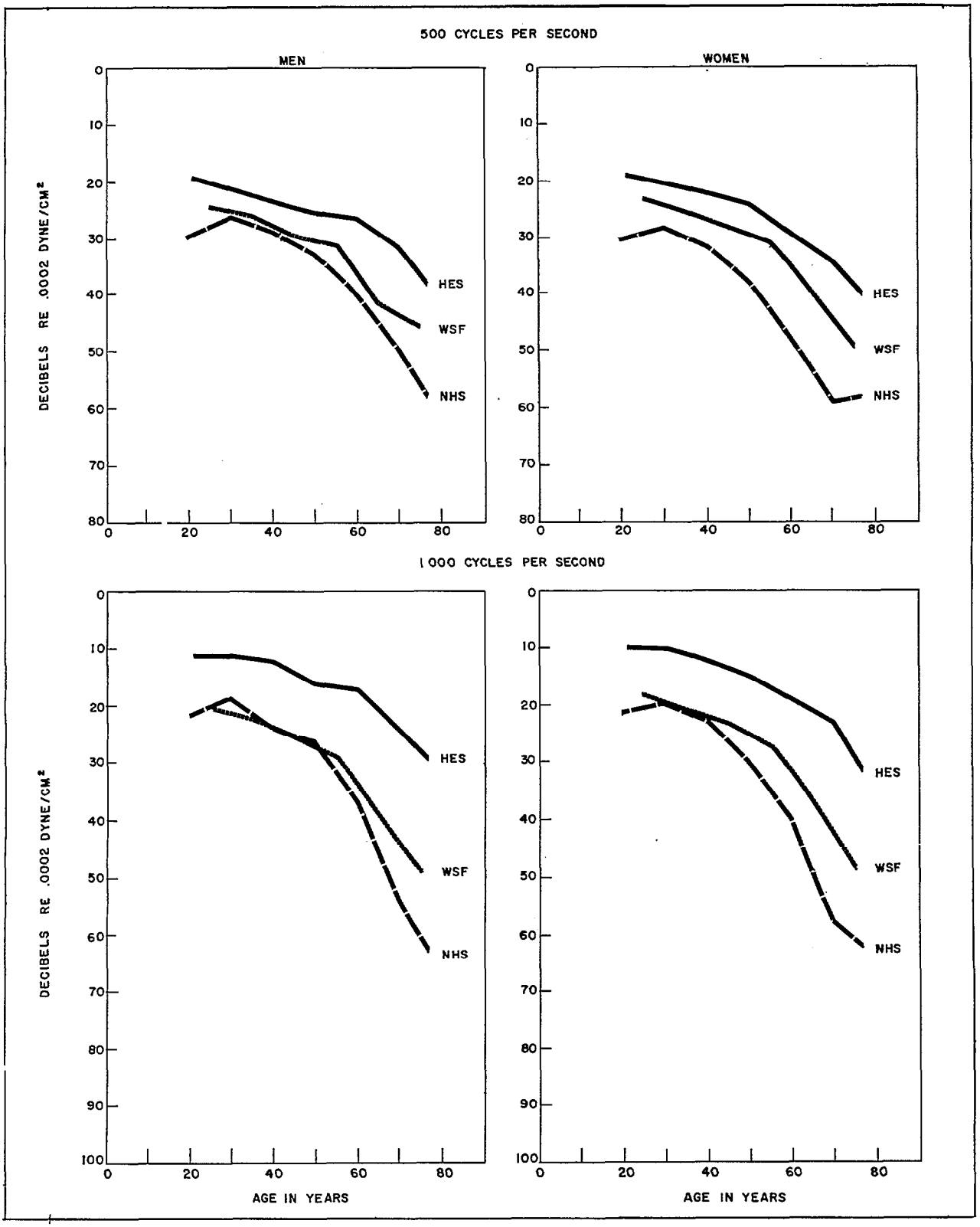

Figure 9. Median hearing threshold levels (in decibels re 0.0002 dyne per square centimeter) for men and women, by age at four frequencies, from the present study, the 1964 Wisconsin State Fair Survey, and the 1935-36. National Health Survey.

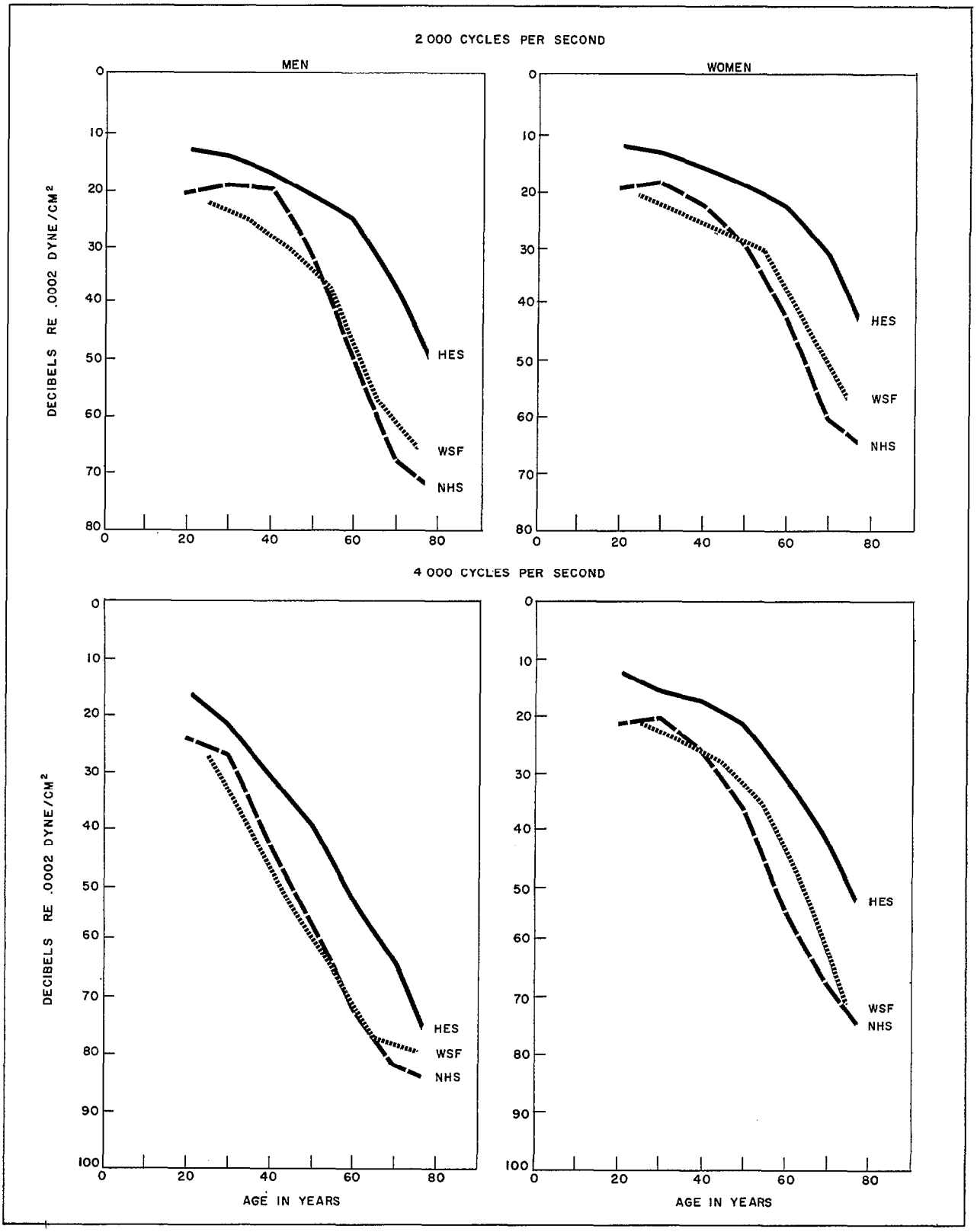

Figure 9. Median hearing threshold levels (in decibels re 0.0002 dyne per square centimeter) for men and women, by age at four frequencies, from the present study, the 1964 Wisconsin State Fair Survey, and the 1935-36 National Health Survey —Con.

To what extent the differences among these several studies may be due to variations in testing conditions, to population differences, or to secular changes in hearing threshold levels, if any, can only be a subject of conjecture.

It is of interest to see in table E how the median levels for all young adults in the two national surveys compare with those from some recent studies limited to otologically normal subjects. The Dadson and King study is one of the two on which the 1954 British Standard zero was based. The subjects were otologically normal employees of the National Physical Laboratory at Teddington who were tested more thoroughly and under more vigorously controlled conditions than was possible in the two national surveys. Data from the Wisconsin State Fair groups shown in table E are also limited here to otologically normal subjects.

SUMMARY

Health examination testing methods for the determination of hearing levels and national estimates of these levels for adults based on findings from the monaural hearing levels at each of six test frequencies have been described and analyzed in this report. The findings show the following about civilian, noninstitutional adults in the United States aged 18-79 years:

1. More than half have hearing thresholds below audiometric zero (1951 American Standard) for the lower frequencies of 500, 1000, and 2000 cycles per second (the frequencies usually considered to be the most essential in understanding speech).
2. At the higher tones—3000, 4000, and 6000 cycles per second—hearing becomes progressively poorer as the frequency increases.
3. Hearing thresholds for the right ear as compared with the left tend to be similar for the majority of adults, with the extent of agreement decreasing as the frequency increases.
4. Hearing levels for men and women are similar in the lower frequencies—500 to 2000 cycles. Above 2000 cycles, women have substantially lower hearing levels (better hearing) than men.
5. Hearing levels increase steadily (hearing gets worse) with age from the youngest to the oldest age group in the Survey for both men and women, the increase being more rapid at the higher frequencies.
6. About 8 percent of the adult population have hearing levels of 15 decibels or more (re audiometric zero) in the better ear within the critical speech range—500 to 2000 cycles.
7. The prevalence of hearing handicaps as estimated from pure-tone audiometric

Table E. Median hearing levels in decibels re 0.0002 dyne per cm^2 for young adults from selected studies[a]

Frequency in cycles per second	United States (18-24 years)	Wisconsin State Fairs[15] (18-24 years)		Dadson-King[16] (18-24 years)	National Health Survey (15-24 years)
	1960-62	1955	1954	1952	1935-36
500	17.6	12.2	23.9	10.8	29.8
1000	9.7	7.7	17.2	7.0	21.3
2000	10.5	8.9	19.2	14.5	19.8
4000	12.3	10.9	18.0	7.2	22.5
Number of examinees	945	122	202	99	1,179

[a] Data converted to uniform basis of the TDH-39 earphones on the NBS 9-A coupler.

testing in the Survey is similar for men and women. The proportion with a severe hearing handicap—thresholds (500, 1000, and 2000 cps) of 45 decibels or more—ranging from those who have difficulty understanding loud speech to those who cannot understand even amplified speech is about .1 percent. The estimated number in the adult population with such handicaps is approximately 1.2 million.

The type of hearing examination given, the methods used in the measurement of hearing level, the acoustical environment, the audiometric calibration and other types of quality control measures used have been described.

REFERENCES

[1]National Center for Health Statistics: Plan and initial program of the Health Examination Survey. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 1-No. 4. Public Health Service. Washington. U.S. Government Printing Office, July 1965.

[2]National Center for Health Statistics: Cycle I of the Health Examination Survey, sample and response. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 11-No. 1. Public Health Service. Washington. U.S. Government Printing Office, April 1964.

[3]American Standards Association: *American Standard Specification for Audiometers for General Diagnostic Purposes*. Pub. No. Z24.5-1951. New York, 1951.

[4]American Standards Association: *American Standard Criteria for Background Noise in Audiometer Rooms*. Pub. No. S3.1-1960. New York, 1960.

[5]National Institute of Health: Hearing Study Series Bulletins 1-7, The National Health Survey, 1935-1936, preliminary reports. Public Health Service. Washington, D.C., 1938.

[6]Corliss, E. L. R., and Snyder, W. F.: Calibration of audiometers. *J. Acoust. Soc. Amer.* 22(6):837-842, Nov. 1950.

[7]Chaiklin, J. B., and Ventry, I. M.: Functional hearing loss, Ch. 3, in J. Jerger, ed., *Modern Developments in Audiology*. New York. Academic Press, 1963. p. 91.

[8]Committee on Medical Rating of Physical Impairment: Guides to the evaluation of permanent impairment—ear, nose, throat, and related structures. *J.A.M.A.* 177:489-501, Aug. 19, 1961.

[9]Committee on Conservation of Hearing: Guide for the evaluation of hearing impairment. *Tr. Am. Acad. Ophth.* 63 (2), Mar.-Apr. 1959.

[10]National Institutes of Health: Methodological problems in collecting data on the deaf, the survey, by E. L. Eagles. *Proceedings—Conference on the Collection of Statistics of Severe Hearing Impairments and Deafness in the United States*. PHS Pub. No. 1227. Public Health Service. Washington. U.S. Government Printing Office, 1964.

[11]U.S. National Health Survey: Selected impairments by etiology and activity limitation. PHS Pub. No. 584-B35. Public Health Service. Washington. U.S. Government Printing Office, July 1962.

[12]Post, R. H.: Hearing acuity variation among Negroes and whites. *Eugenics Quart.* 11(2):65-81, June 1964.

[13]Steinberg, J. C., Montgomery, H. C., and Gardner, M. B.: Results of the World's Fair hearing tests. *J. Accoust. Soc. Amer.* 12:291-301, Oct. 1940.

[14]Glorig, A., Wheeler, D., Quiggle, R., Grings, W., and Summerfield, A.: Some medical implications of the 1954 Wisconsin State Fair hearing survey. *Tr.Am.Acad.Ophth.* 61(2): 160-171, Mar.-Apr. 1957.

[15]Glorig, A.: A report of two normal hearing studies. *Ann. Otol. Rhin. & Laryng.* 67(1):93-111, March 1958.

[16]Dadson, R. S., and King, J. H.: A determination of the normal threshold of hearing and its relation to the standardization of audiometers. *J. Laryng. & Otol.* 66:366-378, Aug. 1952.

[17]Corliss, E. L. R., and Burkhard, M. D.: A probe tube method for the transfer of threshold standards between audiometer earphones. *J. Acoust. Soc. Amer.* 25(5):990-993, Sept. 1953.

[18]Burkhard, M. D., and Corliss, E. L. R.: The response of earphones in ears and couplers. *J. Acoust. Soc. Amer.* 26(5): 679-685, Sept. 1954.

[19]Cox, J. R., Jr., and Bilger, R. C.: Suggestion relative to the standardization of loudness-balance data for telephonics TDH-39 earphone. *J. Acoust. Soc. Amer.* 32:1081-1082, Aug. 1960.

[20]Davis, H., and Kranz, F. W.: The international standard reference zero for pure-tone audiometers and its relation to the evaluation of impairment of hearing. *J. Speech Hear. Res.* 7(1):7-16, March 1964.

[21]International Organization for Standardization: *ISO Recommendation R 389—Standard Reference Zero for the Calibration of Pure Tone Audiometers*. ISO/R 389-1964(E). Switzerland, Nov. 1964.

[22]British Standards Institution: *British Standard Specification for the Normal Threshold of Hearing for Pure Tones by Earphone Listening*. B.S.2497. London. British Standards House, Inc., 1954.

———o o o———

DETAILED TABLES

Table 1. Percentage distribution of hearing levels in decibels for the right, left, and better ears of adults at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second: United States, 1960-62

Tonal frequency	All levels	Hearing level									
		-5 or less	-4 to +5	+6 to +15	+16 to +25	+26 to +35	+36 to +45	+46 to +55	+56 to +65	+66 to +75	+76 or more
Right ear	Percentage distribution										
500	100.0	35.7	38.0	16.0	5.0	2.3	1.1	0.7	0.6	0.3	0.4
1000	100.0	48.4	32.5	10.2	3.6	1.9	1.4	0.7	0.7	0.3	0.5
2000	100.0	35.3	34.3	13.6	6.8	3.7	2.5	1.8	1.0	0.4	0.7
3000	100.0	16.8	36.0	17.6	9.3	6.1	4.8	4.2	2.9	1.0	1.5
4000	100.0	11.6	30.1	19.1	11.0	7.9	6.4	5.4	4.2	2.1	2.2
6000	100.0	3.8	17.6	25.7	16.6	9.4	7.0	5.7	5.3	4.1	4.7
Left ear											
500	100.0	40.3	37.2	13.2	4.3	1.9	0.9	0.8	0.6	0.4	0.3
1000	100.0	49.6	31.1	10.5	3.6	1.8	1.0	1.1	0.7	0.2	0.4
2000	100.0	32.7	34.3	14.5	7.0	4.0	2.6	2.4	1.4	0.5	0.6
3000	100.0	15.5	32.9	19.4	9.3	6.3	5.7	4.8	3.2	1.3	1.5
4000	100.0	10.6	28.4	19.5	11.3	8.1	7.1	6.1	4.3	2.4	2.3
6000	100.0	4.1	16.5	24.1	16.5	10.1	8.1	6.2	5.3	4.3	4.8
Better ear											
500	100.0	49.1	35.2	10.1	3.1	1.2	0.6	0.2	0.3	0.2	0.1
1000	100.0	59.3	27.4	8.0	2.4	1.3	0.7	0.3	0.4	0.1	0.2
2000	100.0	45.1	31.2	11.1	5.7	2.7	1.8	1.3	0.5	0.2	0.3
3000	100.0	23.5	36.3	16.0	8.2	5.3	4.2	3.5	1.9	0.5	0.6
4000	100.0	16.0	33.5	18.2	10.0	6.5	5.8	4.9	3.0	1.4	0.9
6000	100.0	6.4	23.5	26.4	14.5	8.7	6.2	4.9	4.1	2.8	2.4

Table 2. Percentage distribution of hearing levels in decibels re audiometric zero for the right and left ears at 500 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
RIGHT EAR								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	35.2	53.6	47.6	39.3	29.6	22.8	11.4	8.1
-4 to +5	40.2	35.2	40.9	40.4	43.3	44.9	37.1	24.7
+6 to +15	15.2	7.9	8.7	13.1	18.5	20.9	26.2	23.5
+16 to +25	4.1	1.4	1.2	2.5	5.1	4.0	13.2	11.6
+26 to +35	2.2	1.0	0.6	2.5	1.9	2.6	4.7	9.4
+36 to +45	1.2	0.4	0.3	0.9	0.3	2.4	4.3	5.3
+46 to +55	0.8	-	0.6	0.8	0.9	0.6	1.1	4.7
+56 to +65	0.5	0.3	0.2	0.1	0.4	0.7	0.9	5.2
+66 to +75	0.3	-	-	0.1	-	0.4	0.2	7.7
+76 or more	0.3	0.3	-	0.4	-	0.7	0.8	-
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	36.2	58.8	49.1	41.5	33.0	16.2	10.5	6.4
-4 to +5	36.0	32.5	37.4	39.1	39.1	38.4	27.8	18.6
+6 to +15	16.7	6.1	9.6	14.0	19.0	27.9	28.1	29.0
+16 to +25	5.8	1.1	2.4	2.8	4.2	11.0	17.0	18.9
+26 to +35	2.4	0.9	0.1	1.7	2.2	3.2	6.6	12.6
+36 to +45	1.0	0.3	0.7	0.2	1.2	1.6	2.3	2.5
+46 to +55	0.5	0.3	0.1	0.3	0.3	0.7	1.6	3.2
+56 to +65	0.6	-	0.1	0.5	0.4	0.1	2.8	5.4
+66 to +75	0.2	-	-	-	0.2	-	1.7	0.8
+76 or more	0.5	-	0.4	-	0.3	0.9	1.6	2.6
LEFT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	39.7	55.0	54.7	45.3	37.0	22.6	14.8	5.1
-4 to +5	39.2	34.9	38.3	37.4	42.4	47.2	35.6	28.4
+6 to +15	13.0	7.6	4.8	11.8	15.7	17.5	24.1	26.2
+16 to +25	3.2	1.5	0.4	2.4	1.9	6.0	8.3	15.6
+26 to +35	1.8	-	0.8	0.6	0.8	2.9	7.2	10.3
+36 to +45	0.8	0.2	0.2	1.2	0.3	1.4	1.8	1.0
+46 to +55	1.1	0.2	0.6	0.6	1.2	0.9	4.5	2.1
+56 to +65	0.6	-	0.1	0.4	0.4	0.8	2.1	2.5
+66 to +75	0.5	0.2	-	0.3	-	0.3	1.3	7.7
+76 or more	0.2	0.3	-	0.1	0.2	0.3	0.4	1.0
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	40.8	63.7	57.1	48.8	33.8	20.7	10.1	5.6
-4 to +5	35.4	29.1	33.2	36.0	41.7	40.3	33.2	20.7
+6 to +15	13.4	5.6	6.6	10.3	14.8	22.1	26.7	21.7
+16 to +25	5.3	0.9	0.7	3.0	4.4	9.9	16.2	21.6
+26 to +35	2.0	0.2	1.0	0.7	2.4	2.9	4.2	14.4
+36 to +45	1.1	0.1	0.7	0.4	1.3	1.6	2.5	5.2
+46 to +55	0.6	-	0.3	0.6	0.5	1.2	0.5	3.3
+56 to +65	0.6	0.1	0.3	0.1	0.8	0.5	2.2	4.0
+66 to +75	0.4	0.2	-	-	0.2	0.7	1.5	1.0
+76 or more	0.5	-	0.2	-	0.2	0.2	2.9	2.7

Table 3. Percentage distribution of hearing levels in decibels re audiometric zero for the right and left ears at 1000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
	Percentage distribution							
RIGHT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	46.6	66.7	64.0	52.6	37.9	31.8	18.7	10.1
-4 to +5	33.6	29.2	28.7	32.3	41.7	40.7	28.1	28.1
+6 to +15	10.5	1.6	5.4	8.7	12.4	15.4	24.5	19.5
+16 to +25	3.4	1.4	0.5	2.7	3.6	4.5	10.5	8.7
+26 to +35	1.8	0.2	0.2	1.0	1.3	3.0	7.2	6.3
+36 to +45	1.8	0.6	0.9	1.2	2.3	2.0	4.2	6.5
+46 to +55	0.8	-	0.1	0.8	0.1	0.8	3.8	6.1
+56 to +65	0.6	-	0.2	0.2	0.6	1.1	1.4	4.6
+66 to +75	0.3	-	-	0.2	0.1	0.3	0.8	3.4
+76 or more	0.5	0.3	-	0.4	-	0.5	0.8	6.7
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	50.0	79.7	68.9	54.5	43.9	26.6	17.4	5.8
-4 to +5	31.4	17.0	25.0	34.4	38.5	41.9	32.5	24.2
+6 to +15	9.9	1.6	4.1	6.4	10.9	18.2	23.3	24.0
+16 to +25	3.8	0.4	0.9	2.3	2.8	7.7	11.7	12.2
+26 to +35	1.9	0.4	0.3	1.2	1.4	2.7	4.5	16.7
+36 to +45	1.0	0.6	0.3	0.4	0.9	1.2	2.2	6.7
+46 to +55	0.5	0.2	0.1	0.4	1.1	0.4	0.3	2.4
+56 to +65	0.7	0.1	0.1	0.2	-	0.3	4.4	4.5
+66 to +75	0.4	-	-	0.2	0.4	0.4	1.3	2.5
+76 or more	0.5	-	0.3	-	0.1	0.5	2.6	1.0
LEFT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	46.3	66.4	63.1	50.0	40.5	33.2	18.1	4.8
-4 to +5	33.5	28.8	29.9	34.7	39.7	37.8	28.9	23.3
+6 to +15	11.3	3.6	4.8	9.8	14.2	17.5	21.4	20.9
+16 to +25	3.1	-	0.1	2.0	2.6	4.1	11.1	18.2
+26 to +35	1.9	0.2	1.0	1.2	1.0	3.5	4.9	8.2
+36 to +45	1.1	-	0.5	0.3	0.4	1.5	4.4	10.0
+46 to +55	1.4	0.4	0.3	1.0	0.8	0.6	6.9	5.0
+56 to +65	1.0	-	0.3	0.4	0.7	1.2	3.2	7.6
+66 to +75	0.1	0.2	-	0.2	-	-	0.3	-
+76 or more	0.3	0.3	-	0.3	0.2	0.6	0.8	2.0
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	52.6	79.8	70.2	58.9	48.2	28.6	20.7	5.0
-4 to +5	28.9	17.2	23.6	30.5	34.2	41.1	27.5	22.3
+6 to +15	9.8	1.8	3.5	6.7	8.6	18.8	24.7	24.8
+16 to +25	4.0	0.6	1.3	1.6	3.9	5.0	12.7	22.1
+26 to +35	1.7	0.3	0.5	1.1	1.6	1.9	4.6	13.3
+36 to +45	0.9	0.1	0.3	0.4	1.5	0.9	2.6	3.7
+46 to +55	1.0	0.2	0.2	0.2	1.3	2.2	2.6	1.0
+56 to +65	0.5	-	0.1	0.6	0.5	0.4	1.0	5.3
+66 to +75	0.2	-	-	-	-	0.9	0.7	-
+76 or more	0.5	-	0.3	-	0.2	-	2.8	2.7

Table 4. Percentage distribution of hearing levels in decibels re audiometric zero for the right and left ears at 2000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
RIGHT EAR								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	32.8	57.4	49.3	37.3	24.1	14.8	5.7	2.8
-4 to +5	33.3	32.3	37.8	37.1	37.7	32.8	14.4	13.1
+6 to +15	13.7	6.8	7.2	14.5	15.9	18.1	24.9	11.2
+16 to +25	7.6	2.1	3.2	5.5	9.7	12.3	15.2	19.3
+26 to +35	4.0	0.2	1.1	2.1	5.6	7.3	11.3	6.8
+36 to +45	3.4	0.4	0.3	1.5	3.7	6.8	10.5	11.1
+46 to +55	2.3	0.2	0.5	1.0	1.1	3.6	10.3	9.5
+56 to +65	1.5	0.2	0.6	0.4	1.4	2.3	4.0	9.7
+66 to +75	0.5	-	-	0.1	0.4	0.5	2.2	4.8
+76 or more	0.9	0.3	0.1	0.6	0.3	1.5	1.6	11.6
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	37.5	63.3	54.2	43.6	30.3	17.5	7.4	-
-4 to +5	35.1	31.8	35.2	40.4	43.3	34.6	22.6	7.0
+6 to +15	13.6	2.7	7.6	9.7	14.1	24.6	27.5	29.8
+16 to +25	6.0	1.0	1.7	2.9	6.6	10.4	17.8	14.5
+26 to +35	3.3	0.5	0.6	1.4	2.8	6.6	8.4	19.6
+36 to +45	1.7	-	0.1	0.7	1.0	2.8	5.3	14.1
+46 to +55	1.4	0.4	0.1	0.9	1.0	2.3	4.0	7.1
+56 to +65	0.6	0.3	0.1	0.2	0.5	-	2.9	2.5
+66 to +75	0.3	-	-	0.1	0.1	0.6	0.9	4.4
+76 or more	0.6	-	0.3	0.1	0.3	0.6	3.1	1.0
LEFT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	28.2	51.0	45.9	31.8	20.3	9.7	2.9	-
-4 to +5	33.1	38.9	36.4	40.7	34.2	28.0	12.9	10.8
+6 to +15	15.5	7.1	11.2	14.2	23.0	20.3	17.5	12.7
+16 to +25	7.7	0.8	2.9	5.7	9.4	14.6	17.3	12.0
+26 to +35	4.7	1.1	1.5	3.0	4.7	9.5	12.2	8.1
+36 to +45	3.7	0.2	0.9	2.0	4.7	6.5	9.7	10.4
+46 to +55	3.4	0.4	0.5	1.4	1.8	6.4	13.9	15.6
+56 to +65	2.1	0.2	0.7	0.5	1.4	2.8	9.3	11.2
+66 to +75	0.6	-	-	0.1	0.3	1.5	1.9	6.0
+76 or more	0.9	0.3	-	0.5	0.2	0.7	2.5	13.3
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	36.8	63.7	52.0	42.5	30.8	15.3	7.2	2.3
-4 to +5	35.3	30.7	37.6	42.3	36.8	35.0	26.0	12.8
+6 to +15	13.7	4.0	7.2	9.5	18.0	25.7	22.6	20.6
+16 to +25	6.4	0.5	1.8	3.0	7.4	12.4	17.5	18.0
+26 to +35	3.3	0.7	0.5	1.2	3.2	4.3	11.6	19.6
+36 to +45	1.6	0.2	0.1	0.4	1.4	3.0	4.1	12.9
+46 to +55	1.4	-	0.4	0.7	1.5	1.5	5.6	5.8
+56 to +65	0.8	0.2	-	0.3	0.4	1.9	2.1	3.2
+66 to +75	0.4	-	0.2	-	0.3	0.8	1.6	3.1
+76 or more	0.3	-	0.3	-	0.2	0.1	1.7	1.7

Table 5. Percentage distribution of hearing levels in decibels re audiometric zero for the right and left ears at 3000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
RIGHT EAR								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	11.5	30.5	20.7	10.2	4.6	2.2	-	-
-4 to +5	29.7	49.6	43.5	34.7	23.5	15.2	3.0	2.8
+6 to +15	17.8	13.6	17.0	21.9	24.0	16.2	9.3	6.4
+16 to +25	10.2	3.3	5.8	11.4	16.0	12.7	12.3	7.8
+26 to +35	7.6	1.3	5.7	7.0	8.4	13.8	11.3	8.0
+36 to +45	7.2	0.1	2.7	5.6	8.9	11.8	18.8	12.9
+46 to +55	7.1	0.7	2.8	5.2	7.2	12.2	19.4	14.0
+56 to +65	5.0	0.7	1.4	2.1	4.1	10.5	15.3	15.9
+66 to +75	1.7	-	0.3	1.0	1.1	2.9	4.4	15.5
+76 or more	2.1	0.3	0.1	0.9	2.2	2.5	6.2	16.6
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	21.5	46.8	31.6	23.5	14.4	5.9	2.2	-
-4 to +5	41.7	43.8	50.1	51.5	47.2	28.8	20.2	5.3
+6 to +15	17.3	5.9	13.7	15.5	21.7	30.2	19.2	14.1
+16 to +25	8.4	2.0	2.5	4.3	9.3	16.5	20.6	21.6
+26 to +35	4.6	0.6	1.0	2.4	3.1	8.9	14.9	20.4
+36 to +45	2.5	0.3	0.5	1.3	1.5	3.4	10.2	12.5
+46 to +55	1.6	0.3	-	0.8	1.2	2.2	5.2	12.4
+56 to +65	1.0	0.2	0.2	0.4	1.3	2.1	1.5	7.5
+66 to +75	0.4	0.1	-	0.1	-	0.7	2.2	1.6
+76 or more	0.9	-	0.4	0.2	0.5	1.3	3.8	4.6
LEFT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	9.5	23.4	19.0	7.4	4.1	1.7	0.2	-
-4 to +5	26.1	48.3	39.9	29.3	20.5	8.3	3.3	2.5
+6 to +15	19.9	20.4	20.7	25.2	23.7	16.8	8.2	1.1
+16 to +25	10.2	3.4	6.1	12.8	15.5	12.5	8.5	9.1
+26 to +35	8.1	2.2	5.4	9.1	10.3	12.7	8.8	7.5
+36 to +45	8.3	0.6	4.0	7.4	10.9	15.9	12.9	10.1
+46 to +55	7.7	0.6	2.1	4.4	7.7	14.1	24.8	17.7
+56 to +65	5.6	0.4	1.4	2.3	5.6	10.9	16.0	23.7
+66 to +75	2.2	-	0.6	1.1	1.2	4.7	7.3	10.9
+76 or more	2.3	0.5	0.7	1.1	0.5	2.3	9.9	17.5
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	21.0	45.6	33.2	22.2	13.3	5.4	0.7	1.7
-4 to +5	39.0	44.8	49.1	48.8	41.3	27.0	13.0	6.3
+6 to +15	18.9	6.8	12.4	18.8	26.0	26.3	26.1	16.8
+16 to +25	8.5	1.1	2.4	5.9	8.7	18.9	18.7	16.2
+26 to +35	4.7	0.2	1.3	1.4	4.2	10.0	13.4	22.9
+36 to +45	3.4	0.7	0.6	1.3	2.5	5.9	13.3	10.6
+46 to +55	2.1	-	0.5	0.7	1.9	2.7	7.5	13.0
+56 to +65	1.1	0.5	0.2	0.5	1.5	1.5	3.2	1.0
+66 to +75	0.5	0.2	0.1	0.1	0.3	0.9	1.4	5.0
+76 or more	0.8	-	0.3	0.2	0.2	1.3	2.7	6.6

Table 6. Percentage distribution of hearing levels in decibels re audiometric zero for the right and left ears at 4000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total, 18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
RIGHT EAR								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	5.8	21.5	10.6	2.9	0.9	0.5	-	-
-4 to +5	22.5	46.3	35.8	25.6	13.9	6.9	1.0	-
+6 to +15	17.5	16.5	21.5	21.4	20.7	13.8	5.2	1.3
+16 to +25	11.7	5.0	8.8	13.8	15.8	15.8	9.8	7.1
+26 to +35	9.9	4.5	8.8	9.2	15.5	11.0	9.5	5.5
+36 to +45	9.7	3.3	5.1	11.5	12.2	12.0	16.0	8.1
+46 to +55	8.8	1.4	5.0	6.8	9.6	14.2	20.9	15.5
+56 to +65	7.1	0.9	2.6	4.9	5.9	14.3	17.3	24.3
+66 to +75	3.6	0.4	0.9	2.3	2.6	6.4	12.1	13.2
+76 or more	3.3	0.3	0.9	1.6	2.8	5.3	8.2	24.9
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	16.9	43.6	24.4	16.9	9.9	3.0	0.5	-
-4 to +5	36.9	41.8	49.2	48.1	38.0	21.5	12.0	1.9
+6 to +15	20.7	10.2	17.7	21.4	27.6	26.5	21.2	12.7
+16 to +25	10.3	1.5	5.5	6.6	15.4	21.6	14.6	10.4
+26 to +35	6.1	1.5	2.2	3.4	4.2	10.9	17.7	22.4
+36 to +45	3.5	0.7	0.4	1.7	1.3	7.2	12.3	15.7
+46 to +55	2.3	0.3	0.1	0.9	1.0	4.5	8.8	14.0
+56 to +65	1.5	-	0.1	0.4	1.6	1.6	5.4	12.8
+66 to +75	0.8	0.1	-	0.4	0.3	1.9	2.2	3.8
+76 or more	1.1	0.1	0.5	0.1	0.6	1.2	5.2	6.3
LEFT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	4.9	17.9	7.4	3.3	1.3	0.5	-	-
-4 to +5	19.7	45.0	33.6	19.8	12.3	2.3	1.1	1.3
+6 to +15	17.7	20.2	25.1	23.1	15.8	11.8	4.2	1.3
+16 to +25	12.4	7.3	11.4	15.5	16.5	13.2	7.7	2.6
+26 to +35	10.3	4.2	8.2	11.1	16.1	12.7	7.1	7.3
+36 to +45	10.1	2.4	4.9	9.9	15.7	15.8	12.6	10.4
+46 to +55	9.5	0.8	3.9	8.3	11.0	15.0	22.6	16.8
+56 to +65	7.3	1.5	3.2	4.4	6.7	13.5	19.1	21.2
+66 to +75	4.2	0.2	1.3	2.6	3.2	9.6	9.3	17.8
+76 or more	3.8	0.5	1.0	2.0	1.4	5.5	16.2	21.1
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	15.7	35.6	25.0	16.9	9.2	2.5	1.1	-
-4 to +5	36.2	50.0	50.3	45.8	33.5	19.2	7.2	2.4
+6 to +15	21.1	10.3	16.6	24.1	30.5	27.7	16.1	8.0
+16 to +25	10.3	1.9	4.2	6.9	12.0	18.6	23.3	19.2
+26 to +35	6.0	0.6	1.5	2.7	6.1	13.7	14.4	21.1
+36 to +45	4.3	0.5	1.3	2.0	4.0	7.8	13.7	14.1
+46 to +55	3.0	0.3	0.4	1.0	2.2	5.0	11.4	15.9
+56 to +65	1.6	0.2	0.1	0.5	1.6	2.7	5.4	7.9
+66 to +75	0.9	0.3	0.1	0.1	0.6	1.4	3.5	3.6
+76 or more	1.0	0.3	0.4	-	0.3	1.5	3.8	7.7

Table 7. Percentage distribution of hearing levels in decibels re audiometric zero for the right and left ears at 6000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
RIGHT EAR								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	1.9	9.1	2.1	1.0	0.3	-	-	-
-4 to +5	12.1	31.7	20.5	12.8	3.6	1.6	1.1	-
+6 to +15	21.7	32.1	33.0	25.7	20.9	8.4	0.9	2.8
+16 to +25	16.4	13.3	17.5	19.9	22.7	13.8	5.9	1.3
+26 to +35	9.9	3.8	6.7	10.9	13.8	13.9	11.8	-
+36 to +45	9.0	4.1	5.4	8.1	13.1	15.3	7.4	10.2
+46 to +55	7.9	2.2	6.0	6.6	9.2	11.5	13.9	12.3
+56 to +65	7.6	2.4	3.7	5.3	7.7	10.9	21.1	16.9
+66 to +75	6.1	0.6	2.3	4.5	4.1	11.0	18.6	19.2
+76 or more	7.4	0.7	2.9	5.1	4.7	13.6	19.3	37.2
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	5.6	16.4	8.2	5.0	2.9	0.1	-	-
-4 to +5	22.6	42.8	35.2	28.6	15.7	4.1	1.8	-
+6 to +15	29.4	27.8	36.5	36.1	33.5	24.4	11.1	2.7
+16 to +25	16.8	8.8	12.0	17.1	23.3	24.5	17.2	5.2
+26 to +35	9.0	1.7	4.8	6.4	11.3	15.4	18.0	15.4
+36 to +45	5.1	0.5	1.6	3.4	5.3	11.1	11.0	14.7
+46 to +55	3.8	0.3	0.8	1.3	2.9	7.8	13.6	10.9
+56 to +65	3.1	0.9	0.2	0.8	2.2	6.0	10.3	17.7
+66 to +75	2.4	0.5	0.3	0.6	1.6	3.6	7.3	21.4
+76 or more	2.3	0.3	0.4	0.7	1.3	3.0	9.7	12.0
LEFT EAR								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	2.1	8.5	3.1	1.1	0.4	-	-	-
-4 to +5	10.6	28.5	19.1	10.4	3.6	0.7	-	-
+6 to +15	20.0	33.3	31.5	23.7	14.8	8.3	2.7	-
+16 to +25	16.4	13.2	17.7	20.7	23.9	11.8	3.5	4.1
+26 to +35	11.3	5.6	9.9	13.4	16.9	12.7	5.4	6.1
+36 to +45	10.0	4.0	5.3	9.5	13.3	16.7	13.1	8.6
+46 to +55	7.8	3.0	5.1	6.5	7.9	13.0	14.4	9.1
+56 to +65	7.4	2.2	3.5	7.0	7.7	11.7	15.5	11.0
+66 to +75	6.7	1.3	2.9	2.7	7.2	9.9	18.4	30.2
+76 or more	7.9	0.5	1.9	5.0	4.3	15.2	27.0	30.9
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	6.0	17.4	8.9	6.1	2.3	0.2	-	-
-4 to +5	21.9	43.2	33.7	25.5	15.4	5.6	1.8	-
+6 to +15	27.8	26.6	36.4	35.2	31.5	20.2	8.6	2.4
+16 to +25	16.5	7.7	13.1	18.3	21.6	25.0	15.5	-
+26 to +35	9.1	1.9	4.2	7.4	11.3	15.7	16.2	19.5
+36 to +45	6.4	1.1	1.6	3.6	8.0	13.9	12.8	17.4
+46 to +55	4.8	0.9	0.4	2.0	4.2	9.2	17.3	10.4
+56 to +65	3.4	0.2	0.7	1.1	2.4	4.3	13.3	20.3
+66 to +75	2.1	0.4	0.5	0.6	2.1	3.6	6.3	12.4
+76 or more	2.1	0.6	0.4	0.2	1.1	2.4	8.4	17.5

Table 8. Percentage distribution of hearing levels in decibels re audiometric zero for the better ear at 500 and 1000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
500 CYCLES PER SECOND								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	48.9	65.8	65.2	55.7	43.5	33.2	20.5	10.5
-4 to +5	37.2	27.8	31.9	34.1	43.5	48.7	39.6	34.7
+6 to +15	9.1	5.0	1.8	8.1	10.8	10.9	22.0	22.9
+16 to +25	2.1	0.7	0.3	0.7	0.9	3.3	8.8	11.6
+26 to +35	1.3	0.2	0.7	0.4	0.5	2.0	4.1	8.0
+36 to +45	0.6	0.2	-	0.4	0.2	0.6	2.8	2.6
+46 to +55	0.3	-	-	0.3	0.5	0.5	0.5	1.9
+56 to +65	0.2	-	0.1	-	-	0.4	1.1	-
+66 to +75	0.3	-	-	0.3	-	-	0.2	7.7
+76 or more	0.1	0.3	-	-	-	0.3	0.4	-
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	49.2	72.7	65.8	58.0	45.5	27.7	13.9	7.8
-4 to +5	33.3	24.2	29.5	32.2	38.5	41.4	37.9	22.0
+6 to +15	11.0	2.5	3.2	7.5	10.9	20.7	26.2	32.7
+16 to +25	3.9	0.3	0.9	1.7	2.4	7.3	13.3	18.3
+26 to +35	1.2	0.2	0.1	0.5	1.6	1.3	2.8	11.3
+36 to +45	0.6	0.1	0.2	-	0.5	0.9	1.8	4.2
+46 to +55	0.1	-	-	0.2	0.3	-	0.3	0.8
+56 to +65	0.4	-	0.1	-	0.1	0.1	2.9	2.0
+66 to +75	0.1	-	-	-	-	0.4	0.7	-
+76 or more	0.1	-	0.2	-	0.1	0.2	0.4	1.0
1000 CYCLES PER SECOND								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	57.0	76.5	73.7	62.7	51.1	44.3	25.3	11.6
-4 to +5	29.6	21.0	23.2	27.5	37.0	36.6	33.8	32.4
+6 to +15	7.9	1.7	2.1	7.0	9.0	12.7	17.3	20.8
+16 to +25	2.2	-	0.2	1.4	1.5	2.2	9.4	12.5
+26 to +35	1.4	0.2	0.5	0.6	0.8	2.6	5.6	5.2
+36 to +45	0.9	0.2	0.3	0.1	0.4	1.0	3.5	8.0
+46 to +55	0.4	-	-	0.3	-	-	2.9	0.9
+56 to +65	0.4	-	-	0.2	0.1	0.2	1.4	6.7
+66 to +75	0.1	-	-	0.1	-	-	-	2.0
+76 or more	0.2	0.3	-	0.2	-	0.3	0.8	-
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	61.4	89.1	79.8	69.5	56.9	37.4	25.1	8.6
-4 to +5	25.4	9.8	17.3	23.9	32.3	40.9	32.0	25.3
+6 to +15	8.2	0.6	1.7	4.4	6.7	15.5	25.3	30.2
+16 to +25	2.6	0.3	0.9	1.2	2.1	3.8	8.6	13.8
+26 to +35	1.2	0.2	-	0.8	0.6	1.1	3.4	14.2
+36 to +45	0.5	0.1	-	0.1	0.9	0.6	1.0	4.2
+46 to +55	0.2	-	-	-	0.2	-	1.6	-
+56 to +65	0.3	-	0.1	0.1	-	0.5	1.3	2.8
+66 to +75	0.1	-	-	-	-	0.2	0.7	-
+76 or more	0.2	-	0.2	-	0.1	-	1.0	1.0

Table 9. Percentage distribution of hearing levels in decibels re audiometric zero for the better ear at 2000 and 3000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
2000 CYCLES PER SECOND								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	41.0	66.8	61.2	47.5	32.7	20.1	7.3	2.8
-4 to +5	31.6	28.1	30.1	35.0	36.6	36.3	18.2	18.7
+6 to +15	11.9	3.4	5.4	10.9	16.1	15.6	25.7	13.9
+16 to +25	6.1	0.9	1.8	3.2	7.3	11.5	15.8	15.2
+26 to +35	3.2	-	0.5	1.3	3.7	6.4	10.3	8.4
+36 to +45	2.5	-	0.3	0.8	2.0	6.0	8.2	11.8
+46 to +55	2.0	0.5	0.4	1.1	0.7	2.7	8.9	10.0
+56 to +65	0.9	-	0.3	-	0.7	1.0	3.3	9.1
+66 to +75	0.3	-	-	0.1	0.3	0.2	1.3	1.4
+76 or more	0.5	0.3	-	0.3	-	0.3	1.0	8.7
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	48.8	76.7	68.0	58.5	41.8	24.0	11.4	2.3
-4 to +5	30.9	21.7	26.5	32.9	36.4	39.2	30.8	15.8
+6 to +15	10.4	0.8	4.3	5.5	12.5	20.9	22.9	26.8
+16 to +25	5.4	0.6	0.7	1.6	6.3	9.5	18.0	18.0
+26 to +35	2.2	0.2	0.2	0.7	1.7	3.3	8.2	15.8
+36 to +45	1.1	0.1	-	0.3	0.8	1.8	2.7	14.1
+46 to +55	0.8	-	-	0.4	0.5	1.1	3.2	3.4
+56 to +65	0.2	-	-	0.1	-	-	0.9	2.8
+66 to +75	0.1	-	-	-	-	0.2	0.9	1.0
+76 or more	0.2	-	0.3	-	0.1	0.1	0.9	-
3000 CYCLES PER SECOND								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	15.8	39.4	28.7	13.9	7.1	3.5	0.2	-
-4 to +5	32.1	47.7	43.8	39.3	29.4	17.4	5.3	3.9
+6 to +15	17.7	9.4	14.9	21.3	25.2	19.6	12.3	5.3
+16 to +25	9.5	2.1	3.8	11.1	14.7	12.7	12.8	11.4
+26 to +35	6.9	0.6	4.8	5.3	7.3	13.4	12.8	9.7
+36 to +45	6.5	-	1.7	4.5	7.9	12.0	17.5	11.7
+46 to +55	6.0	-	1.2	2.6	5.0	12.9	20.0	19.5
+56 to +65	3.6	0.5	1.1	1.0	2.6	6.8	12.2	19.5
+66 to +75	0.9	-	-	0.4	0.6	1.2	3.1	9.9
+76 or more	0.9	0.3	-	0.6	0.3	0.6	3.8	9.1
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	30.5	60.2	46.3	33.8	21.4	10.5	2.5	1.7
-4 to +5	40.0	35.3	43.5	48.8	49.0	33.3	23.7	8.2
+6 to +15	14.5	3.2	7.7	11.8	17.6	27.1	23.9	22.6
+16 to +25	6.9	0.9	1.5	3.5	6.7	15.6	18.8	17.8
+26 to +35	3.8	0.1	0.7	0.6	2.3	7.9	13.2	23.9
+36 to +45	2.1	0.3	0.1	0.6	1.5	3.1	10.8	3.4
+46 to +55	1.3	-	-	0.8	0.9	1.7	3.3	15.3
+56 to +65	0.4	-	-	0.1	0.3	0.5	2.0	1.7
+66 to +75	0.1	-	0.1	-	0.1	0.2	0.2	2.5
+76 or more	0.3	-	0.2	-	0.1	0.1	1.6	2.9

Table 10. Percentage distribution of hearing levels in decibels re audiometric zero for the better ear at 4000 and 6000 cycles per second for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
4000 CYCLES PER SECOND								
Men	Percentage distribution							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	8.4	28.9	14.8	4.7	2.1	1.1	-	-
-4 to +5	26.2	48.5	42.0	31.3	18.5	7.1	1.9	1.3
+6 to +15	18.3	14.7	19.0	22.9	23.2	16.7	8.5	1.3
+16 to +25	12.4	3.9	9.2	14.9	16.2	18.7	9.6	7.3
+26 to +35	8.7	1.6	6.1	8.4	14.9	10.9	9.7	7.9
+36 to +45	8.7	1.2	3.7	8.3	12.5	12.1	17.7	9.7
+46 to +55	7.8	0.7	2.6	5.2	6.9	13.8	24.8	18.0
+56 to +65	5.4	0.2	1.7	2.0	3.9	12.4	14.8	26.9
+66 to +75	2.6	-	0.9	1.6	1.2	4.8	8.4	14.4
+76 or more	1.4	0.3	-	0.7	0.5	2.4	4.4	13.1
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	22.9	51.7	34.0	26.2	14.3	4.1	1.1	-
-4 to +5	40.0	42.1	50.5	49.3	44.4	28.4	15.2	4.3
+6 to +15	18.1	4.3	11.3	17.2	26.2	27.8	25.1	14.0
+16 to +25	7.9	0.9	2.9	4.3	8.3	17.9	16.7	20.5
+26 to +35	4.5	0.5	0.9	0.9	3.1	10.4	14.4	20.2
+36 to +45	3.1	0.3	0.1	1.2	1.3	6.3	12.8	12.9
+46 to +55	2.2	0.1	0.1	0.5	1.4	3.8	8.4	14.2
+56 to +65	0.8	-	-	0.3	0.8	0.6	2.9	8.4
+66 to +75	0.4	0.1	-	-	-	0.5	1.7	3.5
+76 or more	0.3	-	0.3	-	0.2	0.1	1.8	2.0
6000 CYCLES PER SECOND								
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	3.2	13.1	4.6	2.0	0.5	-	-	-
-4 to +5	16.6	41.5	28.9	17.3	6.1	2.3	1.1	-
+6 to +15	24.3	29.9	34.0	31.4	24.9	12.9	2.7	2.8
+16 to +25	16.3	6.9	14.5	19.5	27.5	16.8	7.0	1.3
+26 to +35	10.3	3.8	6.7	10.5	14.1	15.6	11.7	6.1
+36 to +45	7.8	1.9	3.8	5.8	11.4	12.7	12.0	15.1
+46 to +55	6.7	1.0	3.3	4.6	6.3	13.9	16.2	8.3
+56 to +65	6.0	1.6	1.8	4.0	4.9	9.0	19.5	19.4
+66 to +75	4.8	-	1.9	2.1	2.2	9.7	15.7	23.9
+76 or more	4.1	0.3	0.5	2.6	2.1	7.1	14.2	23.1
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	9.3	26.3	14.2	9.2	4.4	0.2	-	-
-4 to +5	29.7	47.7	46.1	38.2	24.3	8.0	3.3	-
+6 to +15	28.3	20.9	29.3	34.1	36.8	29.4	14.7	3.4
+16 to +25	12.9	2.7	6.8	11.2	17.7	25.1	19.5	4.5
+26 to +35	7.2	1.0	2.2	4.0	6.7	14.9	18.1	24.3
+36 to +45	4.9	0.6	0.9	2.1	5.9	10.7	11.1	16.7
+46 to +55	3.2	0.3	0.1	0.4	1.8	5.5	15.5	12.9
+56 to +65	2.4	-	0.2	0.5	1.2	3.7	10.3	18.7
+66 to +75	1.1	0.4	-	0.2	0.8	1.5	3.3	10.3
+76 or more	1.0	0.1	0.3	0.1	0.5	1.0	4.1	9.1

Table 11. Number and percentage distribution of hearing levels for speech (average of levels at 500, 1000, and 2000 cycles per second) in the better ear for men and women, by age: United States, 1960-62

Sex and hearing level	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
	Number of adults in thousands							
Men								
Total	52,744	7,139	10,281	11,373	10,034	7,517	4,972	1,428
-5 or less	22,845	4,873	6,479	5,786	3,508	1,742	421	36
-4 to +5	19,647	2,074	3,348	4,418	4,383	3,336	1,764	324
+6 to +15	6,198	106	315	754	1,738	1,643	1,270	372
+16 to +25	1,999	32	81	268	236	424	688	270
+26 to +35	816	-	10	25	70	197	347	167
+36 to +45	566	34	48	30	58	109	203	84
+46 to +55	308	-	-	62	14	28	166	38
+56 to +65	131	-	-	-	27	18	73	13
+66 to +75	164	-	-	21	-	-	19	124
+76 or more	70	20	-	9	-	20	21	-
Women								
Total	58,343	8,430	11,291	12,325	10,542	8,120	6,192	1,443
-5 or less	29,138	6,662	8,045	7,143	4,820	1,776	682	10
-4 to +5	19,111	1,632	2,832	4,273	3,989	3,802	2,238	345
+6 to +15	6,028	102	276	644	1,242	1,720	1,639	405
+16 to +25	2,423	11	98	147	273	575	1,010	309
+26 to +35	789	13	7	74	112	111	220	252
+36 to +45	337	10	-	33	46	84	96	68
+46 to +55	165	-	-	-	45	-	120	-
+56 to +65	125	-	-	11	-	-	74	40
+66 to +75	114	-	14	-	-	52	48	-
+76 or more	113	-	19	-	15	-	65	14
	Percentage distribution							
Men								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	43.3	68.3	63.0	50.9	35.0	23.2	8.5	2.5
-4 to +5	37.3	29.0	32.6	38.9	43.7	44.4	35.5	22.7
+6 to +15	11.8	1.5	3.1	6.6	17.3	21.9	25.5	26.1
+16 to +25	3.8	0.4	0.8	2.4	2.4	5.6	13.8	18.9
+26 to +35	1.5	-	0.1	0.2	0.7	2.6	7.0	11.7
+36 to +45	1.1	0.5	0.5	0.3	0.6	1.5	4.1	5.9
+46 to +55	0.6	-	-	0.5	0.1	0.4	3.3	2.6
+56 to +65	0.2	-	-	-	0.3	0.2	1.5	0.9
+66 to +75	0.3	-	-	0.2	-	-	0.4	8.7
+76 or more	0.1	0.3	-	0.1	-	0.3	0.4	-
Women								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-5 or less	49.9	79.0	71.3	58.0	45.7	21.9	11.0	0.7
-4 to +5	32.8	19.4	25.1	34.7	37.8	46.8	36.1	24.0
+6 to +15	10.3	1.2	2.4	5.2	11.8	21.2	26.5	28.1
+16 to +25	4.2	0.1	0.9	1.2	2.6	7.1	16.3	21.4
+26 to +35	1.4	0.2	0.1	0.6	1.1	1.4	3.5	17.5
+36 to +45	0.6	0.1	-	0.3	0.4	1.0	1.5	4.7
+46 to +55	0.3	-	-	-	0.4	-	1.9	-
+56 to +65	0.2	-	-	0.1	-	-	1.2	2.8
+66 to +75	0.2	-	0.1	-	-	0.6	0.8	-
+76 or more	0.2	-	0.2	-	0.1	-	1.0	1.0

Table 12. Median hearing levels in decibels for the right, left, and better ears of men and women at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by age: United States, 1960-62

Tonal frequency	Total-18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
MEN								
Right ear	Median levels							
500 cycles per second	0	-5	-4	-1	+1	+2	+7	+13
1000 cycles per second	-3	-6	-6	-5	-1	0	+7	+12
2000 cycles per second	+1	-5	-4	-1	+3	+7	+19	+31
3000 cycles per second	+11	0	+3	+8	+15	+29	+44	+55
4000 cycles per second	+20	+2	+7	+16	+25	+38	+50	+61
6000 cycles per second	+25	+9	+14	+21	+28	+44	+60	+69
Speech[1]	-1	-5	-4	-2	+1	+3	+11	+19
Left ear								
500 cycles per second	-1	-5	-5	-3	-1	+2	+6	+12
1000 cycles per second	-3	-6	-6	-4	-2	0	+7	+17
2000 cycles per second	+3	-4	-3	0	+5	+12	+26	+42
3000 cycles per second	+13	+1	+4	+11	+17	+34	+49	+57
4000 cycles per second	+22	+4	+10	+18	+29	+42	+54	+61
6000 cycles per second	+27	+10	+15	+23	+30	+46	+63	+70
Speech[1]	0	-5	-5	-2	+1	+5	+13	+24
Better ear								
500 cycles per second	-4	-6	-6	-3	-1	-1	+3	+8
1000 cycles per second	-5	-7	-7	-6	-5	-2	+3	+9
2000 cycles per second	-1	-7	-6	-3	+1	+4	+15	+25
3000 cycles per second	+7	-2	+1	+5	+11	+23	+40	+50
4000 cycles per second	+14	0	+4	+13	+20	+32	+47	+58
6000 cycles per second	+20	+5	+11	+16	+22	+38	+52	+64
Speech[1]	-3	-7	-6	-4	-2	0	+7	+14
WOMEN								
Right ear								
500 cycles per second	0	-5	-4	-2	0	+5	+10	+15
1000 cycles per second	-3	-7	-7	-5	-2	+2	+6	+14
2000 cycles per second	0	-6	-5	-2	+1	+5	+13	+25
3000 cycles per second	+3	-3	0	+1	+4	+11	+20	+30
4000 cycles per second	+5	-2	+1	+3	+7	+16	+27	+38
6000 cycles per second	+13	+4	+8	+11	+15	+25	+38	+57
Speech[1]	-1	-6	-5	-3	0	+4	+10	+18
Left ear								
500 cycles per second	-1	-6	-5	-4	0	+3	+9	+17
1000 cycles per second	-4	-8	-7	-6	-3	+1	+7	+15
2000 cycles per second	0	-6	-4	-2	+1	+6	+13	+24
3000 cycles per second	+3	-3	-1	+2	+5	+13	+21	+30
4000 cycles per second	+5	-1	+1	+3	+8	+16	+28	+36
6000 cycles per second	+14	+4	+8	+11	+16	+26	+42	+56
Speech[1]	-2	-7	-5	-4	+1	+3	+10	+19
Better ear								
500 cycles per second	-4	-7	-6	-5	-5	+1	+5	+12
1000 cycles per second	-6	-8	-8	-7	-5	-1	+4	+11
2000 cycles per second	-4	-8	-7	-6	-2	+2	+9	+19
3000 cycles per second	+1	-6	-3	-1	+2	+8	+16	+26
4000 cycles per second	+3	-4	-1	+1	+4	+12	+21	+31
6000 cycles per second	+9	0	+4	+7	+12	+21	+27	+47
Speech[1]	-5	-8	-7	-6	-4	+1	+6	+14

[1]Average of levels at 500, 1000, and 2000 cycles per second.

APPENDIX I

RECORDING FORM

TESTS AND LABORATORY PROCEDURES
HES-208
AUDIOGRAM

Date_____ Tester_____ Audiometer No._____ Tested in AM ☐ PM ☐

Check which ear was tested first

☐ No Report

_____
Reason

cps	RIGHT ☐	LEFT ☐
1000	/	/
2000		
3000		
4000		
6000		
500		

Record any comments subject makes about hearing:_____

APPENDIX II

SURVEY DESIGN, RELIABILITY, AND VARIANCE

The Survey Design

The first cycle of the Health Examination Survey employed a highly stratified multistage probability design in which a sample of the civilian, noninstitutional population of the conterminous United States 18-79 years of age was selected. At the first stage, a sample of 42 primary sampling units (PSU's) was drawn from among the 1,900 geographic units into which the United States was divided. Random selection was controlled within regional and size-of-urban-place strata into which the units were classified. As used here a PSU is a standard metropolitan statistical area or one to three contiguous counties. Later stages result in the random selection of clusters of typically about four persons from a neighborhood within the PSU. The total sample included some 7,700 persons in 29 different States. The detailed structure of the design and the conduct of the Survey have been described in previous reports.[1,2]

Reliability

Measurement processes employed in the Survey were highly standardized and closely controlled. Of course, this does not mean that the correspondence between the real world and the Survey results is exact. Data from the Survey are imperfect for three major reasons: (1) results are subject to sampling error, (2) the actual conduct of a survey never agrees perfectly with the design, and (3) the measurement processes themselves are inexact even though standardized and controlled.

The first-stage evaluation of the Survey was reported in reference 2, which dealt principally with an analysis of the faithfulness with which the sampling design was carried out. This study notes that out of the 7,700 sample persons the 6,670 who were examined—a response rate of over 86 percent—gave evidence that they were a highly representative sample of the civilian, noninstitutional population of the United States. Imputation of nonrespondents was accomplished by attributing to nonexamined persons the characteristics of comparable examined persons as described in reference 2. The specific procedure used amounted to inflating the sampling weight for each examined person in order to compensate for sample persons at that stand of the same age-sex group who were not examined.

In addition to persons not examined at all, there were some whose examination was incomplete in one procedure or another. Age, sex, and race were known for every examined person, but for a number of the examinees, one or more of the hearing tests were not available. The extent of these missing data is indicated in table I.

For each of the 27 examinees not given the hearing test, a respondent of the same age-sex-race group was selected at random and his test results assigned to the nonexamined person.

When only incomplete test results were available (56 persons), a variety of methods were used, depending upon the extent of existing data. If only one ear was tested, it was assumed that the findings for the other ear would have been the same. If partial results were available, the levels reached by the other ear at the particular frequencies were used as the estimates if they were consistent with the rest of the audiogram for the ear on which data were missing. Otherwise, projections were made on the basis of the parts of the audiogram available.

Sampling and Measurement Error

In the present report, reference has been made to efforts to minimize bias and variability of the measurement techniques.

The probability design of the Survey makes possible the calculation of sampling errors. The sampling error is used here to determine how imprecise the survey results may be because they come from a sample rather than from the measurements of all elements in the universe.

The estimation of sampling errors for a study of the type of the Health Examination Survey is difficult for at least three reasons: (1) measurement error and "pure" sampling error are confounded in the data—it is not easy to find a procedure which will either completely include both or treat one or the other separately, (2) the survey design and estimation procedure are complex and accordingly require computationally involved techniques for the calculation of variances, and (3) from the survey are coming thousands of statistics, many

Table I. Number of examinees with incomplete hearing tests: Health Examination Survey, 1960-62

Hearing test	Total	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
HEARING TESTS NOT GIVEN	Number of examinees							
All examinees----	27	3	1	2	7	8	4	2
Men----------	10	1	-	-	4	4	1	-
Women----------	17	2	1	2	3	4	3	2
HEARING TESTS INCOMPLETE FOR FREQUENCIES (in cycles per second)								
All examinees----	56	11	5	9	15	7	7	2
Men----------	26	4	1	6	6	4	4	1
Women----------	30	7	4	3	9	3	3	1
500								
Men----------	20	4	1	4	3	4	3	1
Women----------	19	5	3	2	8	1	-	-
1000								
Men----------	2	-	-	2	-	-	-	-
Women----------	3	1	1	-	1	-	-	-
2000								
Men----------	3	-	-	1	2	-	-	-
Women----------	6	1	2	-	1	-	2	-
3000								
Men----------	1	-	-	1	-	-	-	-
Women----------	7	3	2	1	-	-	1	-
4000								
Men----------	1	-	-	1	-	-	-	-
Women----------	10	4	1	1	-	1	2	1
6000								
Men----------	6	-	-	3	2	-	1	-
Women----------	6	2	1	-	1	1	1	-

for subclasses of the population for which there are a small number of sample cases. Estimates of sampling error are obtained from the sample data and are themselves subject to sampling error when the number of cases in a cell is small or even occasionally when the number of cases is substantial.

Estimates of approximate sampling variability for selected statistics used in this report are presented in table II. These estimates have been prepared by a replication technique which yields overall variability through observation of variability among random subsamples of the total sample. The method reflects both "pure" sampling variance and a part of the measurement variance.

In accordance with usual practice, the interval estimate for any statistic may be considered the range within one standard error of the tabulated statistic, with 68 percent confidence; or the range within two standard errors of the tabulated statistic, with 95 percent confidence.

The 95-percent confidence limits of medians based on sample data may be estimated as follows: (1) from

Table II. Standard error expressed in percentage, for percent of persons with a specified hearing threshold level: United States, 1960-62

Age	Prevalence in percent			
	1 or 99	5 or 95	25 or 75	50
	Standard error			
All ages, 18-79 years	0.1	0.5	1.5	2.0
18-24 years	0.6	1.0	4.0	4.0
25-34 years	0.5	1.0	3.5	3.5
35-44 years	0.4	1.0	2.5	3.0
45-54 years	0.3	1.0	2.5	3.0
55-64 years	0.5	1.0	2.5	3.0
65-74 years	0.6	1.5	2.5	3.5
75-79 years	0.9	3.0	5.5	6.0

table II, using the appropriate age class, determine the standard error for a 50-percent statistic; (2) add to and subtract from 50 percent twice the standard error determined in step 1. Decibel values corresponding to the resulting percents from step 2 can then be determined for the distribution of persons by hearing threshold using a mapping or translation procedure. The method is best described by an illustration:

> The estimated median hearing level in the right ear for men aged 55-64 years at 6000 cycles per second is 44 decibels re audiometric zero. From table II, the standard error of a 50-percent statistic of persons in the age class 55-64 years is 3.0 percent. Twice the standard error added to and subtracted from 50 percent yields the percentage limits, 44 and 56 percent. The decibel values corresponding to the percentage limits, in this case 40 and 48 decibels, are obtained from the appropriate distribution in table 7 and are the 95-percent confidence limits. To obtain the upper confidence limit in decibels, it is necessary to interpolate within the 10-decibel class interval 46 to 55 decibels. Thus the upper confidence limit, 48 decibels, is obtained by adding to 45.5 decibels the interpolated value $\frac{56.0-53.0}{11.5}$ times 10 decibels, or approximately 2.6 decibels.

The method illustrated is, of course, extendible to other measures of location such as the quartiles, deciles, or percentiles and to other levels of confidence. For example, the 68-percent or one-standard-error confidence interval for the above is 42 to 46 decibels. It is possible to investigate whether an observed difference between two estimated medians can be attributed to sampling error alone by obtaining the upper 68-percent confidence limit, in decibels, U_1', of the smaller observed median, M_1', and the lower 68-percent confidence limit in decibels, L_2', of the larger, M_2'. The square root of the sum of the squared difference between M_1' and U_1' and M_2' and L_2' is the standard error of the difference between M_1' and M_2'; that is,

$$S_{M_1'-M_2'} = \sqrt{(M_1'-U_1')^2 + (M_2'-L_2')^2}.$$

For the purposes of this report any difference between M_1' and M_2' greater than $2(S_{M_1'-M_2'})$ has been presumed to be a real difference.

As noted, efforts to minimize both bias and variance in measurements were an important part of the design and procedure. The method of calculating standard errors, which is described above, includes in that error a substantial part of the residual measurement variance but does not encompass any residual bias which may lie in the hearing measurement process. Bias is used here in the sense of difference between expected value of the survey procedure to the (unknown) true value of the conceptual target—in this case the true hearing threshold level.

Small Categories

In some tables magnitudes are shown for cells for which sample size is so small that the sampling error may be several times as great as the statistic itself. Obviously in such instances the statistic has no meaning in itself except to indicate that the true quantity is small. Such numbers, if shown, have been included in the belief that they help to convey an impression of the overall story of the table.

———ooo———

APPENDIX III

STANDARDS FOR REFERENCE ZERO

The sound pressure standards for "normal" auditory threshold—the 1951 American Standards Association audiometric zero—maintained by the National Bureau of Standards were derived from data of the National Health Survey of 1935-36, as described previously. The original measurements were determinations of voltages applied at the terminals of the audiometer earphones used in the survey for a subgroup of persons with "normal" hearing. These threshold data were transferred by loudness balancing to a group of standard earphones designed especially for stability in calibration—the Western Electric 705-A. After loudness balancing, the earphones were placed on an NBS 9-A standard calibrating coupler and their response was measured.

Later, and in a similar fashion, the National Bureau of Standards transferred the threshold from the Western Electric 705-A earphone to five other types of earphones.

The threshold standards in terms of sound pressure in a standard coupler will be valid for the earphones of these types provided the earphone cushions are of controlled profile, thickness, and compliance; the distance from the front of the face of the moving diaphragm to the plane of the cushion is held constant; and that the earphone is held against the ear with a constant coupling force.[17 18] They will not apply to earphones of other types.

The transfer characteristics for the TDH-39 earphones with MX-41/AR cushions used in this Survey were those suggested by Cox and Bilger,[19] which are an average of the data from their loudness balance study and those from two other independent private studies. The methods used in these studies have not been published and are not readily available.

The new (1964) standard reference zero recommended by the International Organization for Standardization (ISO),[20 21] is now under consideration to replace the differing 1951 American and the 1954 British Standards.[22] The new standard has been accepted by the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology and by the American Speech and Hearing Association for their own use. Since these new standards will be appearing in many of the journals and other technical publications starting January 1, 1965, the comparison of them with the 1951 American Standard on the 705-A earphones and the TDH-39 earphones used in this Survey is shown in table III.

The thresholds for the 1951 American Standard and the recommended ISO Standard on the 705-A earphones are rounded to the nearest 0.5 dB in accordance with the ISO method of presentation. The TDH-39 thresholds are retained in the form used to convert the findings from this Survey to decibels re 0.0002 dyne per square centimeter, as shown in the section "Comparison With Findings From Other Studies."

Table III. Comparison of 1951 American Standard and the proposed International Standard for reference zero

Frequency in cycles per second	1951 American Standard for reference zero of		Recommended ISO Standard for reference zero of WE-705-A earphones[1]
	WE-705A earphones[1]	TDH-39 earphones[1]	
	Decibels re 0.0002 dyne per square cm		
500	25.0	24.1	11.0
1000	16.5	17.2	6.5
2000	[2]17.0	18.0	8.5
3000	[2]16.0	15.6	7.5
4000	[2]15.0	14.3	9.0
6000	[2]17.5	19.5	8.0

[1]On NBS 9-A coupler. TDH-39 earphone reference values shown here are those of Cox and Bilger. The other two sets were determined by the National Bureau of Standards.
[2]Estimated.

———o o o———

*U.S. GOVERNMENT PRINTING OFFICE : 1979 0-281-259/13

VITAL AND HEALTH STATISTICS Series

Series 1. Programs and Collection Procedures.—Reports which describe the general programs of the National Center for Health Statistics and its offices and divisions and data collection methods used and include 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, and 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, all based on data collected in a continuing national household interview survey.

Series 11. Data From the Health Examination Survey and the Health and Nutrition Examination Survey.—Data from direct examination, testing, and measurement of national samples of the civilian noninstitutionalized 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 Institutionalized Population Surveys.—Discontinued effective 1975. Future reports from these surveys will be in Series 13.

Series 13. Data on Health Resources Utilization.—Statistics on the utilization of health manpower and facilities providing long-term care, ambulatory care, hospital care, and family planning services.

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 occupations, hospitals, nursing homes, and outpatient facilities.

Series 20. Data on Mortality.—Various statistics on mortality other than as included in regular annual or monthly reports. Special analyses by cause of death, age, and other demographic variables; geographic and time series analyses; and statistics on characteristics of deaths not available from the vital records based on sample surveys of those records.

Series 21. Data on Natality, Marriage, and Divorce.—Various statistics on natality, marriage, and divorce other than as included in regular annual or monthly reports. Special analyses by demographic variables; geographic and time series analyses; studies of fertility; and statistics on characteristics of births not available from the vital records based on sample surveys of those records.

Series 22. Data From the National Mortality and Natality Surveys.—Discontinued effective 1975. Future reports from these sample surveys based on vital records will be included in Series 20 and 21, respectively.

Series 23. Data From the National Survey of Family Growth.—Statistics on fertility, family formation and dissolution, family planning, and related maternal and infant health topics derived from a biennial survey of a nationwide probability sample of ever-married women 15-44 years of age.

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

Scientific and Technical Information Branch
National Center for Health Statistics
Public Health Service
Hyattsville, Md. 20782